Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
65039	0	0	0	0	Perhaps take the comment boxes off as it keep popping up and covering text and gets quite annoying after a while… (For a valid comment the chapter….)	Noted	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
70305	0	0	0	0	International transport (aviation & shipping) should have their own dedicated paraprapgh in the Executive Summary. This is extremely important since there is currently little quantitative insight into what emissions from these sectors look like in 1.5°C & below 2°C scenarios. Chapters 2-4 concentrate mainly on domestic emissions (i.e. not international bunkers).	Noted. We continue to struggle with this need versus space issues.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
11287	0				The concepts of induced traffic / induced demand and disapearing traffic / evaporating traffic should be explicitly included in this chapter. In particular, this reccomendation of the recent ITF report Reversing Car Dependency could be quoted. "Use road space allocation to proactively manage traffic Reallocation of road space and changes to road layouts that give more space to cyclists and pedestrians should be used as a strategy to manage car use. A growing body of evidence suggests that a well-planned reduction of road space for private cars does not add to congestion. On the contrary, reduced road capacity can lead to “disappearing traffic”. Car drivers adapt to changed conditions in many ways, often too complex for computer models to predict. Empirical evidence from measures implemented is therefore as important as modelling for decision-making. The Improvements to public space and liveability associated with the reallocation of road space generally benefit retailers via increased footfall and associated sales. Citizens and local administrations are less prone to contesting road space reallocation than road pricing, as no cash payments are involved." ITF (2021) p 7, Reversing Car Dependency: Summary and Conclusions, ITF Roundtable Reports, No. 181, OECD Publishing, Paris. www.itf-oecd.org/avoiding-car-dependency	Noted. It is clearly in the chapter and we have added the ITF report.	Eric Doherty	Ecopath Planning	Canada
23267	0				Chapter 10 gives a pretty complete and accurate analysis of maritime transport stakes. However, not incorporating Wind Assisted Ship Propulsion (WASP) into the potential propulsion alternatives / complements is highly regrettable. (Clodic et al. 2018) (Atkinson et al. 2018) (Tillig, Ringsberg. 2020).	Noted. Literature does not suggest it is a significant part of the future but it is in there.	Government of France	Ministère de la Transition écologique et solidaire	France
28477	0				This chapter lacks coherence with the industry chapter. Specifically on the issue of CCU and fuels issued from these processes, the industry report is extremely clear that the climate benefit of CCU is contextual. Chapter 11 (page 35 onwards) is clear on this point, by stating that net effect of CCU on the atmosphere depends on the initial source of the carbon and that 'fossil waste carbon will initially be plentiful but will add to net atmospheric CO2 when released'. The source of the carbon must be more heavily emphasised in the section on synthetic fuels, perhaps by drawing from chapter 11. Otherwise, readers may erroneously assume that syntethic fuels made with fossil CO2 can be carbon neutral.	Noted. This is very clear throughout the chapter.	Mark Preston Aragones	Bellona Europa	Belgium
31099	0				Chapter 10 is weak in presenting a coherent transition for the transit sector in the nearterm. There ought to be a special section that presents a viable two year transition plan to zero anthropogenic carbon release, with several alternatives. Such a plan should explicitly include options for how the various parts of the transportation sector (road, rail, shipping, aviation) can be transitioned the fastest, with various options, including retrofits to make EVs and H2 vehicles quickly from existing road transport.	Noted. Literature is thin on transition plans but some additions have been made to text.	Daniel Helman	College of Micronesia-FSM	Micronesia, Federated States of
43753	0				The chapter doesn't seem to have any examples from small island developing states. There is literature that looks at the potential for electric vehicles in SIDS, for example, Gay et al 2018 https://doi.org/10.1016/j.jup.2018.09.006	Noted. It does look at leapfrogging in any developing place.	Government of Jamaica	Meteorological Service Division	Jamaica
43771	0				I think that the climate impact of non-CO2 emissions from road transportation should be discussed in more detail, as it is done for the aviation and shipping sector in this chapter. Section 4 in the assessment by Uherek et al. (2010) gives a comprehensive overview on this. More recent studies include, e.g., Mhyre et al. (2011), Righi et al. (2013, 2015), Mertens et al. (2018): - Myhre, G., Shine, K., Rädel, G., Gauss, M., Isaksen, I.,Tang, Q., Prather, M., Williams, J., van Velthoven, P.,Dessens, O., Koffi, B., Szopa, S., Hoor, P., Grewe, V.,Borken-Kleefeld, J., Berntsen, T., and Fuglestvedt, J.: Radiative forcing due to changes in ozone and methane causedby the transport sector, Atmos. Environ., 45, 387–394,https://doi.org/10.1016/j.atmosenv.2010.10.001, 2011. - Righi, M.; Hendricks, J. and Sausen, R.: The global impact of the transport sectors on atmospheric aerosol: simulations for year 2000 emissions. Atmos. Chem. Phys., Copernicus GmbH, 2013, 13, 9939-9970. - Righi, M., Hendricks, J., and Sausen, R.: The global impact of the transport sectors on atmospheric aerosol in 2030 – Part 1: Land transport and shipping, Atmos. Chem. Phys. 15, 633-651, doi:10.5194/acp-15-633-2015, 2015. - Mertens, M., Grewe, V., Rieger, V. S., and Jöckel, P.: Revisiting the contribution of land transport and shipping emissions to tropospheric ozone, Atmos. Chem. Phys., 18, 5567–5588, https://doi.org/10.5194/acp-18-5567-2018, 2018.	Noted. Text has been revised.	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
51589	0				Whereas the SPM highlights that a small portion of high emitters account for a large part of the emissions (the top 1% account for 50% of GHG emissions from aviation (high confidence)), the equity issue is not addressed at all in Chapter 10. Yet it has strong implications on the way demand should be reduced as technological solutions will not allow climate objectives to be reached in due time (See 2-64, lines 32-34). SPM statement based on : Gössling S. et al. (2020). The global scale, distribution and growth of aviation: Implications for climate change. https://doi.org/10.1016/j.gloenvcha.2020.102194 Results suggest that the share of the world’s population travelling by air in 2018 was 11%, with at most 4% taking international flights. Data also supports that a minor share of air travelers is responsible for a large share of warming: The percentile of the most frequent fliers – at most 1% of the world population - likely accounts for more than half of the total emissions from passenger air travel. Individual users of private aircraft can contribute to emissions of up to 7,500 t CO2 per year.	Noted. Aviation is being revised.	eric lombard	Stay Grounded	France
52545	0				The chapter should consider blue hydrogen as another compatitve option together with green hydrogen	Noted. Covered in other chapters like ch 6.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
69889	0				Like many others, this chapter would strongly benefit from building on the IEA 2020 World Energy Outlook's Chapter 4 "Achieving net zero emissions by 2050" which focuses entirely on the actions to be undertaken by 2030. The Chapter 11 Industry quotes it extensively, but the IEA 2020 covers all sectors. It notes that almost 60% of passenger cars sold in 2030 should be electric, and 30% of medium and heayv-duty trucks should be electric or fuel cell electric. Global battery manufacturing capacity should double every two years, vs. every three-to-four years previously. Some behaviour changes should also happen, such as flights under one hour being replaced with low-carbon alternatives, cycling or walking for trips under 3 km, reducing road traffic speeds by 7 km/h.	Noted. This is helpful for the transition period and will be used in the chapter	Cédric PHILIBERT	Institut Français des Relations Internationales	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
72483	0				Bike and cargo-bike, as well as disruptions in city or inter-city infrastructures to favor bike/e-bike, is only mentionned in a few occurrences throughout the entire chapter: boxes 10.1 and 10.2 and section 10.8.4. While I think bike is not going to solve transport GHG emissions on a large scale it is one of the most easily accessible mode of change at the personnal to city levels. Literature show that infrastructure changes can promote cycling hence favoring carbon-free person transport (work, leisure, etc.) [e.g. Marqués R., Hernández-Herrador V., Calvo-Salazar M., and García-Cebrián J.A. (2015) How infrastructure can promote cycling in cities: Lessons from Seville. Research in Transportation Economics 53, 31-44, https://doi.org/10.1016/j.retrec.2015.10.017]. Similarly for intra-city freight, cargo bike is an efficient mode of transport that can contribute to a reduction of 10%-36% of van usage hence resulting in a 45 to 73% reduction of CO2 emissions depending on the type of cargo and city size considered [e.g. Melo S. and Baptista P. (2017) Evaluating the impacts of using cargo cycles on urban logistics: integrating traffic, environmental and operational boundaries. European Transport Research Review 9, 10.1007/s12544-017-0246-8; McLeod F.N., Cherrett T.J., Bektas T., Allen J., Martinez-Sykora A., Lamas-Fernandez C., Bates O., Cheliotis K., Friday A., Piecyk M., and Wise S. (2020) Quantifying environmental and financial benefits of using porters and cycle couriers for last-mile parcel delivery. Transportation Research Part D-Transport and Environment 82, 10.1016/j.trd.2020.102311; Dalla Chiara G., Alho A.R., Cheng C., Ben-Akiva M., and Cheah L. (2020) Exploring Benefits of Cargo-Cycles versus Trucks for Urban Parcel Delivery under Different Demand Scenarios. Transportation Research Record 2674, 553-562, 10.1177/0361198120917162]. The emission of other pollutants is also reduced by this mean (e.g. -33% of NOx, PM10). Additinaly cargo bike freight allows cost reductions without a notable increase in delivery time (decrease of 5 min on the shortest hauls and a median increase of 6 min in a 0-20 km range [Gruber J. and Narayanan S. (2019) Travel Time Differences between Cargo Cycles and Cars in Commercial Transport Operations. Transportation Research Record 2673, 623-637, 10.1177/0361198119843088]) all the more if correct infrastructures (e.g. bike paths and parcel hubs) are developped. The references given also give a number of problems that needs to be adressed such as infrastructure development, possible congestion of bike traffic, difficulties to fully assess the potential of cargo bikes to replace vans, etc.	Noted. Very helpful addition.	Sylvain Pichat	University of Lyon, Ecole normale supérieure de Lyon, Laboratoire de Géologie (LGL-TPE)	Germany
72777	0				The chapter doesn't seem to have any examples from small island developing states. There is literature that looks at the potential for electric vehicles in SIDS. E.g. Gay et al 2018 https://doi.org/10.1016/j.jup.2018.09.006	Noted. Leapfrogging is mentioned.	Matthew Gidden	Climate Analytics	Germany
72893	0				Use of the avoid-shift-framework is mainly constrained to one section from page 16-20 rather than being systematically applied. For example, leverage on emission reduction via lighter vehicles is only approached on the basis of improving material rather than policy adjustments favoring lighter vehicles.	Noted and ASI expanded in 10.8	Antoine BONDUELLE	EE-Consultant	France
73047	0				Ch.10 doesn't mention "fairness", and has only three minor mentions of "equity". Both considerations are crucial to applying the Paris Agreement and other climate policy, especially so for imbalances in transportation and its emissions, and particularly for aviation. Substantial concern exists that ICAO's processes and resulting climate-related policies (e.g. CORSIA, which is a license to grow) are unfair, result in inequity, and inadequately mitigate aviation's and its customer's emissions. (T&E 2019, Becken 2020). It is important to add full and fair discussions of equity and fairness in Chapter 10, to inform international policymaking and NDCs. Aviation's substantial GHG emissions and climate impact are in large part caused by travel practices of a small number of elite people mainly in N. America and the EU, heightening that need. ("Gills & Morgan 2020; Gossling & Nilsson 2009; Stay Grounded 2020). It is important, too, that the added discussions inform about the growing sense of "climate emergency" among global governments.	Noted. Equity does not have to mentioned as a word when it is heavily used as a concept in the importance of reducing car dependence, enabling public transport and active transport. On aviation the inequity of the 1% is mentioned. Climate emergency is mentioned in 10.8 as a significant new driver.	Larry Edwards	Larry Edwards Environmental Consulting	United States of America
73049	0				(Continuing)... The Chapter 10 draft omits mention and discussion of the significant numbers of national and subnational declarations of climate emergency that have been passed globally since December 2016, with nearly all having been passed after (and reacting to) the IPCC's 2018 SR-1.5 report and Steffen et al. 2018. For example, although "emergency" appears several times in Chapter 10, this is a very different use of the word - always about responding to disasters, and not about rapidly ending GHG emissions, which is the topic of the declarations. These declarations, and their still-growing number, indicate an increasing global willingness for rapid, decisive governmental action. The WGIII report should discuss the potential bearing of this growing public and governmental recognition (that a climate emergency already exists) on what are often optional, elite transportation practices such as such as excessive flying and on the scope and impact of the aviation industry.	Noted. Climate emergency is mentioned in 10.8 as a significant new driver.	Larry Edwards	Larry Edwards Environmental Consulting	United States of America
73051	0				(Continuing)... To date, the EU and worldwide 13 individual national governments have passed declarations of climate emergency (including France and three others in the EU). Sub-nationally, by current count 1886 governments in 34 nations have passed such declarations, including four significant subnational governments. (CED 2021a, CED 2021b). Among the declarations: 36% urge a zero or net-zero emission deadline of 2030 or earlier; 9% urge deadlines between 2030 and 2045; and 55% urge a "by 2050" deadline. (CED 2021a). The declarations should be viewed in the WGIII as trending governmental and popular recognitions covering a range of views ranging from ones that the Paris Agreement is inadequate in view of experienced subsequent climate impacts (and that implementation of the SR 1.5's 2030/2050 recommendation will be insufficient) to ones that the Paris Agreement is acceptable but (dangerously) inadequately implemented. The WGIII report should deal with this.	Later versions clarified this.	Larry Edwards	Larry Edwards Environmental Consulting	United States of America
73053	0				(Continuing)... The European Union (comprised of 27 nations) and globally the following thirteen (13) individual nations have passed declarations of climate emergency in 2019 or thereafter: Andorra, Argentina, Austria, Bangladesh, Canada, France, Japan, Maldives, Malta, New Zealand, Rep. of Ireland, South Korea, and Spain. Declarations have partially passed in Portugal and the UK, and are in process. The following significant sub-national governments have passed declarations: Northern Ireland, Scotland, South Australia and Wales. (CED 2021a, CED 2021b).	Later versions clarified this.	Larry Edwards	Larry Edwards Environmental Consulting	United States of America
73055	0				(Continuing)... In Jan. 2021, UNDP published its poll results on the global public's climate change attitude. (UNDP 2021). Among the 1.2 million respondents from 50 nations covering 56% of the world's population: "64% of people said that climate change was an emergency - presenting a clear and convincing call for decision-makers to step up on ambition." This recognition was by universal super-majority: "The highest level of support was in SIDS (74%), followed by high-income countries (72%), middle-income countries (62%), then LDCs (58%). And it had "a high level of support everywhere - in Western Europe and North America (72%), Eastern Europe and Central Asia (65%), Arab States (64%), Latin America and Caribbean (63%), Asia and Pacific (63%), and Sub-Saharan Africa (61%)." Of individuals recognising the emergency "59% said that the world should do everything necessary and urgently in response[,] 20% said we should act slowly, while 10% percent of people thought the world is already doing enough."	Later versions clarified this.	Larry Edwards	Larry Edwards Environmental Consulting	United States of America

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
73057	0				References for above comments: [1] CED (2021a) https://climateemergencydeclaration.org/four-years-of-climate-emergency-declarations/; [2] CED (2021b) https://climateemergencydeclaration.org/climate-emergency-declarations-cover-15-million-citizens/; [3] Becken (2021); "Decarbonising tourism: Mission Impossible?", Tourism Recr. Res. 44: 4; [4] Gills & Morgan 2020, "Global climate emergency: After COP24, climate science, urgency and the threat to humanity", Globalizations 17:6,885-902; [5] Gossling & Nilsson 2009, "Frequent Flyer Programmes as Mobility Booster?: Implications for Sustainable Aviation", in Transport & Tourism: Challenges, Issues and Conflicts. Proceedings of the Travel and Tourism Research Association Europe 2009 Annual Conference, 22-24 April 2009;	Later versions clarified this.	Larry Edwards	Larry Edwards Environmental Consulting	United States of America
73059	0				More References: [6] Stay Grounded 2020, "It's about more than just CO2: Aviation must reduce its total impact on climate", Oct 2020, https://stay-grounded.org/wp-content/uploads/2020/10/SG_Factsheet_Non-CO2_2020.pdf; [7] Steffen et al. 2018, "Trajectories of the Earth System in the Anthropocene", PNAS 115 (33) 8252-8259 ; [8] T&E 2019, "Why ICAO and Corsia cannot deliver on climate", Transp. & Env., Sep. 2019, https://www.transportenvironment.org/sites/te/files/publications/2019_09_Corsia_assessement_final.pdf; [9] UNDP (2021) "Peoples' Climate Vote: Results", https://www.undp.org/content/dam/undp/library/km-qap/UNDP-Oxford-Peoples-Climate-Vote-Results.pdf.	Later versions clarified this.	Larry Edwards	Larry Edwards Environmental Consulting	United States of America
73061	0				Chapter 10 is biased by omitting some potential regulatory controls on transportation emissions. In contrast to its plentiful references to taxes, levies and pricing, NOT mentioned are: carbon or fuel rationing, personal carbon trading, tradeable energy quotas (TEQs), Discussion of these and other measures is needed throughout the chapter. References: [1] Cox 2013, "Any way you slice it: The past, present and future of rationing", The New Press; [2] Fawcett 2012, "Personal carbon trading - is now the right time?", Carbon Mgmt 3(3): 283-291; [3] Chamberlin et al. 2014, "Reconciling scientific reality with realpolitik: Moving beyond carbon pricing to TEQs - An integrated, economy-wide emissions cap", Carbon Mgmt 5(4), 411-427).	Noted. Covered in other chapters .	Larry Edwards	Larry Edwards Environmental Consulting	United States of America
73063	0				(Continuing)… Specific to aviation, such measures the draft omits and which should be added include: limiting how frequent flyer points can be acquired (e.g. not via general credit card purchases), banning frequent flyer programs, or limiting the kerosene supply to within nation or within region airports. References: [1] Gossling & Nilsson 2009 (ref'd above); [2] Storm 1999, "Air transport policies and frequent flyer programmes in the European Community", Unit of Tour. Res., Res. Ctr of Bornholm; [3] Stay Grounded, Talanoa Dialogue submission of 18 Oct 2018, Sec. 3A, https://unfccc.int/sites/default/files/resource/295_Stay%20Grounded%20submission%20to%20Talanoa%20Dialogue_%28Final%29_18-Oct-2018.pdf	Later versions clarified this.	Larry Edwards	Larry Edwards Environmental Consulting	United States of America
74895	0				Under section 10.3 consider including a sub-header that addresses upstream emission from electric vehicles. While electric cars offer a very practical alternative for ICE vehicles, the executive summary should highlight the fact that materials and battery pack production for EVs actually results in higher CO2e emissions than a conventional car. It is therefore necessary that emphasis is placed on reduction of carbon footprint upstream	Noted. The Life Cycle Analysis material in 10.4 shows that this statement is incorrect. Upstream reductions in GHG are a focus of these sections.	Government of Kenya	Kenya Meteorological Service	Kenya
75721	0				There is a puzzling choice of not separating freight and passenger transport by plane or to a lesser extend by ship (air or sea). In terms of both mitigation pathways and causes of variations / evolution freight and passengers have indded common grounds but also very different specificities. The politics used to change the evolution of freight transport, e.g. relocalizing productions to minimize transport, cannot necessarily be applied to passenger transport: it could be true for business but clearly not for leisure. This chapter would certainly gain in terms of readability of the mitigation pathways if these two types of transport, passengers and freight, were separated.	Noted. They are separated in earlier sections but not in the special sections on Shipping and Aviation requested by IPCC. The statements about leisure may not be correct with data showing localization strategies unfolding in Covid may reduce demand for aviation toursim.	Sylvain Pichat	University of Lyon, Ecole normale supérieure de Lyon, Laboratoire de Géologie (LGL-TPE)	Germany
76145	0				For improved transparency and clarity, I hope the authors can report emissions and mitigation options for individual gases wherever possible, instead of the often more ambiguous CO2-eqivalents. This is in important especially for aviation and Shipping since so much of the climate impacts from these sectors are from non-CO2.See more on this in Annex B section A.B.10.6: Use of GHG metrics in WGIII contribution to AR6: guidance to authors.	Noted. More attempts to do this are being made.	Jan Fuglestvedt	CICERO	Norway
76149	0				Regarding contributions from the transport sectors: The chapter also consider using contributions in terms of temperature as calualeted by simple climate models; See WGII as an example	Noted. Revisions attempts to include this.	Jan Fuglestvedt	CICERO	Norway
76167	0				Please check for consistent use of the terms net zero CO, net zero GHG, carbon neutrality and GHG neutrality. See glossary.	Noted.	Jan Fuglestvedt	CICERO	Norway
76171	0				The covid situation is addressed in this chapter, which is very relevant due to the huge effect of this sector. I suggest you give a reference to the box on covid in WGI Ch6.	Noted. This was added.	Jan Fuglestvedt	CICERO	Norway
83989	0				The chapter underrepresents demand-side solutions, particularly of "avoid" or "shift" type. This is particularly striking in the aviation sector. It is clear from the chapter's content and other literature that foreseeable efficiency improvements and offsetting schemes (CORSIA) will not be effective in reducing emissions from the sector, and strong policies that would curtail further growth of demand and then reduce the demand would be necessary. Policies that could potentially reduce the demand are at best underdeveloped in the chapter, or omitted altogether. Instead, the chapter overly focuses on technological options, which are often in their infancy, have potentially negative social and environmental consequences, limited breadth of application, and large uncertainties. This is particularly the case in the so called "smart city technologies" (section 10.2.3 and Box 10.1) and aviation fuels (section 10.5.3.3). As a result, the chapter in its current form will not provide a proper guidance to policy-makers willing to make transformative action in the transportation sector, and social actors willing to demand such action. A closer coupling of the chapter with Chapter 5 would mitigate this lack with a benefit for both chapters - and mitigation action in general. Ideally, Chapter 10 should include a detailed description of sector-specific demand-side solutions (balanced over the Avoid-Shift-Improve spectrum), which are described in general terms in Chapter 5 (e.g. changes in prices, provision of infrastructures, social norms, attitudes etc.). Authors of Chapter 10 should be bolder in suggesting a course of action that has a chance to transform the sector in a way that complies with ambitious goals of climate change mitigation set elsewhere in the report. The IPCC reports are very influential, and if such voice is not provided here, the sector will have less chance to decarbonize sufficiently to protect the climate. The stakes are very high and such is responsibility of the authors.	Noted. The value of demand-side approaches is seen to be transformative only when combined with technology changes. This is consistent with the rest of the report and is clearly shown in the scenarios. Transformation will need all factors to be intgerated, not just social, if the political is to be given the material from the whole literature on transport.	Michał Czepkiewicz	University of Iceland	Poland
83993	0				The chapter lacks a qualification of claims (the level of agreement and evidence) present in other chapters. This lack makes its academic quality questionable as there are many contested claims substantiated by only few sources (particularly with regard to "ned demand concepts" in section 10.2.2.2 and "smart city technologies" in section 10.2.3 and Box 10.1.	Noted. Levels of agreement and evidence are added now.	Michał Czepkiewicz	University of Iceland	Poland

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
84115	0				Great chapter. Pity I don't have time to comment - but not much need. I'd be interested to be reassured about consistency between the industry and transport chapters and the following: Comment from a colleague at UCL: "Have you / reviewers taken UNEP EGR as an input. Ch. 6? This has some content on TRL. There are already investments and orders in for ammonia powered ships and GW scale green ammonia supply chains targeted at marine. There are bio/e-methanol powered ships and 2nd gen/waste bio fuels already in operation (which I don't fancy as scalable but still important as a stop gap as we scale ammonia). Both supply chain and fleet are therefore on track for full TR maturity by 2025. Most of the info is in the grey literature (and often specialist/shipping grey lit), so hard to use/access. What has perhaps confused authors/reviewers is that there are lobbying vested interests for different fuels which can give the impression that there is lack of clarity on tech pathway. Lots of content that could be leveraged here: https://wedocs.unep.org/xmlui/bitstream/handle/20.500.11822/34431/EGR20ch5.pdf?sequence=3 " Also review Figure TS.22 in light of this?	Noted. Helpful comment that is consistent with how the chapter has focussed more on ammonia with shipping. Other comments are consistent with this.	Michael Grubb	UCL - Institute of Sustainable Resources	United Kingdom (of Great Britain and Northern Ireland)
84971	0				There are some very well developed sections on the supply side, but the assessment of the demand side is comparatively weak. One of the key challenges for the transport sector is to enable change at a rate that will contribute to meeting climate change targets, and this needs a fuller discussion of the enabling measures required to shift/ switch demand e.g. to electric vehicles or other lower carbon modes.	Noted. The value of demand-side approaches is seen to be transformative only when combined with technology changes. This is consistent with the rest of the report and is clearly shown in the scenarios. Transformation will need all factors to be intgerated	Jameel Hayat	AECOM	United Kingdom (of Great Britain and Northern Ireland)
84973	0				There are references to lifecycle emissions. There are several references to infrastructure needs and the potential requirement to upgrade or introduce new infrastructure. These may have shorter term negative embodied carbon impacts e.g. during construction. It is important to demonstrate if these are considered unlikely to be material or how they could be mitigated. Similarly, EVs and other options are not a panacea if accompanied by extensive and carbon intensive approaches to road building (this is partly picked up in the Box on page 15 - 16).	Noted. A very extensive coverage of LCA literature has been made in 10.4	Jameel Hayat	AECOM	United Kingdom (of Great Britain and Northern Ireland)
84975	0				There are several references to COVID-19. Presumably this can be updated in future updates/ revisions to this chapter, if new data and research becomes available e.g. please see https://storymaps.arcgis.com/stories/74e0152da90d45f9901555989f6461eb	Noted. More has been added.	Jameel Hayat	AECOM	United Kingdom (of Great Britain and Northern Ireland)
84977	0				There are several references to logistics / freight optimisation. Given that there is significant work on optimising freight and logistics,	Noted. More has been added on this.	Jameel Hayat	AECOM	United Kingdom (of Great Britain and Northern Ireland)
49721	1	1	165	4	The whole chapter on transport takes a rather conservative approach compared to the other sections of the AR6. The other chapters took a very comprehensive, integrated view of transport as a service, the transport chapter ignores it and goes back to discuss fuel and fuel-based mitigation activities.	Noted. There are very large sections covering these broader aspects in 10.2 and 10.8.	Nikola Medimorec	SLOCAT Partnership on Sustainable, Low Carbon Transport	Republic of Korea
79461	1	1	165	4	The whole chapter on transport takes a rather conservative approach compared to the other sections of the AR6. The other chapters took a very comprehensive, integrated view of transport as a service, the transport chapter ignores it and goes back to discuss fuel and fuel-based mitigation activities.	Noted. There are very large sections covering these broader aspects in 10.2 and 10.8.	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
81919	1	1	164		The Chapter does not sufficiently address the fact that transport is a response to needs that are created in other sectors, e.g., industry, agriculture, and trade policies, urban development, education and health. The AVOID (of travel/transport demand) must mainly come from these other sectors and respective policies.	Noted. There are very large sections covering these broader aspects in 10.2 and 10.8 and in chapter 5.	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
81921	1	1	164		The Chapter sets a too strong focus on the classical IMPROVE measures, i.e. the energy efficiency and footprint of a single mode or energy carrier. The discussion of AVOID and SHIFT should get more emphasis.	Noted. There are very large sections covering these broader aspects in 10.2 and 10.8.	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
81923	1	1	164		The term "non-motoriized transport" is not seen as adequate term anymore as it opposes motorized and non-motorized. The Chapter should consistently use the term "active modes" or "active transport" or "active mobility".	Noted. Changed to Active Transport.	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
84159	1	1	165	4	The report does not guide the reader as to which approaches will make a difference. A casual reader could resolve that electricfication of passenger ccars will be enough to fix the problem. There should be some contextual commentary to establish that fixing the energy supply chain to transport vehicles only gets us so far, that in countries where grid electricity remains above 500g/CO2E per KwH beyond 2030 it is a poor mitigation pathway to accelerate. I see nothing noting that no one wants to get in a car for an hour to get from home to work, so the best solution is to remove that demand. The report notes greatly expanded freight demend, but doesn't talk of avoidance mechanisms for that freight volume (satisfy the demand for the product without moving it so far - edge manufacturing approaches or instance). Policy makers and the public need more clear distallation of each sector, the links between them and the actions that make a difference. The public are looking for guidence and leadership.	Noted. These matters are discussed. There are very large sections covering these broader aspects in 10.2 and 10.8.	Kym Lennox	climate change equity	Australia
84791	1	1	115	40	Overall, this report seems reflect the old transport planning paradigm which assumes that people need a high level of vehicle travel (more than 5,000 annual vehicle kilometers) to be productive and happy. It argues that travel demand reduction strategies have been tried but largely failed. I believe that this is inaccurate. The new paradigm recognzies that the ultimate goal of most mobility is access to services and activities, that there are many ways to meet those needs with far less mobility than currently occurs, that there is significant demand for resource-efficient modes that is not being met due to automobile-dependent planning practices, and that serving this demand for improved walking, bicycling, public transit and telework benefits individuals and provides huge economic, social and environmental benefits. I therefore recommend changing the narative to be much more positive about TDRs and to highlight the many success stories.	Extra additions have been made as well.	TODD LITMAN	Victoria Transport Policy Institute	Canada
85565	1	1	165	4	I am "complaining" a lot about leaving out heavy battery-electric trucks and other things. But I would like to just say that overall I found the chapter was impressive! I'm considered an expert but I learned a lot of new things. So I must not forget to give a compliment where it's due. And a big thank you for your hard work from the entire human race!	Noted. Thank you!	Auke Hoekstra	Eindhoven University of Technology	Netherlands
46051	1	3	1	3	From the references provided it seems that the assessment is mainly based on the work of one CLA. We strongly encourage the author team to comprehensively review the available literature and include additional references.	Noted. More references have been added.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
337	1		115		It is not clear why short-lived climate forcers are mentioned only in connection with air and maritime transport. Their emissions and related air quality effects concer all types of transport.	Noted. They are mentioned in earlier section on land vehicles.	Sandro Fuzzi	ISAC CNR	Italy
3993	1		165		The text is very clear, complete and objective. It brings, in my understanding, fundamentally all the information pertinent to the treated subject. The section is very well written and the authors were very responsible and assertive in dealing with the subject in question. For these reasons I have nothing significant to add as I understand that the topic is being treated very clearly and completely. The authors are to be congratulated for the excellent work.	Noted. Thankyou!	FABIO RUBENS SOARES	USP - Universidade de São Paulo	Brazil
61107	4	1	7	25	Unlike other chapter, this chapter has question-answer form of executive summary. This is a departure from the style. May please check.	Noted. Thanks!	LOKESH CHANDRA DUBE	TERI School of Advanced Studies	India

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
65003	4	1	7	24	Perhaps the executive summary and overall report could make the point stronger that the real solution in transport is not electric cars that drive themselves, but rather balancing the private fleet by bringing back large scale effective shared transit (or public transport) that is integrated into land development, especially for commuter travel, otherwise it may be perceived that the IPCC has given up on interrupting car dependence and is hoping alternative fuels will save us because we all want to use cars rather than have cities that work for walking and offer shared transit options that are faster and more convenience than cars...	Accepted but already part of the text here and elsewhere	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
70307	4	1	7	25	The Executive Summary of this chapter is remarkably tech-focussed (on fuels & vehicles rather than mobility). Little prominence is given to modal shift and behaviour change. And where it does appear (on page 10), it is only framed as a fuel saving device (increased efficiency and reduced demand for transport fuels). Previous chapters (e.g. 5 & 6) seem less pessimistic on this point. Is it possible for the authors to reach a common view on this. Focus on technology also risks overlooking rebound effects: e.g. more batteries, more private EVs, more passenger kms, more emissions...	Accepted but already part of the text here and elsewhere	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
72479	4	1			In the executive summary, the references to micromobility are electricity-related. However, the covid pandemia has shown that bikes/scooters/walking (i.e. non electricity-based mobilities) also have a role to play in changing the GHG emissions due to transport. While this is explained later in the Chapter, I found that there is a bias towards these electricity-based transport modes for micromobility in the Executive Summary.	Accepted but already part of the text here and elsewhere	Sylvain Pichat	University of Lyon, Ecole normale supérieure de Lyon, Laboratoire de Géologie (LGL-TPE)	Germany
28535	4	2	4	12	I think it is very important to clarify that what is discussed here is only related with direct GHG emissions, and excludes indirect emissions that are still directly related with transport. These include emissions due to fuel production (e.g. occurring in refineries, likely included in Chapter 6: Energy systems), emissions due to vehicle manufacturing and infrastructure construction - along with related material extraction/processing (likely included in Chapter 11: Industry). This opening paragraph should explain what is included in the Gt values outlined, and it is currently not doing so. A key reason for this is that future developments, induced by climate mitigation strategy, may really shift the balance of transport emissions towards from direct to indirect ones.	Accepted but beyond the scope of changes to text at this stage	Pierpaolo Cazzola	International Transport Forum	France
79489	4	2	4	12	Renewable energy share in the sector and in different modes is missing. Would be useful to include to help explain emissions in the sector, as the vast majority of transport energy comes from fossil fuels (see Figure 3 in REN21 GSR 2020: https://www.ren21.net/gsr-2020/assets/pipe/?asset=Figure_03&type=png&cat=c&ind=01&id=figure_3)	Accepted but beyond the scope of changes to text at this stage	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
83857	4	2	4	12	Renewable energy share in the sector and in different modes is missing. Would be useful to include to help explain emissions in the sector, as the vast majority of transport energy comes from fossil fuels (see Figure 3 in REN21 GSR 2020: https://www.ren21.net/gsr-2020/assets/pipe/?asset=Figure_03&type=png&cat=c&ind=01&id=figure_3)	Accepted but beyond the scope of changes to text at this stage	Hannah E. Murdock	REN21	France
61143	4	3	4	3	The data for transport sector emissions is too old.	Accepted but beyond the scope of changes to text at this stage	Su Song	Young Crane Consulting	China
70309	4	3			JBK 8.5 Gt CO2eq - check source	Noted. Thanks	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
4151	4	6	4	9	What is the source for these numbers? IMO has rported slightly different numbers in their Fourth IMO GHG Study 2020t	Noted. Thanks	Monique Giese	KPMG AG	Germany
11477	4	6	4	8	The figure "75% of transport emissions came from road vehicles" is different from that presented in the main text (73%, P.10, line 7 and Figure 10.1). Please check and revise as appropriate. According to Figure 10.1, emissions from rail should be 1% instead of 3%. Emissions from internation/domestic aviation and international/inland shipping appear to add up to 21%, not 22%. Please check and revise as appropriate.	Accepted and changes made	SAI MING LEE	Hong Kong Observatory	China
23121	4	6	4	7	After the sentence "About 75% of [...], 3% from rail.", this other split could be added to state from the beginning that clear distinction should be made between passenger and freight: "About 60% of transport emissions came from passenger and 40% from freight.". Reason: Most of the time, the modal approach dominates and erase the fact that "road" vehicles and the mobility associated to it encompasses very different dimensions and mitigations options. The split between freight and passenger is more important to understand the place of the transformations.	Accepted but beyond the scope of changes to text at this stage	Government of France	Ministère de la Transition écologique et solidaire	France
81005	4	6	4	7	After the sentence "About 75% of [...], 3% from rail.", this other split could be added to state from the beginning that clear distinction should be made between passenger and freight: "About 60% of transport emissions came from passenger and 40% from freight.". Reason: Most of the time, the modal approach dominates and erase the fact that "road" vehicles and the mobility associated to it encompasses very different dimensions and mitigations options. The split between freight and passenger is more important to understand the place of the transformations.	Accepted but beyond the scope of changes to text at this stage	Yann BRIAND	Iddri, Sciences Po	France
85379	4	6	4	6	Is the statement and the rationale for the chapter fair and relevant, given the possible impacts on aviation future growth due to COVID-19; and additionally, if the majority of transport emissions re associated with road travel, should the focus of the chapter be on road transportation emissions?	Noted, all transport segments need to be covered in this chapter and a special section on aviation and on shipping is in the approved outline of AR6 IPCC WG3	Neil Dickson	ICAO	Canada
56769	4	7	4	9	"Emissions from aviation and shipping, which account for 22% of current transportation-related emissions (split evenly), could grow the fastest in coming decades." It would be helpful to indicate here whether aviation and shipping emissions are growing at same rate.	Accepted but beyond the scope of changes to text at this stage	Government of United States of America	U.S. Department of State	United States of America
76147	4	7	4	7	The contribution from Aviation and shipping to total emissions is probematic due to the somewhat special effects of these sectors (contrail cirrus, sulphate cooling). I think you could avoid this by clearly talking about CO2 only. The chapter may also consider using contributions in terms of temperature as calculated by simple climate models; See WGI as an example	Accepted but beyond the scope of changes to text at this stage	Jan Fuglestvedt	CICERO	Norway
79495	4	7	4	9	Need to mention the climate impact multiplyer (2-4 times) effect of high altitude aviation emissions - for aviation just refering to emissions is NOT enough. The issue is climate impact.	Accepted but beyond the scope of changes to text at this stage	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
86657	4	8	4	8	Please clarify is the "22% of current transportation-related emissions" - is this on a carbon basis or a carbon EQUIVALENT WARMING basis (accepting the uncertainty around carbon equivalence)	Accepted and changes made	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
4619	4	9	4	9	why focus on aviation and shipping, if 70% of emissions are from road mobility? I understand that emission growth in aviation and shipping must be stopped, but the main effect has to be on road mobility.	Rejected, all transport segments need to be covere d in this chapter	Ulf Groos	Fraunhofer ISE	Germany

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
61175	4	9	4	9	Can transit and transit oriented development be mentioned in the first paragraph of the executive summary? The reasons for focusing on shipping and aviation are very clear. However, seeng as road vehicles account for 75% of transportation emmissions and economic growth will certainly increase road vehilce emmissions. By not mentioning transit and electrification - the paragraph ignores the elphant in the room. Recommended sentence "addressing emmissions from road vehicles continues to be of high relevance."	Accepted but beyond the scope of changes to text at this stage	Andrea Cristina Ruiz	Abdul Latif Jameel Poverty Action Lab and Member of Committee on Extreme Weather and Climate Change Adaptation Transportation Review Board-National Academy of Science	United States of America
64975	4	9	4	10	It sounds from line like aviation and shipping might be over focused on and perhaps start the sentence with something like "Along with a focus on major transport modes this chapter also focuses on probelatic areas such as aviation and shipping." …"	Accepted but beyond the scope of changes to text at this stage	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
61177	4	10	4	10	There are many active debates about the appropriateness of the use of “developed/developing countries. In this context. Annex B does not define which country is included in "developing" and "developed". Using "developing" as a catch all reduces the ability for the report to lead to targeted conversations and policy prioritization. Alternative language can include "low income countries" (using World Bank classifications) or geographic areas (Annex B does this for the pacific). While there is further discussion later on, the terminology of "developed" vs "developing" is risky and dilutes the precision we need to target climate action in regions and transport modes with highest emmissions. To illustrate, it is the case that within the United States, the context I am more familiar with- some cities are experiencing increased vehicle use, similarly, some transit oriented cities in middle income countries are experiencing less exponential growth.	accepted but mostly covered in other chapters and beyond the scope of changes at this stage	Andrea Cristina Ruiz	Abdul Latif Jameel Poverty Action Lab and Member of Committee on Extreme Weather and Climate Change Adaptation Transportation Review Board-National Academy of Science	United States of America
23123	4	14	4	15	We suggest to replace by: "divergent technology development to reduce emissions from light-duty vehicles and heavy-duty vehicles." Reason: The paragraph is clearly focused on the development of vehicle technologies as options to mitigate. This should be clearer in the first sentence.	Accepted and changes made	Government of France	Ministère de la Transition écologique et solidaire	France
28537	4	14	4	20	I think this section includes an important omissions: light commercial vehciles, especially those used for urban deliveries, are also an important candidate for electrifcation. See: https://www.itf-oecd.org/how-urban-delivery-vehicles-can-boost-electric-mobility	Accepted and changes made	Pierpaolo Cazzola	International Transport Forum	France
28741	4	14		16	It would be helpful to mention light-duty freight (vans/light commercial vehicles) also here.	Accepted and changes made	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy
48041	4	14	4	20	This paragraph must be updated to adequately summarize the content of Chapter 10. Moreover, readers would great benefit if this chapter – as well as this summary – presented a more comprehensive overview of the actual developments of the transport sector since AR5 and on new prospects in terms of decarbonization. Since AR5, Brazil launched a major biofuels policy (RenovaBio) focused on GHG emissions reduction on a life cycle basis, Canada structured its Clean Fuel Standard (CFS), the E.U. launched a new renewable energy directive (RED II), India, South Africa and many other countries approved different policies and programs to adopt higher biofuels blends, several advanced biofuels plants entered into commercial production (especially HVO/HEFA) – including by retrofitting of old oil refineries - and many countries began to structure programs to incentivize the use of sustainable aviation fuels. It is absolutely misleading to ignore so many important developments throughout the world in terms of increased use of lower carbon transport fuels and focus exclusively in the (undeniable) developments in electrification. Moreover, the need for increased penetration of renewables in the power sector so as to ensure that electromobility delivers real emissions reductions should also be mentioned. The following alternative wording is suggested, but the authors are invited to reassess these issues in other sections of Chapter 10 as well: “Since AR5 there have been divergent developments for decarbonisation of light-duty passenger transport and heavy-duty vehicles. Bioenergy programs have been updated or introduced in several countries and regions. Flex-fuel vehicles (which can run with low carbon fuels) were adopted as mainstream car sales in many countries. The aviation sector stablished decarbonization targets, to be achieved with sustainable aviation fuels and other measures. Electrification options for bikes, autorickshaws, cars, trucks, buses, and passenger trains are now commercially available ((high confidence). When charged with low-carbon electricity, these electric vehicles can significantly reduce emissions compared to the status-quo. If charged from fossil power sources (still the major source in most countries), however, electric vehicles emit as much GHG emissions as cars fueled with gasoline. However, decarbonisation options for long-haul trucks, ships, and planes are still lacking (high confidence). These transportation end-uses may require drop-in fuels or other high energy density fuels for which R&D is still required {10.2, 10.3, 10.4, 10.5 and 10.6}.	Accepted but already part of the text here and elsewhere	Marcelo moreira	UNICAMP - Agroicone	Brazil
50961	4	14	4	20	This paragraph must be updated to adequately summarize the content of Chapter 10. Moreover, readers would great benefit if this chapter – as well as this summary – presented a more comprehensive overview of the actual developments of the transport sector since AR5 and on new prospects in terms of decarbonization. Since AR5, Brazil launched a major biofuels policy (RenovaBio) focused on GHG emissions reduction on a life cycle basis, Canada structured its Clean Fuel Standard (CFS), the E.U. launched a new renewable energy directive (RED II), India, South Africa and many other countries approved different policies and programs to adopt higher biofuels blends, several advanced biofuels plants entered into commercial production (especially HVO/HEFA) – including by retrofitting of old oil refineries - and many countries began to structure programs to incentivize the use of sustainable aviation fuels. It is absolutely misleading to ignore so many important developments throughout the world in terms of increased use of lower carbon transport fuels and focus exclusively in the (undeniable) developments in electrification. Moreover, the need for increased penetration of renewables in the power sector so as to ensure that electromobility delivers real emissions reductions should also be mentioned. The following alternative wording is suggested, but the authors are invited to reassess these issues in other sections of Chapter 10 as well:	Accepted but already part of the text here and elsewhere	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
					"Since AR5 there have been divergent developments for decarbonisation of light-duty passenger transport and heavy-duty vehicles. Bioenergy programs have been updated or introduced in several countries and regions. Flex-fuel vehicles (which can run with low carbon fuels) were adopted as mainstream car sales in many countries. The aviation sector stablished decarbonization targets, to be achieved with sustainable aviation fuels and other measures. Electrification options for bikes, autorickshaws, cars, trucks, buses, and passenger trains are now commercially available ((high confidence). When charged with low-carbon electricity, these electric vehicles can significantly reduce emissions compared to the status-quo. If charged from fossil power sources (still the major source in most countries), however, electric vehicles emit as much GHG emissions as cars fueled with gasoline. However, decarbonisation options for long-haul trucks, ships, and planes are still lacking (high confidence). These transportation end-uses may require drop-in fuels or other high energy density fuels for which R&D is still required {10.2, 10.3, 10.4, 10.5 and 10.6}.				
81007	4	14	4	15	Replace "divergent developments [...] heavy-duty vehicles." by: "divergent technology development to reduce emissions from light-duty vehicles and heavy-duty vehicles." Reason: The paragraph is clearly focused on the development of vehicle technologies as options to mitigate. This should be clearer in the first sentence.	Accepted but already part of the text here and elsewhere	Yann BRIAND	Iddri, Sciences Po	France
10777	4	15	14	16	One should not let believe that electric passenger trains has become available since AR5!	Accepted and changes made	Philippe Waldteufel	CNRS	France
47875	4	15	4	15	Electrification options. Does this mean battery electric vehicles? HEV are also electrified, but are still powered with fossil fuels. I think the language should be clear, "electrification" is very generic and open to interpretations. Does electrification include H2 (fuel cell electric vehicles)?	Accepted and changes made	Matteo Muratori	NREL	United States of America
78859	4	15	4	16	the report appears to use the term truck to refer to all road freight vehicles. The term 'light duty trucks' is used only twice in the whole chapter. This overlooks an important distinction between vans / light duty trucks, typically with a gross weight of under 3-5 tonnes, and larger and heavier 'trucks'. This distinction is important here because it is correct that the commercialisation of electric vans is well underway but this is not the case for 'trucks' with a gross weight over 5 tonnes. I feel that across the chapter as a whole too little is said about the huge growth in van traffic much of it associated with the growth of online retailing. A report by the World Economic Forum / McKinsey in 2020 forecast that, on a business-as -usual basis, CO2 emissions from last-mile deliveries, mainly by vans, in the world's 100 largest cities would grow by 30% by 2030 https://www.weforum.org/reports/the-future-of-the-last-mile-ecosystem	Accepted and changes made	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
4621	4	16	4	16	zero emission vehicles are available but have to be deployed in mass markets together with the transformation of the energy sector towards renewables for emission free charging (battery) or refuelling (fuel cell)	Accepted but already part of the text here and elsewhere	Ulf Groos	Fraunhofer ISE	Germany
53555	4	16	4	16	double parenthesis	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
64977	4	16	4	16	Extra "("	Accepted and changes made	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
69753	4	16	4	16	Why specify "passengers" about trains? Electrification options are also available for freight trains. Suggest deletion of "passengers"	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
69755	4	16	4	16	The term "charged" seems to restrict these options to "battery" vehicles, while there are other options such as continuous or semi-continuous electrification with catenaries, ground-based rail, for trains, tramways, bus ("trolleybuses") and even trucks and cars (see eroadarlanda.com).	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
23125	4	18	4	18	We suggest to replace by: "However, technological mitigation options" Reason: Same than before, just clarify that the topic is technology here and not other options. The paragraph is clearly focused on the development of vehicle technologies as options to mitigate. This should be clearer in the first sentence.	Accepted but already part of the text here and elsewhere	Government of France	Ministère de la Transition écologique et solidaire	France
28463	4	18	5	31	In this chapter the distinction between long-haul and heavy trucks is often unclear. The result of thi is that there is relatively little attention to electric trucks in this segment. To make a clear distinction in terms of any electric vehicle or transport mode. Heavy or light is not a relevant destinction, in fact the heavier a truck is the less the relative added weight of a battery making it less problamatic (Nykvist & Olsson, 2021). The only issue is mobility modes with long continous operating hours. In terms of long haul trucks this would mean that only the fraction driving over 500km a day without relatively long intermediate stops are not able to be electrified. And even these ranges will increase with further battery development and ultra-fast charger capacity. Especially in a European context this is only a small minority of all trips currently stated as long-haul and heavy duty. In conclusion, the potential of electric trucks is far greater than reflected in this chapter.	Accepted but already part of the text here and elsewhere	Naud Loomans	Eindhoven University of Technology	Netherlands
43081	4	18	4	19	It is not correct to say that decarbonisation options for long-haul trucks are still lacking. Biodiesel is a cost-efficient decarbonisation option that exists. There is some confusion between zero emissions options (meaning air quality) and decarbonisation options (meaning GHG). A combination of low carbon technologies and B100 (FAME biodiesel produced from used cooking oil), can decrease GHG emissions by almost 90%. However, this would not mitigate air quality emissions (those would depend on the emissions standard of the tractor unit - e.g. Euro 6). Source: Velazquez Abad, A., et al. (2016). "Sim-heuristics low-carbon technologies' selection framework for reducing costs and carbon emissions of heavy goods vehicles." International Journal of Logistics Research and Applications:1-17.	Rejected, these options are lacking commerciality	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
53557	4	18	4	20	These summary sentences disagree with the later sections. Hydrocarbon fuels are NOT needed for (new) long-haul trucks and likely not for short-distance aviation in a near future. BEV is very cost competitive for long haul trucking, but it only becomes a feasible alternative once charging infrastructure is available. Non-fossil hydrocarbon fuels (or retrofitting of electric propulsion systems) are needed to decarbonize ICE trucks already in operation.	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
56771	4	18	4	20	As currently written, this top-line message implies that decarbonization and electrification of long-haul trucking is similarly challenging to decarbonization of aviation and shipping. From a technology readiness perspective, this is not accurate. Truly emissions-free solutions for aviation and shipping, such as battery electric or carbon-free H2 fuel cell drivetrains, are not yet commercially available for the most part. A few small prototype BEV and FCEV aircraft have been built and there are some battery electric and fuel cell ferry boats in service. But there are no commercial-scale models available for large passenger aircraft or ocean-going vessels. By contrast, several heavy duty truck manufacturers already offer BEV and FCEV models. These technologies are still developing, but one can buy them on the open market. Electrification of long-haul trucking is closer in readiness to light duty vehicles than it is to aviation or shipping. This needs to be reflected in topline messages.	Accepted and changes made	Government of United States of America	U.S. Department of State	United States of America
75631	4	18	5	31	A fairly problematic narrative is read throughout Chapter 15: when it comes to light vehicles, electrifying is 'easy' whereas for large/heavy duty vehicles, electrification will only be possibly once new technology becomes available (prognosed to happen after 2030?). Considering heavy duty, Class 8 tractor-trailer combinations are responsible for approximately 30% of all transport emissions, surmounting aviation and shipping combined. Brand-new research by Nykvist ("The feasibility of heavy battery electric trucks" to be published in April 2021 for the journal 'Joule') showcases that electrification, in fact, becomes 'easier' the heavier the vehicle. The author explains that with bigger size the battery-to-payload ratio will decrease; we therefore can expect a positive business case for Class 8 trucks – while not even integrating carbon pricing – as soon as batteries will get to a $100 USD price for 5000 cycles & a weight smaller than 175Wh/kg. Bloomberg New Finance publications have set the prognoses for this to happen by 2023 (see: http://bit.ly/BNEF2020). Furthermore, it would better to consider range, rather than weight considering that the cost and the weight of a battery per ton of transport will increase with range. Lastly, another critical metric to emphasize is how fast a battery is cycled – the quicker this happens, the sooner the investment will be earned back (both in actual money, and in amount of carbon emitted during the production process). Hereby Class 8 trucks will actually cycle the battery relatively fast and will therefore be even more appropriate for electrification. Specific lines to which this comment pertains are as follows: (line 18-20 on page 4; line 25-26 on page 4; line 27-28 on page 5; line 29-30 on page 5).	Accepted and changes made	Amira El-Feiaz	Technische Universiteit Eindhoven	Netherlands
79137	4	18	4	19	As I'll doubtless detail further below, the conclusion at 4:18–19 about long-haul trucks, ships, and planes is flat wrong. It would be correct to describe their decarb options as ranging from entering the 2021 market (electric heavy trucks) to clearly feasible and in pilot operation (ships) to rapidly emerging (planes). Regrettably these sections are several years outdated. To be sure, 4:25–27 expresses medium confidence that heavy trucks could become viable with electrolytic H2 after 2030, but actually battery-electric versions (notably Tesla's Class 8 Semi with normal range and payload) are already on the road with early deliveries in 2021 and excellent economics at initial prices. The actual status for all heavy transport as of March 2021 is synthesized and documented in Lovins 2021, "Profitably decarbonizing heavy transport and industrial heat," provided to WG3 leaders in draft in Nov 2020, in press for April 2021 release by RMI (www.rmi.org), summarized and strategically augmented by "Six business revolutions to decarbonize heavy transport and industrial heat," in press for June 2021 publication by MIT Sloan Management Review. Actually, even the automotive statement at 4:24 ("likely to be cost competitive in the near future" is incorrect to: what's virtually certain by 2023–5 is purchase-price parity, but lifecycle cost-effectiveness is already clear for ordinary US users and very strong for fleets. That's why VW just upgraded its forecast of its 2030 auto sales to 50% electric in US and China, >70% in EU.	Accepted and changes made	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
81009	4	18	4	18	Replace "decarbonisation options" by: "technological mitigation options" Reason: Same than before, just clarify that the topic is technology here and not other options. The paragraph is clearly focused on the development of vehicle technologies as options to mitigate. This should be clearer in the first sentence.	Accepted. Clarified in FGD	Yann BRIAND	Iddri, Sciences Po	France
82091	4	18	5	31	Most of the chapter seems to repeat on the same idea: electrification can be a solution for light vehicles, but for large/heavy duty vehicles, the technology won't be available any time soon, probably not before 2030. However, there are studies that show that size should not be a problem for electrifying vehicles, thus making electrification of light and heavy duty vehicles equally challenging. The only extra challenge for heavy vehicles (and shipping and air transport) would be that of range, and even then, there are already viable possibilities. The study by Nykvist, "The feasibility of heavy battery electric trucks" shows that in fact, electrification becomes easier as vehicles become heavier. This is becase with as size increases, the battery to payload ratio decreases. The article also shows that a positive business case for class 8 trucks can be expected even in the absence of carbon pricing. On the other hand, at least for heavy transport, there are already some heavy vehicle options that can drive on electric on a 'full days work' of 8h at a speed of 90 km/h. Taking this in consideration, it would maybe be interesting to also emphasize that a remaining challenge is that of adequate infrastructure for electric heavy duty vehicle charging.	Accepted. Clarified in FGD	Sofia Rosero Abad	University	Netherlands
83849	4	18	4	20	Although not all from renewable sources, many alternative fuels are already commercially viable for HDVs, and technological development continues. Alternative fuels include biofuels, synfuels or low-carbon liquid fuels produced from agriculture crops or waste, liquefied natural gas (LNG) or compressed natural gas (CNG), and biomethane. Other propulsion systems that are reaching commercial viability include hydrogen fuel cells, electric vehicles, and electric roads (electric-powered vehicles where the energy source is external, for example through overhead wires). Another option under development is the use of solar PV for road surfaces to charge vehicles while they are in motion. While hybridisation of trucks and buses is already economical and quickly pays for itself with fuel savings, fully electric heavy-duty vehicles are still more expensive; however, manufacturers are having to adapt when operating in some cities that have banned ICE vehicles, such as Madrid. (References: REN21 GSR 2019 and 2020, Transport section in Global Overview chapter: www.ren21.net/gsr-2019, www.ren21.net/gsr-2020)	Noted. Covered largely in the chapter	Hannah E. Murdock	REN21	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
85495	4	18	5	31	Chapter 10 currently repeats the same problematic narrative in dozens of places: electrifying light vehicles is easy, but for large/heavy vehicles we need new technology that will only become available in earnest after 2030. This is important because heavy class 8 tractor-trailer combinations cause 30% of all transport emissions: more than aviation and shipping combined. And it's a problem because it's simply not correct and hampers the adoption of electric trucks. Since I've been researching this for the past five years at the automotive faculty of a technical university, I feel I must try to improve the AR6 in this regard. Fortunately, you don't have to take my word for it. There is now a new article by Nykvist (famous from his article on lithium batteries in Nature). It will appear in the April 2021 issue of the high ranking journal Joule (I was a reviewer) and is called: "The feasibility of heavy battery electric trucks". In it Nykvist shows that electrification actually becomes easier (!) as vehicles become heavier. The reason is simple: as size increases, the battery to payload ratio decreases. He shows we can expect a positive business case for class 8 trucks (even without carbon pricing) once batteries reach a price of 100 USD, can do 5000 cycles and weight less than 175 Wh/kg. According to the 2020 battery survey of Bloomberg New Energy Finance we can expect the average lithium battery to exceed these specs by 2023. See http://bit.ly/BNEF2020. Range would be a more valid argument than weight to use in chapter 10, since the price and weight of a battery per tonne of transport increases with range. However, a truck with one driver that stays within the law cannot drive more than around 750 km per day (8 hours x 90 km/h) and Tesla has sold (but not shipped) a truck with this range to thousands of customers already. The CEO of truck company Scania has announced that they expect 50% of their sales to be electric by 2030 and that in a few years they will sell a heavy truck that can drive at least 4.5 hours under full load (the maximum time a driver is allowed to drive in the EU before a 45 minute rest). See http://bit.ly/ScaniaElectric. That it is not size but range that matters also holds true for ships and planes. The best metric would actually be how fast the battery is cycled. If a battery is cycled faster, it earns its investment back sooner. That's true both in terms of money and in terms of carbon emitted during production. Class 8 trucks would cycle the battery very fast and would thus be even more suited than cars for electrification. I think it's not good that this option is disparaged so often in chapter 10 and more specifically in the summary where this comment is about. For your convenience I now list every text fragment in the summary that the aforementioned information applies to (instead of making multiple comments) but I would highly appreciate it if in the reaction you discuss what you have done with each text fragment separately. On line 18 to 20 the fate of the biggest truck segment (by itself larger than shipping and aviation combined in terms of CO2) is left unclear. But the way I read it, it is implied that class 8 needs new high-density fuel. This could be clarified. For example: "Although we see a quick increase in range for heavy trucks running on batteries, hydrogen is also expected to play an	Accepted and changes made	Auke Hoekstra	Eindhoven University of Technology	Netherlands
56773	4	19	4	19	It would be helpful to very briefly define "drop-in" fuels here.	Accepted and changes made	Government of United States of America	U.S. Department of State	United States of America
64979	4	19	4	19	Perhaps consider diesel from ocean plastic as a shipping option as there are technologies for producing less than 10ppm sulphur fuel from ocean plastic.	Accepted but beyond the scope of changes to text at this stage	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
69757	4	19	4	20	This sentence is a bit vague and may suggest there is an important need for R&D here. However, most technologies leading to low-carbon drop-in fuels already exist, from solar and wind power to water electrolysis to Reverse gas water shift to Fischer-Tropsch technologies. Some R&D would be useful to link them together optimally, i.e. adapt FT technologies to variable fluxes of hydrogen from variable renewables-based electrolysis and/or store some hydrogen to dampen that variability.	Accepted but already part of the text elsewhere	Cédric PHILIBERT	Institut Français des Relations Internationales	France
48043	4	21	4	30	This paragraph - as it is unfortunately the case in some other sections of Chapter 10 as well (for which we present specific comments below) - seems to imply that biofuels as a mitigation option for transport is not a reality (l. 22: "could support decarbonisation"). Reference to conventional biofuels readiness as a mitigation option is missing and therefore should be included. Lower technology readiness level in the case is only true for (most) advanced biofuels pathways - however, even in this case, some notable exceptions should be mentioned in the Chapter, such as the growing commercial production of HVO/HEFA-SPK for both land transportation and aviation. The following alternative language is suggested: "More detailed life cycle analysis is also a feature since AR5 {10.4}. Electrification, hydrogen, biofuels, and synthetic hydrocarbons/e-fuels could support decarbonisation of the transportation sector. However, these technologies are at different technology readiness levels. Low emissions conventional biofuels are ready to be used at large scale and are cost competitive with fossil fuels, depending on oil prices. Electrification options for light-duty passenger transport are at high technology readiness levels and are likely to be cost competitive in the near future."	Accepted.Text was changed	Marcelo moreira	UNICAMP - Agroicone	Brazil
50963	4	21	4	30	This paragraph - as it is unfortunately the case in some other sections of Chapter 10 as well (for which we present specific comments below) - seems to imply that biofuels as a mitigation option for transport is not a reality (l. 22: "could support decarbonisation"). Reference to conventional biofuels readiness as a mitigation option is missing and therefore should be included. Lower technology readiness level in the case is only true for (most) advanced biofuels pathways - however, even in this case, some notable exceptions should be mentioned in the Chapter, such as the growing commercial production of HVO/HEFA-SPK for both land transportation and aviation. The following alternative language is suggested: "More detailed life cycle analysis is also a feature since AR5 {10.4}. Electrification, hydrogen, biofuels, and synthetic hydrocarbons/e-fuels could support decarbonisation of the transportation sector. However, these technologies are at different technology readiness levels. Low emissions conventional biofuels are ready to be used at large scale and are cost competitive with fossil fuels, depending on oil prices. Electrification options for light-duty passenger transport are at high technology readiness levels and are likely to be cost competitive in the near future."	Accepted. Text was chaged	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
29725	4	23	4	25	When describing the cost-competiveness of electric vehicles, please consider to include information showing that these often are competitive already today, not only in the near future.	Accepted and changes made	Government of Norway	Norwegian Environment Agency	Norway
47877	4	24	4	24	BEV buses are even more adopted than BEV LDV, in relative terms	Accepted and changes made	Matteo Muratori	NREL	United States of America

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
53559	4	24	4	27	Electrification is at high technology redineess level also for heavy duty trucks today (several manufacturers have series production of heavy BEV trucks). EV trucks require charging infrastructure to be built before they can be operated, and the technology is so far only cost competitive in markets with fairly expensive diesel and fairly cheap electricity. However, several factors are contributing to that total cost of ownership (TCO) is decreasing VERY rapidly for BEV trucks. This is particularly true for the long haul segment, as high CAPEX and low OPEX favors business cases with long mileage and heavy loads. I am not aware of any evidence (nor have I seen any cited in this chapter) that hydrogen would be a cheaper alternative than BEV before 2040.	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
79497	4	24	4	25	Need to be clear what "cost" you are referng too here. Purchase cost? Total Cost of Ownership? Important differences.	Accepted and changes made	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
4019	4	25	4	27	“Advanced biofuels and electrolytic hydrogen could support decarbonisation of land-based heavy-duty transport (medium confidence). These fuel and vehicle technologies are in advanced development stages and could be commercially viable after 2030” -This seems to suggest that electrification cannot play a role within heavy-duty transport. This jars slightly against the market view which is rather polarised at the moment between those pursuing hydrogen and BEV, e.g. Scania refocusing from FCEV to BEV; GM doubling down on FCEV; Telsa vs Nikola etc. -In fairness – this is addressed clearly on p10-5, Line: 34, but could be brought out more clearly here.	Accepted and changes made	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
9071	4	25	4	30	Biofuels are very promising option for aviation. Please mention this somewhere around here.	Accepted and changes made	Shigeki KOBAYASHI	Transport Institute of Central Japan	Japan
28539	4	25	4	30	Low-carbon synfuels are also an option for heavy duty road vehicles. Given the hurdles associated with hydrogen distribution and storage challenges and standardisation development that are still lacking (see https://www.itf-oecd.org/regulations-and-standards-clean-trucks-and-buses), i also think that placing hydrogen ahead of e-fuels for road transport is a questionable choice. More information on the suitabiliy of different fuel options for low-carbon shipping is also available in https://www.itf-oecd.org/navigating-towards-cleaner-maritime-shipping. This includes considerations on limitation for hydrigen as a low carbon fuel option also in this sector, in favour of methanol or ammonia, provided that they are produced from low carbon pathways. This report also inlcudes an overview of pathways allowing the production of low-carbon fuels that includes hybrid solutuons inregrating low-carbon hydrigen and biogenic carbon, These seem to be missing completely in this summary. FInally, I am very surprised to see that electric road systems do not even get a mention, here. See, on the subject, http://www.csrf.ac.uk/wp-content/uploads/2020/07/SRF-WP-UKEMS-v2.pdf.	Accepted and changes made	Pierpaolo Cazzola	International Transport Forum	France
29727	4	25	4	26	Please consider including "as well as shipping, aviation and non road mobile machinery" in the sentence ("Advanced biofuels and electrolytic hydrogen could support decarbonisation of land-based heavy-duty transport, as well as shipping, aviation and non road mobile machinery")	Accepted but already part of the text here and elsewhere	Government of Norway	Norwegian Environment Agency	Norway
47879	4	25	4	25	"Advanced biofuels and electrolytic hydrogen could support decarbonisation of land-based heavy-duty transport". What about use in ships and airplanes? Why is this different? Biofuels and el. H2 can be a great solution for non-road transport	Accepted but already part of the text here and elsewhere	Matteo Muratori	NREL	United States of America
69759	4	25	4	26	Electrification options can also support decarbonisation of land-based heavy-duty transport. Scania battery electric truck currently has a range of up to 250 km. In the next few years we should see 40 T long-range trucks able to drive for 4.5 hours and then recharge during the driver's compulsory 45 minute rest.	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
4623	4	26	4	26	heavy duty and light duty (China, Japan, Korea are promoting very strong fuel cell cars)	Accepted but already part of the text here and elsewhere	Ulf Groos	Fraunhofer ISE	Germany
7837	4	27	4	29	Here the text says that "Low carbon synthetic hydrocarbons/e-fuels, which could potentially support decarbonisation of aviation and shipping, --- ".It is true that low carbon synthetic hydrocarbons/e-fuels would support carbon emission REDUCTIONS. It would not, however, support DECARBINIZATION as carbon included in synthetic fuels are ultimately emitted to the atmospher unless captured and stored underground. In transport sector, this is quite unrealistic.	Accepted and changes made	Mitsutsune Yamaguchi	Research Institute for the Innovative Technology for the Earth (RITE)	Japan
74225	4	27	4	30	This language fails to account for the very near term use of ammonia based systems that can be deployed on vessels - using readily available technologies. This ammonia can be derived through green technologies including wind, solar, nuclear among others. https://www.ft.com/content/2014e53c-531f-11ea-a1ef-da1721a0541e	Rejected, the text is clear that green ammonia is advanced but not yet commercial	Jeffrey Merrifield	Pillsbury Law Firm	United States of America
47881	4	28	4	29	"which could potentially support decarbonisation of aviation and shipping". Why not on-road? I am c onfused by this siloing of solutitons	Accepted but already part of the text here and elsewhere	Matteo Muratori	NREL	United States of America
64981	4	28	4	29	Is bio-fuel from large scale seaweed production being considered as it has been viable for some time and is carbon neutral, while protecting costliness and reducing ocean acidification.	Accepted but beyond the scope of changes to text at this stage	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
69761	4	28	4	28	Ammonia should be added to the list (it's not a hydrocarbon), as it has now emerged as the most likely option for decarbonising deep sea shipping.	Accepted but already part of the text here and elsewhere	Cédric PHILIBERT	Institut Français des Relations Internationales	France
69763	4	28	4	30	The tone of the sentence is excessively negative. Large-scale investments in electrolytic ammonia running on solar and wind are underway already, notably in Western Australia. MAN ES and Wärtsilä, the main manufacturers of large 4-Stroke and 2-stroke maritime internal combustion engines are working to adapt them to the combustion of ammonia, and the first engines will be available in 2024 - that's near term.	Rejected, this sentence is clear on referring to commercial viablity after 2030, not trials which are already underway	Cédric PHILIBERT	Institut Français des Relations Internationales	France
4625	4	29	4	30	as synthetic fuels could be immediately used in todays combustion engines they are likely to be used in medium term. The production of SynFuels is technologically viable also today and only market/politics/regulations decide on economic feasibility - together with CO2 costs ships and airplanes could switch to SynFuels very fast.	Accepted but already part of the text here and elsewhere	Ulf Groos	Fraunhofer ISE	Germany
28743	4	30			What does 'near to medium term' mean (year)?	Accepted but already part of the text here and elsewhere	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
23127	4	31	4	34	We suggest to replace the sentence by: "In the past, the transformations of land, urban and infrastructure systems or industrial systems or human behaviours have been seen as an incremental mitigation option. Since AR5 and the latest special report on global warming of 1.5°C, there is growing awareness of the need for demand-based mitigation strategies combining these different transformations to reduce and lower the pressure on energy demand and contribute to facilitate the penetration of low-carbon vehicle technologies." Reasons: First, this is important to clarify the transformations and mitigations options required to reduce the demand of energy. The replacement proposes to introduce elements pointed out mostly from the IPCC, 2018, SPM (See extract 1 and 2 below). Second, the replacement proposes to mention clearly the IPCC, 2018 report has an important review enabling to develop the "growing awareness" initially mentionned. Third, the replacement proposes to clarify the second inital sentence without changing its sense and insist on the fact that the contributions of these demand-based mitigation strategies are to "reduce and lower the pressure on energy demand" and "facilitate the penetration of low-carbon vehicle technologies". From IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. : Extract 1 - "Pathways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems (high confidence). These systems transitions are unprecedented in terms of scale, but not necessarily in terms of speed, and imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options (medium confidence). {2.3, 2.4, 2.5, 4.2, 4.3, 4.4, 4.5}" Extract 2 - "Limiting the risks from global warming of 1.5°C in the context of sustainable development and poverty eradication implies system transitions that can be enabled by an increase of adaptation and mitigation investments, policy instruments, the acceleration of technological innovation and behaviour changes (high confidence)."	Accepted and changes made	Government of France	Ministère de la Transition écologique et solidaire	France
46053	4	31	4	36	To achieve substantial impact on decreasing the transport sector's carbon emissions, technology based solutions need a substantial "add-on "to reduce demand and in particular vehicle kilometres travelled (VKT). Therefore, a paradigm shift in transport systems planning and the provision of transport infrastructure is essential. This should clearly be mentioned. Demand reduction ("Avoid" referring to ASI) as well as "modal shift" play a very important role in reducing transports GHG emissions. Understandingly, throughout the report there is more focus on technical aspects and measures ("Improve" and "Fuels"). Therefore it is of high importance to highlight "Avoid" and "Shift" in the whole storyline. Supposed all sectors are widely climate neutral in 2050/60, the whole scientific debate will condense to efficiency (see also Ch10-07, lines 6-8). However, renewable energy will not be ubiquitous, so energy efficient modes (bundled mass transport such as rail) will be an important part of the solution beyond GHG. Please clarify. References: Bellis, R., Davis, S. L., Sundquist, E., McCahill, C., & Mangan, E. (2020). THE CONGESTION CON How more lanes and more money equals more congestion. Retrieved from http://t4america.org/maps-tools/congestion-con/ Noland, R. B. (2007). Transport Planning and Environmental Assessment: Implications of Induced Travel Effects. International Journal of Sustainable Transportation, 1, pp. 1-28. doi:10.1080/15568310601095131	Accepted but already part of the text here and elsewhere	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
61179	4	31	4	36	The paragraph should include "transit use" in addition to "local active transport". Active transport may not be feasible for all tranport needs, the next lowest emmission option after that is transit.	Rejected, this sentence is specific to changes due to COVID specifically increased active transport and ICT.	Andrea Cristina Ruiz	Abdul Latif Jameel Poverty Action Lab and Member of Committee on Extreme Weather and Climate Change Adaptation Transportation Review Board-National Academy of Science	United States of America
69765	4	31	4	34	Not sure what this two sentences actually means. Demand reduction and efficiency improvements are still, by definition, incremental mitigation options. The following sentence seems to alleviate that assessment, but "particularly when combined with technology change" tends to empties the sentence of its meaning.	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
81011	4	31	4	34	Replace "In the past, [...] when combined with technology change" by: "In the past, the transformations of land, urban and infrastructure systems or industrial systems or human behaviours have been seen as an incremental mitigation option. Since AR5 and the latest special report on global warming of 1.5°C, there is growing awareness of the need for demand-based mitigation strategies combining these different transformations to reduce and lower the pressure on energy demand and contribute to facilitate the penetration of low-carbon vehicle technologies." Reasons: First, this is important to clarify the transformations and mitigations options required to reduce the demand of energy. The replacement proposes to introduce elements pointed out mostly from the IPCC, 2018, SPM (See extract 1 and 2 below). Second, the replacement proposes to mention clearly the IPCC, 2018 report has an important review enabling to develop the "growing awareness" initially mentionned. Third, the replacement proposes to clarify the second inital sentence without changing its sense and insist on the fact that the contributions of these demand-based mitigation strategies are to "reduce and lower the pressure on energy demand" and "facilitate the penetration of low-carbon vehicle technologies". From IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. : Extract 1 - "Pathways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems (high confidence). These systems transitions are unprecedented in terms of scale, but not necessarily in terms of speed, and imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options (medium confidence). {2.3, 2.4, 2.5, 4.2, 4.3, 4.4, 4.5}" Extract 2 - "Limiting the risks from global warming of 1.5°C in the context of sustainable development and poverty eradication implies system transitions that can be enabled by an increase of adaptation and mitigation investments, policy instruments, the acceleration of technological innovation and behaviour changes (high confidence)."	Accepted and changes made	Yann BRIAND	Iddri, Sciences Po	France
15473	4	34	4	36	Should note that there are also potential negative effects in the post-Covid world, including reluctance to use public transport for perceived health reasons and possibility that reduced commuting is offset by motorised trips for other purposes.	Accepted and changes made	Ryan Falconer	Auckland Council, New Zealand	Australia
43773	4	34	4	35	Does this statement take also into account the economic impacts of the pandemic (e.g., on GDP) and their subsequent effects on transport, or just behavioural changes?	Accepted and changes made. The primary focus is on behavioural changes, but it has been updated to reflect potential negative consequences i.e. decreased public transit use.	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
81013	4	34	4	35	Replace "significant changes" by: "significant behavioural changes" Reason: The changes we are talking about are related to lifestyles and behaviours. This is a suggestion to characterize the type of changes, which is not here a technological change.	Accepted and changes made	Yann BRIAND	Iddri, Sciences Po	France
86659	4	34	4	35	The text should clarify there is potential for both significant behavioural as well as technical change.	Accepted and changes made	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
23129	4	35	4	35	To replace by: "behavioural changes" Reason: The changes we are talking about are related to lifestyles and behaviours. This is a suggestion to characterize the type of changes, which is not here a technological change.	Accepted and changes made	Government of France	Ministère de la Transition écologique et solidaire	France
56775	4	35	4	35	"Internet-replaced travel" sounds odd; could rephrase along the lines of remote/telework.	Accepted and changes made	Government of United States of America	U.S. Department of State	United States of America
28541	4	37	5	3	I think this section includes an important omission: light commercial vehicles, especially those used for urban deliveries, are also an important candidate for electrification. See: https://www.itf-oecd.org/how-urban-delivery-vehicles-can-boost-electric-mobility	Accepted and changes made	Pierpaolo Cazzola	International Transport Forum	France
28543	4	37	5	25	I think this section fails to flag risks related to shortfall in government revenues from fuel taxes, and a need to pivot towards road user charges to deal with this. See https://webstore.iea.org/download/direct/2807?fileName=Global_EV_Outlook_2019.pdf (page 189) and references available there for m ore details. See also https://waroadusagecharge.org/final-report/ for an analysis specifically looking at road use charges as a solution to the problem just flagged.	Accepted and changes made	Pierpaolo Cazzola	International Transport Forum	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
48045	4	37	4	38	This excerpt echoes' some other sections of Chapter 10 in making exclusive reference to electromobility as a mitigation option for light-duty vehicles. Reference to liquid biofuels and their role – particularly in the near- to medium-term – is missing. This should be corrected. At least one or two paragraphs should be included addressing biofuels role – now and in the following decades – as a important mitigation option in many countries and regions. The following text is proposed: "Liquid biofuels are currently the only low emissions fuel capable of reducing emissions within the existing fleet and infrastructure. Blends of up to 10%, or more are viable in current ICE without any modifications. Biofuels can also substitute fossil fuels at much higher blend levels (up to 85% or 100%) in FFV vehicles. Liquid biofuels remain as the most promising option in the short and medium term (up to 2050) in many countries and regions. However, biofuels should be implemented with adequate planning to avoid unintended negative impacts on sustainability. Biogas can also be used with minor adjustments to the existing fleet." Some additional references are provided, so as to reference the arguments presented in the suggested paragraph: Staples, M. D., Malina, R., & Barrett, S. R. (2017). The limits of bioenergy for mitigating global life-cycle greenhouse gas emissions from fossil fuels. Nature Energy, 2(2), 1-8. Liu, B., & Rajagopal, D. (2019). Life-cycle energy and climate benefits of energy recovery from wastes and biomass residues in the United States. Nature Energy, 4(8), 700-708. Kang, Y., Yang, Q., Bartocci, P., Wei, H., Liu, S. S., Wu, Z., ... & Chen, H. (2020). Bioenergy in China: Evaluation of domestic biomass resources and the associated greenhouse gas mitigation potentials. Renewable and Sustainable Energy Reviews, 127, 109842. Mittal, S., Ahlgren, E. O., & Shukla, P. R. (2019). Future biogas resource potential in India: a bottom-up analysis. Renewable Energy, 141, 379-389.	Accepted. Text was changed, point made however we have lenght constraints. Biofuels heavily debated and included in other chapters.	Marcelo moreira	UNICAMP - Agroicone	Brazil
50965	4	37	4	38	This excerpt echoes' some other sections of Chapter 10 in making exclusive reference to electromobility as a mitigation option for light-duty vehicles. Reference to liquid biofuels and their role – particularly in the near- to medium-term – is missing. This should be corrected. At least one or two paragraphs should be included addressing biofuels role – now and in the following decades – as a important mitigation option in many countries and regions. The following text is proposed: "Liquid biofuels are currently the only low emissions fuel capable of reducing emissions within the existing fleet and infrastructure. Blends of up to 10%, or more are viable in current ICE without any modifications. Biofuels can also substitute fossil fuels at much higher blend levels (up to 85% or 100%) in FFV vehicles. Liquid biofuels remain as the most promising option in the short and medium term (up to 2050) in many countries and regions. However, biofuels should be implemented with adequate planning to avoid unintended negative impacts on sustainability. Biogas can also be used with minor adjustments to the existing fleet." Some additional references are provided, so as to reference the arguments presented in the suggested paragraph: Staples, M. D., Malina, R., & Barrett, S. R. (2017). The limits of bioenergy for mitigating global life-cycle greenhouse gas emissions from fossil fuels. Nature Energy, 2(2), 1-8. Liu, B., & Rajagopal, D. (2019). Life-cycle energy and climate benefits of energy recovery from wastes and biomass residues in the United States. Nature Energy, 4(8), 700-708. Kang, Y., Yang, Q., Bartocci, P., Wei, H., Liu, S. S., Wu, Z., ... & Chen, H. (2020). Bioenergy in China: Evaluation of domestic biomass resources and the associated greenhouse gas mitigation potentials. Renewable and Sustainable Energy Reviews, 127, 109842. Mittal, S., Ahlgren, E. O., & Shukla, P. R. (2019). Future biogas resource potential in India: a bottom-up analysis. Renewable Energy, 141, 379-389.	Accepted. Text was changed, point made however we have lenght constraints	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
77131	4	37	5	3	The report asserts that LIBVs have "lower life-cycle GHG intensity" than ICEVs "if charged by low-carbon electricity". That is generally untrue. Research shows that production of a 30kWh battery releases 4.5-6tCO2. Thus, even if charged by wind power, the breakeven point in total CO2 released between a LBIV and ICEV will be 50k km. For a European average power generation mix it will be 78k km, and for an average global power mix it will be 112k km. See for example: https://www.polestar.com/uk/electric-sustainability/transparency/. LBIVs are certainly not a "Low-Carbon" solution. See comment #11.	Rejected, please refer to lifecycle analysis in 10.7	Jim O'Brien	Expert Reviewer AR6 SOD WG1	Ireland
23131	4	38	4	38	Replace by: "1. Shifting to electro-mobility in light duty land transport vehicles" Reason: The title could be clearer in answering directly to the question: What are the main mitigation options in the transport sector: 1. Shifting to electro-mobility in light duty land transport vehicles 2. Shifting to electro-fuels and biofuels in heavy duty vehicles and long haul 3. Transforming land, urban and infrastructure systems, industrial systems and human behaviours to reduce demand for transport fuels	Accepted but beyond the scope of changes to text at this stage	Government of France	Ministère de la Transition écologique et solidaire	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
81015	4	38	4	38	Replace the sentence by: "1. Shifting to electro-mobility in light duty land transport vehicles" Reason: The title could be clearer in answering directly to the question: What are the main mitigation options in the transport sector: 1. Shifting to electro-mobility in light duty land transport vehicles 2. Shifting to electro-fuels and biofuels in heavy duty vehicles and long haul 3. Transforming land, urban and infrastructure systems, industrial systems and human behaviours to reduce demand for transport fuels	Accepted but beyond the scope of changes to text at this stage	Yann BRIAND	Iddri, Sciences Po	France
83991	4	38	5	25	This part of the executive summary does not sufficiently highlights the limitations and risks of replacing combustion light-duty vehicles with electric ones, such as indirect emissions associated with EVs, carbon lock-ins in energy systems, and potentially negative social and environmental consequences of continued growth in demand for personal vehicles (electric or otherwise). These effects could be mitigated with policies to reduce car ownership. Such policies are indeed included in some of the IAMs used in the report (e.g. Grubler et al. 2018, who envision *halving* of vehicle fleet by 2050) and should be emphasized in this chapter and its executive summary.	Accepted but beyond the scope of changes to text at this stage	Michał Czepkiewicz	University of Iceland	Poland
52411	4	39	4	40	Sentence not clear	Accepted and changes made	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
63215	4	39	4	40	buses should not be categorized as "light duty vehicles".	Noted. Changes made to address vehicles directly.	Government of Canada	Environment and Climate Change Canada	Canada
64983	4	39	5	3	Brilliantly written!	Accepted	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
70311	4	39			Replace "the major source" with "a major source", else inconsistent with balance of sources presented.	Accepted and changes made	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
74227	4	39	5	3	References to renewable energy should be changed to carbon-free energy resources as power produced by hydroelectric and nuclear could also be absorbed by elecric vehicles for grid stablilization and absorb excess clean energy.	Noted. Covered mostly in chapter 6. Transport is mostly now about batteries and other fuels.	Jeffrey Merrifield	Pillsbury Law Firm	United States of America
5485	4	40	4	40	add, after "vehicles : as long as the electricity is produced from low carbon sources.	Accepted but already part of the text here and elsewhere	Michel SIMON	Retraité/ Pdt d'association	France
9073	4	40	4	43	"Lithium Ion Battery-electric vehicles (BEVs)" Here probably you do not need to specify "lithium ion".	Accepted and changes made	Shigeki KOBAYASHI	Transport Institute of Central Japan	Japan
47883	4	40	4	40	Line 40: why excluding medium and heavy-duty vehicles?	Accepted and changes made	Matteo Muratori	NREL	United States of America
72903	4	40	4	43	Here an order of magnitude could be very interesting for the reader to access pertinence/importance of statement.	Unclear what this is referring to	Antoine BONDUELLE	EE-Consultant	France
4629	4	41	4	43	BEVs and FCEV (fuel cell electric vehicles) are more energy efficient … with low carbon electricity or regenerative hydrogen.	Rejected, this section is focused on e-mobility	Ulf Groos	Fraunhofer ISE	Germany
4627	4	42	4	42	… than ICEV powered by fossil fuels … (if powered by regenerative SynFuels the LCA shows even better results than for BEVs)	Rejected, this section is focused on e-mobility	Ulf Groos	Fraunhofer ISE	Germany
5487	4	45	4	45	replace Renewables" by "low carbon sources"	Noted. Nuclear is addressed in Feasibility and in other chapters.	Michel SIMON	Retraité/ Pdt d'association	France
79487	4	45	4	46	Also in rail. In addition, an increasing number of cases are arising with renewable energy-powered rail and buses (e.g. India and China, respectively).	Unclear what this is referring to	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
83851	4	45	4	46	Also in rail. In addition, an increasing number of cases are arising with renewable energy-powered rail and buses (e.g. India and China, respectively).	Unclear what this is referring to	Hannah E. Murdock	REN21	France
43083	4	46	5	3	It doesn't seem right to say that e-autorickshaws, e-scooters and e-bikes are going to provide energy balancing services to the grid. Vehicle to Grid technologies could play a role when the batteries have a considerable size (minimum cars, probably heavy goods vehicles).I would rewrite as follows: "Energy storage can avoid curtailment of surplus renewables and vehicle-to-grid technologies can potentially provide energy balancing services to the grid".	Accepted and changes made	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
56777	4	46	4	46	Text states that "all these vehicles, in addition to private cars, can be used for grid stabilisation". This statement groups together micro-mobility (e.g., e-scooters and e-bikes) with transit buses, which have very different battery capacities for having true vehicle to grid capability. Revise to distinguish between the micro-mobility and larger vehicles for grid stabilisation.	Accepted and changes made	Government of United States of America	U.S. Department of State	United States of America
81543	4	46	5	3	This sentence, and its connection with the previous one, seem to infer that micro-mobility modes have a large role to play in providing grid services. However, small batteries per vehicle and the lack of dedicated charging infrastructure for those lead to uncertain technical potential and economic returns in the provision of grid services - the exception might be for very large and well-coordinated fleets of micro-mobility vehicles that, with their scale, might both be able to offer significant grid services and have sufficient potential for economic returns so that fleet owners participate. For more information, see p. 236 and figure 5.4 in Global EV Outlook 2020 (https://www.iea.org/reports/global-ev-outlook-2020).	Accepted and changes made	Marine Gorner	International Energy Agency (former)	France
31659	4		7		ES is Q-A format. Please change as this is not the standard format	Noted and non-Q-A format adopted.	Shreya Some	Ahmedabad University	India
82069	4				The Executive Summary (and it seems, also the rest of the chapter) misses information and data on the production on green energy (i.e. what would the energy mix look like in the future, and under what assumptions/ energy mix scenarios will electric transportation lead to CO2 reductions) . It doesn't include numbers on the expected production of green energy in different timelines and how that fits with the projections to the future. If there is no clarity on the energy mix in the future, it is also unclear how much can electric vehicles contribute to decarbonization.	Covered in detail later in the chapter	Sofia Rosero Abad	University	Netherlands

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79289	5	1	5	4	This gives an overly positive description of automobile electrification. Applying lifecycle analysis that accounts for embodied and upstream emissions, electric vehicles typically reduce 60-80% of emissions by comparable fossil fuel vehicles, which is good, but it is inaccurate to call them "zero emission vehicles"; they are really "elsewhere emission vehicles." Because they are cheaper to operate, typically half the operating costs of a comparable fossil fueled vehicle, electric vehicles are likely to be driven more annual kilometers, a rebound effect, which will increase external costs including congestion, road and parking infrastructure costs, crashes, and sprawl-related costs. Because their batteries add weight (as much as a half-tonne), they tend to generate more tire particulates, which are a very harmful air pollutant. Fleet electrification will take many years, which is slower than many other transport emission reduction straegies. Optimistically, half of all new vehicles will be electric by 2030, but since only about 5% of the fleet is replaced each year it will take until the 2040s before the majority of vehicles on the road are electric. In contrast, many vehicle travel reduction strategies (active and public transport improvements; fuel and carbon tax increases; efficient road, parking and vehicle insurance pricing; and various TDM programs, such as commute trips reduction and school transport management) can be implemented in a few months or years. In addition, automobile electrification is currently a cost ineffective emission reduction strategy, typically costing $50-200 per tonne reduced, considering CAFE credits, purchase subsidies, recharging network subsidies and exemptions for road user fuel taxes. Although these may decline over time as the technology develops and becomes more competitive, until electric vehicles are charged road user fees they will continue to receive subsidies worth hunderds of dollars annually compared with fossil fuel vehicles. Since electric vehicles are purchased by higher-income households, these subsidies are regressive and unfair. Due to these factors, electric vehicles should be implemented with vehicle downsizing (i.e., shifts to smaller vehicles and e-bikes) and vehcile travel reduciton strategies. A good rule of thumb is that about half of all emission reductions should be achieved by fuel switching and half through vehicle travel reductions. See: ACEEE (2019), Sustainable Transportation Planning, American Council for an Energy Efficient Economy (www.aceee.org); at https://database.aceee.org/city/sustainable-transportation-planning.	Addressed through changes	TODD LITMAN	Victoria Transport Policy Institute	Canada
4021	5	2	5	2	"…conversely minimise charging during peak energy demand periods". -May be worth noting that they can even discharge during peak energy demand (i.e. V2G) (this is covered in main body)	Accepted and changes made	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
30531	5	2	5	2	Mitigation option of electro-mobility during peak demand periods is, as decribed in 10.3.1.3, to reduce peak loads rather than to minimise charging. It would be better to describe "reduce peak loads" instead of "conversely minimise charging."	Accepted and changes made	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
70313	5	3			Reference missing.	Unclear what this is referring to	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
79753	5	3	5	12	Section 10.7 considers transport CO2 emissions per capita, which is very useful. The ES could also include this and say something about the differences in emissions per capita	Noted. Thanks	Stefan Bakker	KiM Netherlands Institute for Transport Policy Assessment	Netherlands
63217	5	4	5	20	It would be worth noting that some rare earth metals required for various lithium ion chemistries are extracted at great cost and potential environmental damage, including potential damage to sensitive ecosystems and vulnerable species	Accepted and addressed in the text and elsewhere in the chapter	Government of Canada	Environment and Climate Change Canada	Canada
77133	5	4	5	20	While globally there may be adequate Lithium reserves, that is not true for Cobalt. Extraction of both still raises very significant human rights issues.	Accepted and addressed in the text and elsewhere in the chapter	Jim O'Brien	Expert Reviewer AR6 SOD WG1	Ireland
81545	5	4	5	20	This paragraph does not mention environmental risks (pollution, water use, GHG emissions) of material extraction, processing, battery manufacturing and disposal/recycling), which exist and are important to take into consideration and mitigate from an early stage in the transition to electrified transport. Further information available from page 171 in Global EV Outlook 2019 (https://www.iea.org/reports/global-ev-outlook-2019).	Accepted and addressed in the text and elsewhere in the chapter	Marine Gorner	International Energy Agency (former)	France
125	5	6	5	7	It would be useful to distinguish the share of road vehicle emissions caused by trucks (freight transport) versus Light-Duty vehicles (passenger transport) already at this point. Like this, the necessity of every OEM decarbonising as well as the customers' choices would be more in the focus. Here, the 75% remain a little unrelatable for someone who is "just" buying a new car.	Noted. Some text changed	Mara Neef	Volkswagen AG	Germany
79139	5	7	5	8	Current dominance of LIBs does not establish their continued dominance "for the foreseeable future." Of note, solid electrolytes and nanostructures (think Ionic Materials and QuantumScape, for example) permit safe Li-air, and the former permits high-enerygy-density safe chemistries using no Li—indeed, nothing costly, toxic, or flammable, notably rechargeable alkalines such as MnZn or MnAl. The 5:8 comment that "Dependnence on LIB metals will remain" is thus incorrect too. The discussion is about two years outdated, perhaps through exclusive reliance on peer-reviewed lit rather than observation of market realities, which are changing very quickly. At least this handicap of your process could be articulated.	Noted. Unfortunately no references provided to support this case.	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
15475	5	8	5	10	Labour equality and other concerns with resource extraction need also be considered in view of historic practices and impacts associated with production of fossil fuels.	Accepted and addressed in the text and elsewhere in the chapter	Ryan Falconer	Auckland Council, New Zealand	Australia
28745	5	9		10	"the demand for such metals is much lower than the global reserves available". It would be helpful to state the degree of confidence.	Accepted and addressed in the text and elsewhere in the chapter	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy
30533	5	9	5	14	It is not clear which metals are mentioned with the words "LIB metals", as following sentence suggests that cobalt is not a matter of concern here. It would be better to specify types of metals relating to this issue.	Accepted and addressed in the text and elsewhere in the chapter	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
69767	5	9	4	9	What is "labour equality"?	Accepted and addressed in the text and elsewhere in the chapter	Cédric PHILIBERT	Institut Français des Relations Internationales	France
79751	5	11	5	11	"and therefore such resource concerns may be overstated" I believe the sections on LiBs in 10.3 and 10.8 do not provide sufficient substantiation of this quote.	Accepted and addressed in the text and elsewhere in the chapter	Stefan Bakker	KiM Netherlands Institute for Transport Policy Assessment	Netherlands

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
81547	5	11	5	13	This statement on Cobalt would benefit from further indications on the type of concerns that Cobalt brings about (cost, local working conditions, other). The nature of concerns are not the same for all materials. In addition, the use of Cobalt (or any other material bearing social, environmental or other types of risk) can become an opportunity to take risk mitigation action from an early stage by stakeholders and policymakers and significantly improve its conditions of extraction, processing and eventually its benefits-over-impacts balance (including for local populations). Further information available in table 5.1 and from page 171 in Global EV Outlook 2019 (https://www.iea.org/reports/global-ev-outlook-2019).	Accepted and addressed in the text and elsewhere in the chapter	Marine Gorner	International Energy Agency (former)	France
69769	5	13	5	13	Suggest replacing "prioritisation" by "Deployment"... or simply "Recycling"...	Rejected	Cédric PHILIBERT	Institut Français des Relations Internationales	France
4023	5	14	5	20	Recycling is important, yes, but this paper fails to acknowledge: oThe challenge of recycling many battery materials oSecond-life is also important (and likely to be prioritised over recycling), although this is not referenced here	Accepted and addressed in the text and elsewhere in the chapter	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
81549	5	15	5	16	Currently, one of the main challenges to electric vehicle battery recycling is the low volumes available to recycling because of the early stage of the transition to electric transport (leading to lack of significant volumes of recovered material and therefore lack of economic viability for recyclers). The lack of standardisation and design for recycling that are mentioned in the text are, for a large part, a consequence of this early stage development. The scale-up of the electric vehicle industry, and of the electric vehicle battery recycling industry, supported by policy and regulatory signals, is needed to overcome these challenges. Further information available in Global EV Outlook 2020, chapter 4, https://www.iea.org/reports/global-ev-outlook-2020.	Accepted and addressed in the text and elsewhere in the chapter	Marine Gorner	International Energy Agency (former)	France
52539	5	18	5	18	Discuss economic feasiblility	Accepted and addressed in the text and elsewhere in the chapter	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
69771	5	19	5	19	Ibid: suggest skeeping "prioritisation"	Rejected	Cédric PHILIBERT	Institut Français des Relations Internationales	France
64985	5	21	5	21	This space has shifted recently with the increased range of EVs meaning most will be charged at home (off a simple powerpoint) rather than needing to charge while driving.	Accepted and changes made	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
79141	5	21	5	25	This is true today. It may not remain true if automakers get serious about advantageous (but culturally challenging) 2-3x reductions in tractive load (doi:10.4271/13-01-01-0004), which correspondingly reduce recharging capacity or time and hence the investment and installation intensity required. Indeed, more-ambitious efficiency gains, such as two interesting electric vehicles entering the market in 2021 (2-seat Aptera, 0.7 Lequiv/100 km, and 5-seat Lightyear, 0.9—both firms I advise, to declare an interest) may largely or wholly bypass recharging requirements: their topside photovoltaics respectively charge ~30–50 km/d and 12 km/h, the former sufficient for most commutes (though a battery of up to 1600 km range can be quickly home-charged for long road-trips). I fear this whole chapter is based on a tacit assumption of only minor and incremental gains in platform efficiency, hence continuation of today's norms in batteries, recharging, cost, and infrastructure. That all depends on whether other OEMs did what BMW did with the i3 in 2013 (see SAE paper at doi:10.4271/13-01-01-0004 cited above). I'm aware of 4–7 OEMs who think differently and could embarrassingly invalidate your assumption. I therefore advise that you qualify it with an explicit mention that 2–3x efficiency gains not counting electrification could greatly change the picture you present. Indeed, that SAE paper shows from 15 empirical industry vehicle designs—both market products and virtual designs—that conventional part-by-part analytic methods overlook most of the efficiency design space, understating its quantity and overstating its cost. The paper presents strongly documented empirical support and as far as I know remains uncontested—just uncomfortably unfamiliar to many. That paper's integrative design of whole automobiles is a special case of integrative design for all sectors (10.1088/1748-9326/aad965, cited in Ch 9), which is lamentably absent from virtually all IAMs (doi:10.1088/1748-9326/ab55ab).	Accepted and addressed in the text and elsewhere in the chapter	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
79291	5	21	5	25	Another important electrification encouragement factor is fossil fuel prices. To encourage electrification governments should greadually and predictably increase fossil fuel prices and carbon taxes, so electric vehicles are relatively cheaper.	Accepted and addressed in the text and elsewhere in the chapter	TODD LITMAN	Victoria Transport Policy Institute	Canada
83853	5	21	5	25	Also policies incentivising EV purchase when proof is provided that the owner purchases renewable electricity for charging. Only two countries globally have such linked policies - Austria as of 2017 and Japan as of 2020. (References: Austria: https://www.bmk.gv.at/themen/mobilitaet/alternative_verkehrskonzepte/elektromobilitaet/foerderungen/e-mobilitaet2021.html; Japan: https://www.meti.go.jp/press/2020/12/20201222006/20201222006.html)	Accepted but beyond the scope of changes to text at this stage	Hannah E. Murdock	REN21	France
4631	5	22	5	22	... electric charging and hydrogen refueling infrastructure... ... of fossil fuel powered internal combustion engines ...	Rejected, this paragraph is focussed on e-mobility.	Ulf Groos	Fraunhofer ISE	Germany
52413	5	22	5	22	There is no supporting discussion on costs and benefits of setting targets for the phase-out of internal combustion engine vehicles in the chapter. Either consider providing detailed cost-benefit analysis discussion or excluding this statement from the executive summary section.	Noted. Costs and potentials are discussed.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
64987	5	22	5	23	It is likely that supply will be a smaller issue and it is more likely going to be the ability to demonstrate clear demand for suppliers to send vehicles to a particular country, which starts with clear government policies and commitments. It is understandable that EV manufacturers are hesitant to send vehicles to countires with no or low levels of national government support for the transition as it is a good proxy for overall demand.	Accepted and addressed in the text and elsewhere in the chapter	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
5489	5	24	5	24	After renewable, add : in excess.	Accepted and addressed in the text and elsewhere in the chapter	Michel SIMON	Retraité/ Pdt d'association	France
70315	5	24			"...including the uptake of renewable energy." Two issues: There is hardly discussion of this aspect in the cited chapter 10.8. And then it is hard for me to understand why (more) renewable electriity supply would be a 'most significant enabling condition' for electrified LDVs....? [I agree on substance, that this is required for CC mitigation, but I dispute that it is required for electric vehicle deployment (as can e.g. be seen in China: Government targets and financial incentives are key there despite a very high share of coal based electricity....) Therefore please rephrase to make the argument pertinent.	Accepted and changes made	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
74229	5	24	5	24	Strike "renewable energy" and insert "carbon free generation" so as not to discriminate against other methods of producting green clean energy such as nuclear and hydroelectric.	Accepted and changes made	Jeffrey Merrifield	Pillsbury Law Firm	United States of America
29729	5	26	5	26	The heading makes it seem that there would be a connection between heavy duty vehicles and long-haul (ref. page 4, line 38 where light duty vehicles is mentioned but not in connection to short or long-haul). Please review the heading and adjust it so that it does not create a misconception of a natural link between heavy duty vehicles and long-haul.	Accepted and changes made	Government of Norway	Norwegian Environment Agency	Norway

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
53567	5	26	6	9	I am not sure where this edit should go, but low-cost fossil fuels that don't incorporate the social cost of carbon are the main reason that electric vehicles do not already dominate the market. This is particularly true in the US, which has fuel prices far below those in Europe and even China and India.	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
69773	5	26	5	26	I don't understand that title. "Fuels for long haul trucks, shipping and aviation" would be enough, it seems.	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
81017	5	26	5	26	Replace the sentence by: "2. Shifting to electro-fuels and biofuels in heavy duty vehicles and long haul" Reason: The title could be clearer in answering directly to the question: What are the main mitigation options in the transport sector: 1. Shifting to electro-mobility in light duty land transport vehicles 2. Shifting to electro-fuels and biofuels in heavy duty vehicles and long haul 3. Transforming land, urban and infrastructure systems, industrial systems and human behaviours to reduce demand for transport fuels	Accepted and changes made	Yann BRIAND	Iddri, Sciences Po	France
83995	5	26	5	26	I suggest switching the order with point "3. Increased efficiency and reduced demand..." Many readers might treat list items as ordered, and here point 2 has a way lower mitigation potential than the point 3.	Rejected, order is based on flow of the chapter	Michał Czepkiewicz	University of Iceland	Poland
9075	5	27	5	29	For HDV, there are still many opportunities to reduce the energy consumption and CO2 emission by improving system-wide efficiency. Each reduction may be small, but there are many and low cost options.	Accepted but beyond the scope of changes to text at this stage	Shigeki KOBAYASHI	Transport Institute of Central Japan	Japan
23133	5	27	5	29	We suggest that the confidence of this sentence be downgraded to medium. The detailed contents of the report point to the lack of consensus on this issue and on the fact that biofuels will probably part of the solution in the long run.	Rejected, but changes made elsewhere to justify this level	Government of France	Ministère de la Transition écologique et solidaire	France
64989	5	27	5	27	Perhaps it is wise to again point out that much of the freight task carried by trucks can easily be carried by rail, and should be, which can be electrified, with smaller trucks at rail ports for distribution (linked to shipping and airfreight options).	Accepted but beyond the scope of changes to text at this stage	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
79143	5	27	5	39	The electric-heavy-truck discussion is >2 y outdated; please see my comment on 4:18–19. Tesla's Class 8 Semi began limited major-customer deliveries in 2021, constrained only by battery-pack production that's scaling rapidly. It offers 800-km standard and ~1,000-km premium (2468 batteries) range; the former is the average US haul length, and drivers can't go much farther without running illegally over permitted hours. Another 650 km can be added with a half-hour recharge (the driver must stop sometime to excrete!) at 10x automotive Supercharger speed; given Tesla's track record, it would be unwise to bet it won't deliver on the infrastructure, already attracting investment in major trucking corridors. (The investment including grid is significant but worthwhile, and can be spread by proper scheduling like aircraft landing slots and mitigated by demand-response, ancillary service sales, energy arbitrage, and other grid transactions.) The base price has a 50% premium, likely to drop to about zero in this decade. Halved opex yields a 2-y US payback. The 1.6-Mkm warranty transforms business models. Operating advantages include a much more pleasant driving experience, equal or better safety, 3-5x faster acceleration, and 1/3 faster 5%-grade hillclimbing fully laden. Payload will be within 1t of normal as battery weight and 400 kg of motor systems are offset by lightening elsewhere (still wtih a lot left on the table), including ~3t of avoided diesel powertrain and fuel. Also noteworthy is the rapid emergence and initial uptake of electric specialized heavy vehicles, from garbage trucks to mining ore trucks.	Accepted and changes made	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
81551	5	27	5	27	I am not sure that presenting the electrification of light-duty vehicles as a "simple solution" is the right message to pass. Although there is increasing consensus that the deployment of electric vehicles coupled with charging infrastructure is the most technically and economically viable way to decarbonise light-duty transport, this entails the turnover of millions of vehicles over decades and a redical change in this historic industry, with many implications, including for skills and employment, while this transition is still at a very early stage.	Accepted and addressed in the text and elsewhere in the chapter	Marine Gorner	International Energy Agency (former)	France
4633	5	30	5	31	... drop in fuels or hydrogen ...A1	This text has been changed to be more clear on what drop-in fuels are	Ulf Groos	Fraunhofer ISE	Germany
4025	5	31	5	33	"...none of these drop-in fuel options (which include low-carbon biofuels....) have reached TRL or commercial viability comparable to LIB". -This is rather vague, and actually there are some bio-fuels which are already fairly advanced – for instance bio-CNG (e.g. John Lewis in the UK is transitioning all vehicles to bio-CNG by 2028). Note – this is not a drop-in fuel, but I'm not sure "drop-in fuels" are really a viable alternative here.	This text has been changed to be more clear on what drop-in fuels are	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
4027	5	31	5	33	You have specifically called out Electric Road Systems. It may be worth noting that this would almost certainly require significant Government investment (further detailed comment on this point noted below).	Accepted and addressed in the text and elsewhere in the chapter	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
45567	5	31	5	33	There are quite some biofuels that can be "dropped in". Why are they not considered mature enough?	Those are primarily blended biofuels, here we refer to high proportion biofuels that would be required to deliver genunine and significant emissions reductions, of which there are some options, but they are not yet economically viable	Kornelis Blok	Delft University of Technology	Netherlands
53561	5	31	5	32	Low-carbon biofuels or synthetic fuels/e-fuels are mentioned as an alternative to LIB EVs. It is more productive to see low-carbon hydrocarbon fuels as a method of decarbonizing the rollong fleet of already built ICE vehicles, while electrification is a method applicable to vehicles yet to be built. Vehicles are in operation for 15-20 years and we need a strategy that adds up when phasing out the ICE will take decades even if all new vehicles from today and onwards are electric. In many countries, most trucks bought are used trucks imported from other countries. It will take many years for EVs to reach high market penetration there.	Unclear what the comment is referring to; this text already considers synthetic fuels.	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
43085	5	34	5	39	Hydrogen in mentioned and then an incorrect statement that seems to include H2 is made "challenges regarding driving range". There are not challenges regarding hydrogen HD trucks range, if infrastructure is available.	Driving range of these vehicles is not yet comparable with diesel incumbents, so this does remain a challenge; acknowledging it could also be overcome with infrastructure, similar to electric trucks	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
53563	5	34	5	35	What does "transformed in their GHG emissions" mean? Rephrase.	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
78861	5	34	5	35	the reference to 'trains' in parenthesis is a bit misleading. According to the IEA around 48% rail freight worldwide is hauled by electric locos drawing power mainly from overhead catenaries. It would be better to refer separately to rail and say that in many countries it has the advantage of direct connection to electric power grids removing the need for batteries and fuel cells. https://www.iea.org/reports/the-future-of-rail	Accepted and changes made	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
82071	5	34	5	47	It needs to be mentioned that aviation and shipping also face infrastructure problems and these are a main obstacle for adopting sustainable options in these areas.	Accepted and changes made	Sofia Rosero Abad	University	Netherlands

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
85501	5	34	5	39	This paragraph - that I largely agree with - actually underscores my previous criticisms on dismissing battery electric trucks. But I would skip the formulation "Commercial operations are considered feasible after 2030." Tesla has developed and will sell a truck in the long range segment this year and Scania just anounced that they expect 50% of their sales to be electric in 2030 (and that includes class 8) and there are many more who echo this point. So you are actively undermining their credibility - thus slowing down the transition - with very limited evidence to back up this attack and while there is now peer reviewed literature that goes against this claim. (See my remark for chapter 10, page 4 line 18 to page 5 line 31.)	Accepted and changes made	Auke Hoekstra	Eindhoven University of Technology	Netherlands
47885	5	35	5	36	Why excluding sustainable biofuels and e-fuels?	As outlined in the chapter, those fuels have a more important role to play in shipping and aviation.	Matteo Muratori	NREL	United States of America
53565	5	36	5	38	I disagree (supported by later sections) that capital and operating costs are issues for electric heavy duty trucks. The technology is cost competitive in several markets today, and within 5-10 years, BEV will have the lowest total cost of ownership for (new) long-haul trucks in most regions of the world. I agree that driving range will remain an issue in most countries until perhaps 2030; not because of technology immaturity, but due to that charging infrastructure is not available. Without a power supply, the vehicle cannot be used. As heavy BEV vehicles are already in series production from several manufacturers, the technology itself must be considered mature.	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
28747	5	37			I miss in this Chapter a sentence on the impact of travel speed/load on electric driving range.	Accepted and changes made	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy
45601	5	37	5	37	Commercial operations can be considered feasible by 2025. See Auke Hoekstra, Eidhoven University of Technology: https://www.cleanenergywire.org/news/battery-electric-trucks-will-win-race-against-fuel-cells-and-e-fuels-researcher	Accepted and changes made	Annika Bose Styczynski	O.P. Jindal Global University	India
4635	5	38	5	38	delete sentence: fuel cell durability also continues… (Prototypes and field trials show the viability of the fuel cell technology)	Rejected, chapter addresses this detail; fuel cell durability is not yet sufficient to be deemed competitive with diesel vehicles i.e. 30,000 hours	Ulf Groos	Fraunhofer ISE	Germany
47887	5	38	5	39	I'd argue that FC and H2 costs are also a major element to mention here	Accepted and changes made	Matteo Muratori	NREL	United States of America
78863	5	38	5	39	could also mention two other major disadvantages of hydrogen fuel cell trucks - the high energy losses in distributing low carbon electricity by this means and the amount of renewable energy infrastructure that will be required to produce enough green hydrogen for this purpose: http://www.csrf.ac.uk/2020/07/white-paper-long-haul-freight-electrification/	Accepted and changes made	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
4637	5	40	5	40	delete : …hydrogen fuel cells or… (there are many R&D and demonstration project under way for fuel cells also for large transport or cruise ships as well as for intracontinental airplanes (not for transatlantic airplanes so far). Then often liquid hydrogen storages are favored.)	Accepted and addressed elsewhere in the chapter	Ulf Groos	Fraunhofer ISE	Germany
4639	5	40	6	9	add: Hydrogen powered fuel cells are investigated today for boats and ships as well as for small airplanes, often in connection with liquid hydrogen storages.	Accepted and addressed elsewhere in the chapter	Ulf Groos	Fraunhofer ISE	Germany
28545	5	40	5	43	I share the skepticism on hydrogen as an aviation fuel (see also https://www.revolution-energetique.com/lavion-a-hydrogene-est-une-chimere/), but I think it Is inevitable to acknowledge the recent announcement from Airbus on the subject. See: https://www.airbus.com/innovation/zero-emission/hydrogen/zeroe.html	Accepted and addressed elsewhere in the chapter	Pierpaolo Cazzola	International Transport Forum	France
29731	5	40	5	43	These two sentences contradict each other, the first one saying that hydrogen fuel cells will not be a solution for shipping and aviation, while the second sentence states that hydrogen will be one of the main solutions.	Accepted and changes made	Government of Norway	Norwegian Environment Agency	Norway
48153	5	40	5	41	"Electric propulsion using hydrogen fuel cells or Li-ion batteries are unlikely to help with aviation and shipping, with the possible exception of very short-haul operations." This is simply not true. Detailed analyses show otherwise: https://twitter.com/mzjacobson/status/1288331514384547846 Katalenich, S.M., "Analyzing the feasibility of transitioning United States Army vehicles, contingency bases, and permanent bases toward 100% clean, renewable energy, Stanford University, 2020, 828 pp.	Accepted and changes made	Mark Jacobson	Stanford University	United States of America
79145	5	40	6	5	Please see my comments on 4:18–19. I'd have agreed with your text ~18 months ago, but no longer. NAS said it'd take 20 y to reach 400–500 Wh/kg LIBs, but it took three (for 3–4 firms). Eviation is scarcely very-short-haul; United Airlines just invested $1b in short-haul electric feeders. The gamechanger is Otto Aviation's Celera 500L/1000L superlaminar multifuel-diesel plane, initially a 6-seat air taxi with 4500nm range, 1/8 normal fuel, and 1/6 normal opex; the nearly doubled-volume 1000L can take 20–30 seats with similar specs, which suffice to blow up both general--aviation and airline business models by fitting perfectly into the point-to-point route architectures that are already eating deeply into hub monopolists' big-plane hub-and-spoke models. Otto is an ideal candidate for disruptive electrification. So I now expect all shorthauls and some medium-hauls to electrify, depending on how good batteries get, while longhauls, which use most of aviation's fuel, can use green LH2. (There are two schools of thought about how hard this is; I think Boeing got it right a decade ago and Airbus hasn't yet.) Marine shipping has gone heavily already to all-electric for ferries and some coastals; transoceanics are going to green NH3 (and perhaps LH2), not batteries, so you should break apart aviation and shipping into separate cases and sentences for clarity. The marine-shipping green-NH3 case is far more attractive than 6:2–5 implies; ask Maersk, and remember that efficient ships offset early marginal fuel cost before today's cheapest (<$20/MWh unsubsidized) renewable electricity works through into the NH3 price.	Accepted and changes made	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
86661	5	40	5	41	Disagree that electric especially in combination with fuel cell, can only help with "very short-haul" operations. There are several developments of up to 100 passengers and up to 500 nautical miles, either in electric or hybrid propulsion (eg Wright electric, Evolution Alice and Airbus projects). Jim Skea highlighted the need, on one of the Stakeholder Engagement Workshops with business, to make what is being said on hydrogen more internally consistent. This is a case in point. For example section 10.3.2.4 of this chapter is positive about the opportunities for hydrogen in Aviation.	Accepted and changes made	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
69775	5	42	5	42	I would perhaps be easier to distinguish here aviation and maritime. Most aircrafts indeed will likely require drop-in liquid fuels, with characteristics (in particular specific energy) very close to that of avgas or jet fuel. Ships have more room and in particular coudl be adapted to using ammonia in new and existing internal combustion engines. This would not be a "drop-in fuel", though.	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
70317	5	43			"the main focus"… of what? Specify!	Accepted and changes made	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
52541	5	44	5	44	Biofuel as an alternative fuel, however, the authors should also look at the other side of using biofuel and its impact on deforestation	Accepted and changes made	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
47889	5	45	5	45	"as little more than a niche fuel in certain places" I think this is an underestimation of the role that biofuels could play. See, for example: https://link.springer.com/article/10.1007/s10584-018-2226-y	Noted. We include biofuels in ES now	Matteo Muratori	NREL	United States of America

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
65033	5	45	5	45	Perhaps also list Hydrogen as a niche fuel in the Executive Summary as it states on page 32, rather than just biofuel, so readers don't get the wrong impression about its viability as a transport option, and it may also be seen as an attempt to not annoy H2 supporters by saying this in the report but leaving it out of the executive summary?	Accepted and changes made	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
7839	5	46	5	46	Insert 'through DAC or BECC' after captured CO2.	Accepted and changes made	Mitsutsune Yamaguchi	Research Institute for the Innovative Technology for the Earth (RITE)	Japan
52543	5	46	5	46	This is an inclusive solution	Unclear what this is referring to	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
29733	5	47	6	1	This sentence regards condensation trails from aircraft. Please consider using "condensation trails" instead of the abbrevation "contrail". Also, please add a short explanation to how synthetic fuels may reduce condensation trails related climate impacts, as this is not intuitive.	Noted. Aviation is being revised still.	Government of Norway	Norwegian Environment Agency	Norway
30535	5	47	5	47	Generally it is said that synthetic fuels or e-fuels cannot reduce contrails-based climate impacts as they emit water vapor. It is necessary to refer to the evidence if this is correct.	Noted, Thanks	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
51561	5	47	6	1	"These fuels may also reduce contrails-based climate impacts and lower local noxious air pollutants". This statement is not supported for aviation by 10.5.3.3 (Page 10-64, lines 12-17)	Noted, Thanks	eric lombard	Stay Grounded	France
69777	5	47	5	47	Suggest deleting "and marine fuels" and just keep "jet fuel". The following sentence, by the way, only applies to aviation (contrails-based climate impacts), while for maritime, in case of ammonia, the balance of noxious air pollutants (including NOX) is more complex and depends on end-of-pipe devices.	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
69779	6	1	6	1	Suggest being more explicit: production of synthetic fuels/e-fuel requires some R&D for adaptation to variable renewables such as solar and wind. All other technology bricks are proven and commercial.	Rejected, synthetic fuels are not commercially-competitive, and are unlikely to be without significant increases in carbon fuel taxes	Cédric PHILIBERT	Institut Français des Relations Internationales	France
24681	6	2	6	2	Hydrogen produced via electrolysis: both renewable and nuclear power can be used in this process (see reference already used in the chapter: Bicer, Y., and Dincer, I. (2017). Life cycle assessment of nuclear-based hydrogen and ammonia production options: A comparative evaluation. International Journal of Hydrogen Energy, 42(33), 21559–21570. https://doi.org/https://doi.org/10.1016/j.ijhydene.2017.02.002). So we recommend replacing "Renewable hydrogen, and/or a renewable hydrogen-derivatives" with 'Low carbon hydrogen produced from low-carbon electricity sources via electrolysis and/or low-carbon hydrogen-derivatives'	Accepted and changes made	Ann Jessica Johnson	FORATOM (European Atomic Forum)	Belgium
43147	6	2	6	3	I would add '..like ammonia and liquid hydrogen organic carriers (LHOC)..'	Accepted but beyond the scope of changes to text at this stage	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
74231	6	2	6	24	Strike "renewable energy" and insert "carbon free generation" so as not to discriminate against other methods of producting green clean energy such as nuclear and hydroelectric.	Accepted and changes made	Jeffrey Merrifield	Pillsbury Law Firm	United States of America
69781	6	3	6	3	Ammonia won't be an actual "drop-in fuel", its use in diesel engines will require some adaptative work (esp. In the fuel storage, preparation and injection system).	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
69783	6	4	6	4	There is no scaled-up production of any of these fuels. Maritime stakeholders strongly believe the cost of biofuels is much more uncertain and can be higher due to sustainability concerns. See, e.g. Korean Register, 2020, Forecasting the Alternative Marine Fuel - Ammonia, Busan, KR. Efficiency of green ammonia production is higher, and costs are lower, than those of low-carbon methanol and synthetic (Fischer-Tropsch hydrocarbons) that would require capturing CO2 from biomass or the atmosphere to be actually low carbon.	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
23135	6	5	6	7	We recommand to reformulate this sentence as it is indeed often said that automated mobility for freight will reduce the need for heavy trucks. However, there is little to no evidence of this fact, nor a convincing rationale. On the contrary, by diminishing strongly the cost of transport, automation (if it is indeed cost-efficient) will create induced demand. Also, the cost decrease due to automation would be in favor of smaller vehicles, so that freight traffic would increase even more. Also, there is no convincing argument that automation is related to electric propulsion. One should consider automation and energy as two independent issues.	Noted. This comment is in regards to the size of the vehicles, rather than the volume/demand. The statement outlines that automation could reduce the need for 'large' vehicles, as the largest cost component is removed i.e. the driver. Given the above may not be clear from the current text, changes have been made.	Government of France	Ministère de la Transition écologique et solidaire	France
30537	6	5	6	7	The logic that automated mobility for freight may reduce the need for heavy trucks and create more electric trucks is not clear. It would be better to refer related articles.	Accepted and changes made	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
43087	6	5	6	6	I don't think that is correct to say that 'automated mobility for freight…may reduce the need for heavy trucks". The weight of trucks does not correlate with the vehicles being or not automated.	Noted. The statement is related to the reduction in cost, due to automation, removing the need for the driver, and providing the flexiblity to split loads across multiple, smaller vehicles.	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
52415	6	5	6	7	No discussion was found in the chapter supporting the statement that automated mobility may reduce the need for heavy trucks and create more opportunities for electric trucks. Either consider providing supporting discussion in the chapter or excluding this statement from the executive summary section.	Noted, reviewing chapter to ensure this is supported.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
78871	6	5	6	7	this sentence about the automation of freight is very odd. Apart from a few isolated, niche examples (e.g. mining operations, medicines by drone, port AGV operations) there is virtually no automation of freight operations and it is growing only marginally. To say that this might 'reduce the need for heavy trucks' is bizarre. The longer term automation of heavy trucks will increase their fuel efficiency and productivity, but is likely to have little affect on the demand for road freight transport. The connection between truck automation and electrification is also tenuous.	This has been revised to make it clearer that the statement is referring to the size of the vehicle, not the volume/demand.	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
30539	6	7	6	9	It may be the case, but the reason for mentioning in the executive summary is not obvious. And this seems not outlined in chapter 11. It is better to confirm its evidence.	Accepted and changes made	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
51563	6	7	6	9	"Regional ports are likely to play a major role in provisioning heavy vehicle fuels as they can link to rural industries using renewable hydrogen as the basis for manufacturing jet and shipping fuels as outlined in chapter 11". This statement is difficult to understand and does not seem to be sustained by Chapter 11. Why would jet/shipping fuels manufacturing from hydrogen need to be located in rural areas ? Why would ports play a major role in provisioning these fuels ? The same statement is reproduced on p 10-93, lines 22-24.	Accepted and changes made	eric lombard	Stay Grounded	France
24683	6	8	6	8	Hydrogen produced via electrolysis: both renewable and nuclear power can be used in this process (see reference already used in the chapter: Bicer, Y., and Dincer, I. (2017). Life cycle assessment of nuclear-based hydrogen and ammonia production options: A comparative evaluation. International Journal of Hydrogen Energy, 42(33), 21559–21570. https://doi.org/https://doi.org/10.1016/j.ijhydene.2017.02.002). So we recommend replacing "using renewable hydrogen as the basis for manufacturing" with "using low-carbon hydrogen produced from low-carbon electricity sources as the basis for manufacturing"	Accepted and changes made	Ann Jessica Johnson	FORATOM (European Atomic Forum)	Belgium

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
4641	6	10	6	30	add: Micro mobility in cities by electric bikes or scootes may have some impact on passenger transport emissions if the dynamic growth in developed countries continues and is adopted also in developing countries.	Accepted but beyond the scope of changes to text at this stage	Ulf Groos	Fraunhofer ISE	Germany
23137	6	10	6	10	Replace by: "3. Transforming land, urban and infrastructure systems, industrial systems and human behaviours to reduce demand for transport fuels" Reason: The title could be clearer in answering directly to the question: What are the main mitigation options in the transport sector: 1. Shifting to electro-mobility in light duty land transport vehicles 2. Shifting to electro-fuels and biofuels in heavy duty vehicles and long haul 3. Transforming land, urban and infrastructure systems, industrial systems and human behaviours to reduce demand for transport fuels Other reason: The content of this part 3 looks focused on "system transitions" enabling the transformation of the demand structure. It looks therefore important to mention it directly in the title.	Accepted and changes made	Government of France	Ministère de la Transition écologique et solidaire	France
49723	6	10	6	30	Previous chapters of the AR6 emphasized the need for reduced motorised travel, but here the third recommendations is framed around transport fuels. For more consistency, it would be better to change the title to "Increased efficiency and avoided demand for motorised transport".	Accepted and changes made	Nikola Medimorec	SLOCAT Partnership on Sustainable, Low Carbon Transport	Republic of Korea
79463	6	10	6	30	Previous chapters of the AR6 emphasized the need for reduced motorised travel, but here the third recommendations is framed around transport fuels. For more consistency, it would be better to change the title to "Increased efficiency and avoided demand for motorised transport".	Accepted and changes made	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
81019	6	10	6	10	Replace the sentence by: "3. Transforming land, urban and infrastructure systems, industrial systems and human behaviours to reduce demand for transport fuels" Reason: The title could be clearer in answering directly to the question: What are the main mitigation options in the transport sector: 1. Shifting to electro-mobility in light duty land transport vehicles 2. Shifting to electro-fuels and biofuels in heavy duty vehicles and long haul 3. Transforming land, urban and infrastructure systems, industrial systems and human behaviours to reduce demand for transport fuels Other reason: The content of this part 3 looks focused on "system transitions" enabling the transformation of the demand structure. It looks therefore important to mention it directly in the title.	Accepted and changes made	Yann BRIAND	Iddri, Sciences Po	France
83997	6	10	6	10	I suggest removing "for transport fuels" from the title, as reduction of demand also pertains to vehicles and infrastructures	Accepted and changes made	Michał Czepkiewicz	University of Iceland	Poland
46055	6	11	6	15	The "shift" strategy as part of Avoid/Shift/Improve (ASI) is not highlighted appropriately in the executive summary. Please add some more explanation on shifting transport modes for the climates benefit in the executive summary drawing on sections 10.1.2 and 10.5.3.6.	Accepted and changes made	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
79293	6	11	6	15	This mentions "avoid-shift-improve." I suggest adding a sentence that explains this important concept, perhaps describing it as the transportation equivelent of "reduce-reuse-recycle".	Accepted and changes made	TODD LITMAN	Victoria Transport Policy Institute	Canada
79297	6	11	6	15	This is a long and not very clear sentence, and I think I disagree. Large transportation emission reductions can be achieved with existing technologies. Applying best current technologies, multimodal transport planning, efficient transportation pricing, Smart Growth developoment policies, TDM programs, and existing "smart" technologies such as integrated multimodal navigation and payment apps (often called Mobility as a Service or MaaS) can acheive large emission reductions. Similarly, electric vehicles can serve most trips at a competitive price. I don't think it is correct or useful to imply that major emission reductions without technology "breakthroughs." This type of magic thinking ("A breakthrough a day keeps the crisies at bay") implies that technology is more important than policy, so policy reforms can wait. I think it is more accurate and useful for the report to emphasize that exusting technologies are sufficient to achieve large (40-80%) transportation emission reductions, but additional technologies will facilitate and increase their success. I think it is also important to emphasize the importance of transportation system technologies, such as improved user infomation, integrated navigation and payment systems, logistics technologies, telecommuncations that substitute for physical travel, etc. Don't imply that transportation technological innovations consist only of vehicle drive improvments.	Accepted and changes made	TODD LITMAN	Victoria Transport Policy Institute	Canada
81925	6	11	6	15	The paragraph suggests that technology and design breakthroughs are the bottleneck. There is vast agreement that it is the political framework that needs to be set correctly and reliably so that 1)bevaviour change will be encouraged, 2) investments in still to be developed technologys will be made, 3) the available technology will be deployed and in a favourable way. Technology itself does not necessarily bring the needed transformation, as in the case of e.g. autonomous vehicles. This foresight study is a good reference: https://www.t4under2.org/pdf/T4under2_Global-foresight-study_FINAL.pdf	Accepted and changes made	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
79295	6	12	6	12	Change "pricing" to "efficient transportation pricing".	Accepted and changes made	TODD LITMAN	Victoria Transport Policy Institute	Canada
64991	6	13	6	13	These factors listed are unlikely to "shape the extent of roll-out of EVs" as it will be more related to the ability of the grid to supply the power without overloading.	Text reworded to be clearer that not all these factors are related to EVs	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
4029	6	14	6	14	"The recent literature on the systemic parts of transport that can help with Avoid-Shift-Improve strategies, such as urban form, behaviour programs, pricing, smart systems that influence transport choice and electric charging that shapes the extent of the roll-out of electric vehicles, hold potential for mitigation but are unlikely to be strong and rapid without complementary technology and design breakthroughs". -I think we can bring out more clearly the key regulatory role here in encouraging the "shift" in behaviours. -As an example, a move from company cars to mobility credit schemes would be a good example of shift, but requires Government to make this attractive from a tax perspective	Accepted and changes made	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
79501	6	14	6	15	Disagree - if transport pricing was reformed to align with social marginal costs (e.g. congestion, air quality and safety impacts) - changes in corporate and consumer behaviour would be rapid and significant. Your statement would be true if you conclude that the political barriers to reforming transport pricing cannot be overcome. But if they were - change would be rapid and significant.	Accepted and changes made	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
79299	6	16	6	20	I disagee with this statement. First, it is not just cities: cities, suburbs, small towns and rural areas can all increase transport system efficiency and land use accessibility in ways that reduce vehicle travel, and provide significant co-benefits. See the "Emission Variations Illustrated" tab for evidence that many economically successful urban neighborhoods (often called Transit Oriented Development or 15-minute communities) generate an order-of-magnitude less vehicle travel than conventional automobile-dependent sprawl, and additional reductions can be achieved with new technogies such as e-bikes, Mobility as as Service (MaaS), and telework that substitutes for physicla travel. Many people seem to assum that rural residents have little ability to reduce etheir vehicle travel, but this is untrue. Given better opportuniteis and incentives, rural residents can choose closer destinations, consolidate trips, telework, carpool, use public transportation (if there is better service) and bicycle for local errands. Although the potential varies depending on conditions, an integrated set of TDM and Smart Growth strategies can often provide much larger than 25% reductions. Many of these straetgies can be implemented in a few months or years. Also, this is an excessively long sentence. I suggest the following: "Research indicates that urban areas can reduce their transport emissions by 20-40% through combinations of more multimodal planning (improved walking, bicycling, public transit and telework), efficient transportation pricing, Smart Growth development policies, and TDM programs. Additional emission reductions can be achieved with vehicle fleet electrification and vehicle downsizing, for example, from automobiles to e-bikes for local trips. In addition to reducing emissions these reforms tend to provide significant economic, social and environmentla co-benefits." See: Jonn Axsen, Patrick Plötz and Michael Wolinetz (2020), "Crafting Strong, Integrated Policy Mixes for Deep CO2 Mitigation in Road Transport," Nature Climate Change (https://doi.org/10.1038/s41558-020-0877-y). Christian Brand, et al. (2021), "The Climate Change Mitigation Impacts of Active Travel," Global Environmental Change, Vo. 67 (https://doi.org/10.1016/j.gloenvcha.2021.102224).	Accepted and changes made	TODD LITMAN	Victoria Transport Policy Institute	Canada
23139	6	18	6	19	After the mention "a relatively slow process" should be added "in the developed world". Reason: 1. The process is slow when starting from an existing complex built environment. This is mostly the case in the OECD countries, however this is not true in many countries where the urbanization rate is high and the development of new cities is ongoing. However, this requires new planning programmes.	Accepted and changes made	Government of France	Ministère de la Transition écologique et solidaire	France
23141	6	18	6	18	We suggest that the part "lock-in and stranded assets associated with car dependency" be developed in order to understand its meaning.	Accepted and changes made	Government of France	Ministère de la Transition écologique et solidaire	France
64993	6	18	6	18	It is not clear from this text how car dependency (great language by the way) is associated with lock-in and stranded assets and it might be worth a little more context.	Accepted and changes made	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
81021	6	18	6	20	After the mention "a relatively slow process" should be added "in the developed world". After "outcomes.", we could add another sentence "However, in fast-growing economies, where the urbanization rate is faster, the transformation of cities towards a more sustainable built environment could represent a comparative advantage for the developing world in the run for global carbon neutrality." Reason: 1. The process is slow when starting from an existing complex built environment. This is mostly the case in the OECD countries, however this is not true in many countries where the urbanization rate is high and the development of new cities is ongoing. However, this requires new planning programmes. 2. Cervero (2013), Linking urban transport and land use in developing countries, JLTU: "built environments might be expected to hold stronger sway over travel decisions in the Global South".	Accepted and changes made	Yann BRIAND	Iddri, Sciences Po	France
23143	6	20	6	20	After "outcomes. However, in fast-growing economies, where the urbanization rate is faster, this could represent a comparative advantage for the developing world to build more transport sustainable cities." Reason: 1. The process is slow when starting from an existing complex built environment. This is mostly the case in the OECD countries, however this is not true in many countries where the urbanization rate is high and the development of new cities is ongoing. However, this requires new planning programmes.	Accepted and changes made	Government of France	Ministère de la Transition écologique et solidaire	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
1329	6	21	6	25	Indeed in COVID times electric micro-mobility enables greater locatlised travel but whether this is good from a GHG perspective and leads to more efficiency in transport energy is not certain. As the ITF report (Good to go? Assessing the environmental performance of new mobility in cities) the GHG emissions of electromobility are not always low. Especially the GHG emissions of shared e-scooters are relatively high. It is therefore still questionable if all micromobility reduce energy demand. If walking or cycling trips are replaced this is not the case. Both in Paris and Brussel significant numbers of walking trips were replaced by e-scooters; see for instance Moreau et al., 2020 Dockless E-Scooter: A Green Solution for Mobility? Comparative Case Study between Dockless E-Scooters, Displaced Transport, and Personal E-Scooters. Sustainability / Lefrancq (2019). Shared freefloating micromobility regulations & results of e-scooter users' survey (summer 2019). ERSCharter Webinar / 6t-bureau de recherche (2019). Uses and users of free-floating electric scooters in France.	Accepted and changes made	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
4031	6	21	6	21	Possibly worth noting that micro-mobility may need to be complemented with significant Government infrastructure spending (e.g. cycle lines), and shared mobility will require clear regulatory frameworks	Accepted and changes made	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
16543	6	21	6	25	South Korea is showing different developments in the COVID-19 pandemic. Except public transportation and aviation, most industries have almost recovered and domestic freight transport is rather increasing for parcel delivery.	Accepted and changes made	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
56779	6	21	6	25	Althought there was a significant drop in light-duty, freight travel continued to be high and in some areas increased. If there is a more sustained shift in work/leisure behavior, this increase in freight may have significant impact due to the greater challenges in decarbonization of heavy-duty vehicles.	Accepted and changes made	Government of United States of America	U.S. Department of State	United States of America
81553	6	21	6	25	It is unclear to me what message is intended behind the parallel between Covid-19-based lockdowns and the use of electric micro-mobility. Electric micromobility has been fast growing prior to the pandemic. If it is implied that micromobility has displaced car travel, I am unsure of the link with Covid-19. If it is implied that micromobility has displaced public transport and mass transit, these modes being among the most energy-efficient and lowest-emitting per capita in many cities (because of high occupancy and the existence of already widely-electrified modes (metro, tramways), on top of providing social and equity benefits, I am not sure portraying them as "high-energy travel" to the same extent as other modes with significant adverse impacts is correct. Further information on the opportunities and challenges of electric micromobility, as well as the impact of Covid-19 on micromobility services, is available pages 58-60 of the Global EV Outlook 2020 (https://www.iea.org/reports/global-ev-outlook-2020).	Accepted and changes made	Marine Gorner	International Energy Agency (former)	France
83855	6	21	6	25	Might be worth mentioning that (1) increased remote working played a role in increased use of renewable electricity during 2020, and (2) many micro-mobility companies are procuring renewable electricity for charging while some shared mobility companies are requiring EVs and charging using renewable electricity (see Box 2 in Global Overview chapter of REN21 GSR 2020: www.ren21.net/gsr-2020)	Accepted and changes made	Hannah E. Murdock	REN21	France
83999	6	21	6	25	The Covid-19 also revealed the potential of non-technological changes such as not making unnecessary trips ("avoid" kind of change), particularly by plane, but also by other modes. Electric micro-mobility is unnecessarily given more weight here than walking and cycling which also had an important role in "enabling much greater localised active travel", while having much lower impacts on the climate.	Accepted and changes made	Michał Czepkiewicz	University of Iceland	Poland
23145	6	22	6	23	Active mobilities have benefited from COVID-19, it is less certain for electro micro mobility.	Accepted and changes made	Government of France	Ministère de la Transition écologique et solidaire	France
69785	6	22	6	23	Electric micro-mobility may offer new services but is unlikely to make a dent in the GHG emissions associated with transport. In most cases it may replace walking or cycling rather than the use of cars.	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
79301	6	22	6	22	Define "ICT"	Accepted and changes made	TODD LITMAN	Victoria Transport Policy Institute	Canada
79303	6	22	6	22	Change, "These changes can be quite transformative, but the evidence is not available yet as to how long they may last, and wider impacts on productivity and health are still to be fully evaluated." to: "This experience demonstrates that transformative changes are possible, but are unlikely to continue without suitable transportation demand management (TDM) incentives that encourage people to choose resource-efficient transport options whenever possible."	Accepted and changes made	TODD LITMAN	Victoria Transport Policy Institute	Canada
23147	6	26	6	27	We suggest to develop about standards and regulations	Accepted and changes made	Government of France	Ministère de la Transition écologique et solidaire	France
30541	6	26	6	26	It would be better to delete the word "unnessary", or at least modify to the words such as "avoidable", as travel is done with some sort of necessity.	Accepted and changes made	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79305	6	26	6	30	I disagee with this statement. It perpetuates the claim that TDM strategies have been tried and failed, generally based on examples of HOV lanes or mode shift encouragement programs that by themselves failed to transform regional travel patterns. In fact, where integrated TDM programs are properly implemented they are often quite effective and beneficial. The problem is that many public policies encourage automobile travel through low fuel prices, unpriced roads and parking facilities, parking minimums, and development polcies that favor sprawl over infill. In most cases an automobile trip recieves an order of magnitude more infrastructure investment than a pedestrian or bike trip. It is therefore unsurprizing that individual TDM strategies that lack significant financial incentives seem ineffective. However, an integrated TDM program that includes improvements to non-auto modes, significant financial incentives such as cost-recovery road and parking pricing or parking cash out, plus targetted marketing can have significant impacts and benefits. They are often cost effective just considering their congestion reductions and infrastructure cost savings, and so provide "free" emission reductions. For example: Washington State's Commute Trip Reduction (CTR) law, in conjuntion with public transit improvements, reduced affected commuter's automobile trips by 16% and their VMT by 23%, resulting in significnat reductions in automobile mode shares and increases in bicycle, rideshare and transit mode shares into Puget Sound region cities (www.bloomberg.com/news/articles/2018-02-16/seattle-s-slashes-its-downtown-driving-rate). Similarly, many school transport management programs have proven very successful. Efficient road tolls and parking fees (priced to recover facility costs, with higher rates during peak periods) typically reduce affected automobile trips by 10-30%. However, they are seldom implemented: the vast majority of roads and parking facilities are unpriced. People who move from automobile-dependent to Transit Oriented Developments or other multimodal neighborhoods typically drive 20-40% fewer annual kilometers.	Accepted and changes made	TODD LITMAN	Victoria Transport Policy Institute	Canada
84001	6	26	6	30	The word "probably" might well express the uncertainty of this statement, but instead of writing in such way the authors should give a more balanced view of reasons behind the mixed results. Other reasons behind mixed results of more traditional programs could be also related to the insufficient breadth of their implementation (e.g. lack of taxes on aviation fuel and tickets, insufficiently high ticket taxes, insufficiently high parking- or vehicle- pricing, or insufficient subsidies for rail connections compared to subsidies in aviation). Other reasons include structural lock-ins of urban form, and the cultural and social meanings and habits associated with some travel modes which creates additional "lifestyle lock-in" (see Chapter 5 and associated literature)	Accepted and changes made	Michał Czepkiewicz	University of Iceland	Poland
64995	6	27	6	27	Perhaps it is worth exploring the link between revenue from fuel taxes and the transition to EVs? For instance in Australia much of the budget for road maintenance comes from fuel taxes and the shift to EVs thretens this revenue if not appropriatly replaced with a mechanism to allow pay as you go for road use.	Accepted and changes made	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
30543	6	29	6	30	Arguing necessity of interventions such as taxes or subsidies may be policy-prescriptive. It is better to remove this phrase, or to modify to more objective words such as "effective" instead of "needed".	Rejected, these interventions are likely to be needed.	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
17797	6	31			(10 ES) subheading does not read clearly. How about “What will be needed for a transformative transport system according to future scenarios?” or “What, according to future scenarios, will be needed for a transformative transport system?”	Accepted and changes made	Jonathan Lynn	IPCC	Switzerland
77135	6	31	6	35	The report rightly acknowledges that transport will grow in the future, but with estimates between 22% and 65% by 2050; in all cases with emissions outpacing efficiency gains.	Accepted and changes made	Jim O'Brien	Expert Reviewer AR6 SOD WG1	Ireland
23149	6	33	6	33	We suggest to replace "the scenario" by "these scenarios" to avoid any confusion	Accepted but already part of the text here and elsewhere	Government of France	Ministère de la Transition écologique et solidaire	France
81023	6	33	6	33	Replace "The scenarios" by: "The current policy scenarios" Reason: 1. This is important to qualify the scenario at the beginning of the sentence for a better understanding.	Accepted and changes made	Yann BRIAND	Iddri, Sciences Po	France
43775	6	34	6	34	To which reference year do these growth factors refer?	Noted.	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
64997	6	34	6	34	Does this take into account the source of electricity used for Evs, as mentioned below, or just assumes continued fossil fuel use?	Accepted but already part of the text here and elsewhere	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
52417	6	35	6	36	Sentence not clear	Accepted and changes made	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
56781	6	36	6	36	"Thus" seems out of place in this sentence; need punctuation or transition phrase.	Accepted and changes made	Government of United States of America	U.S. Department of State	United States of America
127	6	39	6	41	This sentence could be misleading: electromobility alone will not lead to a decrease of absolute GHG emissions in the passenger transport sector. Not even renewable energy used for the hotspots cathode production and use phase can counterbalance the expected immense increase of mobility in Asia until 2050 (see e.g. https://tuprints.ulb.tu-darmstadt.de/13243/1/Neef_TUPrints_2020_Diss.pdf p. 123 in the pdf for a rough estimate)	Accepted and changes made	Mara Neef	Volkswagen AG	Germany
47891	6	39	6	39	How does this compare wih emissions reductions in other sectors? Are transportation emissions reduced more/less/the same compared to other sectors? This would be a key insight	Noted	Matteo Muratori	NREL	United States of America
50079	6	39	6	39	Only the 25%-tile is shown. Why?	Noted	Masahiro Sugiyama	University of Tokyo	Japan

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
84003	6	39	6	42	Besides electrification, the models also suggest demand reduction, particularly through reducing unnecessary trips, shorter trips ("avoid"), shift from private motorized vehicles to walking, cycling, and public transportation, along with reduction in car ownership rates (see, for example, Gota et al. 2019 and Grubler et al. 2018)	Accepted and changes made	Michał Czepkiewicz	University of Iceland	Poland
43089	6	40	6	40	…as the dominant fuel share…'. Electrification is not a fuel share. I would replace 'fuel share' for 'energy share'. The use of fuel as synonym of energy is repeated along the chapter multiple times.	Accepted and changes made	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
78865	6	41	6	42	This sentence over-generalises 'freight' and overlooks the fact that shipping is primarily used to move freight. Could say that the different modes of freight transport will require a switch from fossil fuels to a broader range of renewable energy sources.	Accepted and changes made	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
69787	6	42	6	42	Would be useful to be more specific: hydrogen based fuels such as ammonia for deep sea shipping, and e-kerosene for aviation, are the prime candidates.	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
43091	6	43	6	45	Beware that the transformative scenarios focus around zero emissions, as in zero air quality. For near zero GHG emissions, HDV can use biodiesel and biomethane. Our work monitoring low emission trials indicate that savings of 85% GHG emissions are common among biomethane fleets.	Accepted but beyond the scope of changes to text at this stage	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
69789	6	43	6	45	The most important role governments should play in this area is to deploy sufficient high-speed recharging stations. For example in Sweden the ministry of transport assesses the number of electric trucks at more than 70 000 by 2040, with as many slow chargers where they stay at night, plus 5000 to 14000 "semi-public" fast recharge points and 3000 to 6000 public fast recharge. See Trafinkverket, 2021, Behov av laddinfrastruktur för snabbladdning av tunga fordon längs större vågar, Borlänge, SE. Clear targets would obviously be very helpful, R&D support may not be warranted.	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
78867	6	44	7	4	This sentence is very long and difficult to follow. As it contains important messages it would be better to split it into several sentences.	Accepted and changes made	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
78869	6	46	6	46	Brief reference is made to 'demand and efficiency' measures. Overall these are under-represented in this Executive Summary, certainly as far as freight transport is concerned. The summary is preoccupied with the switch from fossil fuels to renewable energy and the potential contribution of managerial and operational measures to freight decarbonisation under-estimated, particularly in the short-to-medium term. Also, this AR6 transport chapter is adopting the ASI framework rather than the ASIF framework that was applied in the corresponding chapter in AR5. Given the greater emphasis attached to low carbon fuel in this chapter it is surprising that the ASIF framework which explicitly includes fuel as a variable should be abandoned. This merits some explanation.	Accepted and changes made	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
23151	7	5	7	5	We suggest to add a new paragraph before the paragraph starting with "As all transport", similar to this paragraph of IPCC, SR1.5,2018: "Pathways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems (high confidence). These systems transitions are unprecedented in terms of scale, but not necessarily in terms of speed, and imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options (medium confidence). {2.3, 2.4, 2.5, 4.2, 4.3, 4.4, 4.5}" Reason: 1. The IPCC, SR1.5, 2018 provided new evidences on the fact that reaching 1.5°C is not possible without deep and systemic transitions (See below extract 1) From IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. : Extract 1 - "Pathways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems (high confidence). These systems transitions are unprecedented in terms of scale, but not necessarily in terms of speed, and imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options (medium confidence). {2.3, 2.4, 2.5, 4.2, 4.3, 4.4, 4.5}" Extract 2 - "Limiting the risks from global warming of 1.5°C in the context of sustainable development and poverty eradication implies system transitions that can be enabled by an increase of adaptation and mitigation investments, policy instruments, the acceleration of technological innovation and behaviour changes (high confidence)."	Accepted and changes made	Government of France	Ministère de la Transition écologique et solidaire	France
49725	7	5	7	12	The paragraph should highlight the importance of renewable energy-powered transport and renewably energy-produced fuels (hydrogen etc.), just describing it as low-carbon intensity leaves too much room for interpretation. Useful report on this topic: https://www.ren21.net/decarbonise-transport-sector-2020/	Accepted and changes made	Nikola Medimorec	SLOCAT Partnership on Sustainable, Low Carbon Transport	Republic of Korea
79465	7	5	7	12	The paragraph should highlight the importance of renewable energy-powered transport and renewably energy-produced fuels (hydrogen etc.), just describing it as low-carbon intensity leaves too much room for interpretation. Useful report on this topic: https://www.ren21.net/decarbonise-transport-sector-2020/	Accepted and changes made	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
81025	7	5	7	5	Add a new paragraph before the paragraph starting with "As all transport", similar to this paragraph of IPCC, SR1.5,2018: "Pathways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems (high confidence). These systems transitions are unprecedented in terms of scale, but not necessarily in terms of speed, and imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options (medium confidence). {2.3, 2.4, 2.5, 4.2, 4.3, 4.4, 4.5}" Reason: 1. The IPCC, SR1.5, 2018 provided new evidences on the fact that reaching 1.5°C is not possible without deep and systemic transitions (See below extract 1) From IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. : Extract 1 - "Pathways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems (high confidence). These systems transitions are unprecedented in terms of scale, but not necessarily in terms of speed, and imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options (medium confidence). {2.3, 2.4, 2.5, 4.2, 4.3, 4.4, 4.5}" Extract 2 - "Limiting the risks from global warming of 1.5°C in the context of sustainable development and poverty eradication implies system transitions that can be enabled by an increase of adaptation and mitigation investments, policy instruments, the acceleration of technological innovation and behaviour changes (high confidence)."	Accepted and changes made	Yann BRIAND	Iddri, Sciences Po	France
52419	7	6	7	9	Sentence not clear	Accepted and changes made	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
4643	7	9	7	10	replace: "Hydrogen for transport requires significantly more energy than LiB-based mobility." by "Life cycle assessment with full cradel to grave investigations have to be used to evaluate different power train technologies. Efficiency studies have to take into account the local and global perspectives, e.g. production and global trade of renewable energies." (if the RE is not fully produced in one country and one needs to transport RE e.g. from Australia to Europe, hydrogen and fuel cells would have a higher efficiency than batteries - vice versa: if the power is produced locally the use of batteries is highly efficient)	Rejected, no source provided to justify this claim.	Ulf Groos	Fraunhofer ISE	Germany
46057	7	9	7	12	This notion on energy efficiency is very important and does not only apply for hydrogen but also for PtX in general (factor 3-5!). It therefore should be emphasized much earlier and stronger in this summary. Please revise accordingly in the chapter and reflect in the Executive Summary. (Please see https://www.dena.de/fileadmin/dena/Dokumente/Pdf/9219_E-FUELS-STUDY_The_potential_of_electricity_based_fuels_for_low_emission_transport_in_the_EU.pdf https://www.sciencedirect.com/science/article/abs/pii/S1364032117309358)	Accepted and changes made	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
52421	7	9	7	10	It is hard to understand this statement without suitable context	Unclear what this is referring to	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
84143	7	9	7	12	The statement ignores the issue that the location of the use of energy including the infrastructure that location is linked to is often not an area where renewable energy resources of sufficient scale exist. This dislocation changes the economy and options for energy supply. If an electricity grid can be expanded and decarbonised then LiBs present a lower carbon pathway, however if it more common that our locations of population are not well served by renewable energy sources. The dislocation of energy source and energy demand requires transport of the energy beyond the reach of electricity grids and a viable choice for this transport is a hydrogen based pathway. If the pathway for the energy to the consumption already incorporates hydrogen, in come cases the lower energy consumption path will be for the end-use to be a hydrogen based transport system.	Changes made to highlight need for geographic considerations.	Kym Lennox	climate change equity	Australia
52423	7	10	7	12	Sentence is hard to follow	Accepted and changes made	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
17111	7	13	7	13	It is claimed that "demand reduction" is a prominent strategy adopted by the aviation sector - I don't see evidence for that. If anything travel activity in the aviation sector has sky-rocketed.	Accepted and changes made	Giulio Mattioli	TU Dortmund University	Germany
51565	7	13	7	15	"Fuel efficiency and demand reductions are the only strategies being adopted by the aviation and shipping sectors in recent decades with minimal commitment to new technologies. The most likely way to make further decarbonisation in aviation and shipping is with low-carbon drop-in fuels." This statement is wrong, at least for aviation. Demand reduction is not a strategy that has been adopted by aviation in the recent decades. On the contrary, the aviation industry has always been fighting demand reduction measures. And the most likely way to further decarbonize aviation, at least in the next 2 decades, is not low-carbon drop-in fuels. See 10-4 lines 27-30. Demand reduction will be required and will happen anyway when drop-in fuels are available because their price is much higher than fossil fuels.	Accepted and changes made	eric lombard	Stay Grounded	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79147	7	13	7	20	I'll see below whether this paragraph is followed up recognition (as described in my 2020/21 new papers on heavy transport decarb—see 4:18–19 comments above) that aviation is ripe for an efficiency leapfrog, perhaps elicited by a "Golden Carrot" competition that Boeing asked me to keynote ATAG about in 2019, Airbus was even more interested in, and so are some major customers. Boeing, NASA, MIT, and others designed 3–5x more efficient airliners over a decade ago, but are incrementally adopting those advances at a highly predictable 2%/y or ~20% per airplane generation. At that rate, it'll take most or all of a human lifetime to practice what we knew a decade ago. A big stimulus will come from Otto Aviation's 8x-efficiency demonstration in Aug 2020 (see 5:40–6:5 comment above) whose 6x-lower opex, vs small business jets, should be highly disruptive, especially in combination with the pandemic-sped shift to point-to-point route architectures. So I would unpack 7:13–15 to say that breakthrough and conventional-but-faster-adopted efficiency is even more important than low-carbon drop-in fuels, and to emphasize the 'transformative opportunities" at 7:18 (which I look forward to reading about shortly...).	Accepted and changes made	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
79307	7	13	7	20	Current public policies encourage air travel through low taxes and public subsidies. This paragraph should suggest the need for air travel demand management, including internalizing environmental damages through high fuel taxes, and improvements to alternatives, particualrly rail for medium-distance trips.	Accepted and changes made	TODD LITMAN	Victoria Transport Policy Institute	Canada
81555	7	13	7	13	Unclear whether "demand reductions" refer to fuel demand or activity demand. Suggest to make this more explicit, including if it entails the repetition of the term "fuel".	Accepted and changes made	Marine Gorner	International Energy Agency (former)	France
69791	7	14	7	15	Or quasi drop-in fuels, such as ammonia in the marine ICE, requiring some modifications of the injection system and the end-of-pipe depollution (selective catalytic recirculation).	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
84005	7	14	7	15	Add "and demand reduction" at the end of the sentence as it is clear that it will be necessary if emissions from aviation are to be reduced in the short- and medium-term (by 2030, 40, and 50) and drop-in fuels will not be sufficient.	Accepted and changes made	Michał Czepkiewicz	University of Iceland	Poland
84007	7	14	7	15	What does "likely" mean in this context? Please clarify. Is it the assessment of what the authors think the policy-makers will likely implement or allow to happen, or what would be the most effective option? In my opinion (which is partly based on reading other chapters of this report), the authors should describe the most effective measures to be implemented, and not the most "likely". Tell the policy-makers what to do to protect the climate, instead of estimating what they are likely to implement (!)	Noted	Michał Czepkiewicz	University of Iceland	Poland
76165	7	16	7	16	is this net zero CO2 or net zero GHG?	Noted	Jan Fuglestvedt	CICERO	Norway
86663	7	16	7	20	Transformation requires not only "reviews of international and national governance" but changes in governance such that IMO and ICAO (for example) follow mandates compatible with limiting temperature increases to 1.5 degrees. This means reducing carbon emissions to net zero AND reducing other warming imapcts to net zero. see https://www.icao.int/Meetings/a40/Documents/WP/wp_561_en.pdf. I also think the sentence "some litereatire suggests" international transport systems should now be made part of the Paris Agreement needs strengthening. Unless they ARE made part of Paris(or at least objectives are aligned with Paris), then it seems obvious that industry demands will dominate and action will be inadequate.	Accepted and changes made	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
27803	7	19	7	20	Delete "Some literature suggests that the governance of the international transport systems should now be made part of the Paris Agreement.", as this is an outstanding negotiation issue under the UNFCCC.	Noted	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
52425	7	19	7	20	The chapter also includes literature that concluded otherwise and is worth highlighting here too	Accepted and changes made	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
79499	7	19	7	19	Strongly disagree - all human sources and sinks ARE covered by the PA - there is no reason to suggest in the text that somehow "international transport" (which takes place by road, rail, aviation and maritime) are somehow excluded. The PA makes no mention of the "international transport" being excluded.	Accepted and changes made	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
52427	7	21	7	24	Sentence is hard to follow	Accepted and changes made	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
86665	7	25	7	25	There is no acknowledgement in this summary that transport is both income and price elastic, and as incomes rise, demand is increasing (as shown in section 10.1.2), and as costs fall (on the assumption that electric propusion will rpove cheaper than fossil fuel) then demand may go up. This may confound to a significant extent, improvements in efficiency, hence the importance of relying on planning measures, as well as tax or price measures alongside technical measures (though there is some reference in lines 33-34 on page 10-4	Accepted and changes made	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
1269	8	10	8	13	In this paragraph, there is spoken about "emerging transport disruptions of electrification, shared transport and autonomous transport". It is unclear if shared transport and autonomous transport are going to change the mobility sector significantly the coming decade. The word disruptions may be too exaggerated. In the rest of the text I cannot find support for a disuption in the context of shared transport and autonomous transport.	Accepted. Word disruption has been changed.	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
1317	8	10	8	13	"emerging transport disruptions of electrification, shared transport and autonomous transport (..) are shaping the future". For electrification, this is made obvious in the next sections. For shared transport and autonomous transport this is less clear and in my opinion it is unclear yet what kind of influence shared mobility and autonomous transport has on the mobility sector.In section 10.2 they are mentioned systemic changes, which is much more appropriate. In addition it is phrased much more balanced in section 10.2: "It is likely that different parts of the city will be enabled to use autonomous vehicles more than others" and "literature is still very unsure how much it (shared mobility red.) will contribute to decarbonisation or make it worse as it may take from transit or walking"	Accepted and chages made	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
56783	8	10	8	10	"SDGs" referenced but not defined until line 17. Then "SDG" spelled out in full again on lines 27-28. Define acronyms at first use.	Accepted. Included the definition of SDGs.	Government of United States of America	U.S. Department of State	United States of America
23153	8	14	8	14	The two notions of "decarbonisation of transport" and "sustainable develoment" are not necessarily aligned; the reference study about the connections between "resilience" and "sustainability" conducted by (Marchese 2018) could be replicated here	Accepted and changes made.	Government of France	Ministère de la Transition écologique et solidaire	France
6153	8	15	8	33	Following article examines the wider range of impacts of transport on SDGs indices. - Llorca,C. Silva,C. Kuehnel,N. et al., Integration of land use and transport to reach Sustainable Development Goals: Will radical scenarios actually get us there?, Sustainability, 12(23), 9795, 2020. https://doi.org/10.3390/su12239795	Accepted. Included the suggested reference. Llorca, C., Silva, C., Kuehnel, N., Moreno, A. T., Zhang, Q., Kii, M., & Moeckel, R. (2020). Integration of Land Use and Transport to Reach Sustainable Development Goals: Will Radical Scenarios Actually Get Us There?. Sustainability, 12(23), 9795.	Masanobu Kii	Kagawa university	Japan

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79317	8	15	8	33	It is important to explicitly state that transportation emission plans should favor strategies that help achieve SDGs, for example, by improving affordable, inclusive and healthy mobility options (walking, bicycling, ridesharing, public transit) and creating more compact, multimodal communities where it is easy to access common services and activities without an automobile. It is also important to acknowledge that some emission reduction strategies tend to increase inequity. For example, electric vehicle subisdies are regressive, and because electric cars have lower operating costs than comparable fossil fuel cars they are likely to be driven more annual kilometers, increasing external costs including traffic congestion, road and parking infrastructure costs, traffic crash risk, and sprawl-related costs. These impacts should therefore be explicitly discussed when evaluating and prioritizing emission reduction strategies. Analysis of vehicle travel reduction strategies, such as Table 10.9 on pages 111-113 does a very poor job of reflecting these factors. For example, some of the best win-win strategies, which provide economic opportunity, social equity and health benefits in addition to reducing emissions, including active (walking and bicycling) and public transport improvements, HOV priority, transit-oriented development, complete streets planning, Mobility as a Service (MaaS), efficient road and parking pricing, pay-as-you-drive vehicle insurance and taxes, and integrated navigation and payment apps, are not even mentioned. In addition, the tableassumes that congestion charging (or more accurately called "decongestion pricing") contradicts SDGs; this is generally untrue since efficient road pricing can increase public transit service efficiency and generate revenues to finance affordable mode improvements. Comprehensive evaluation of these SDG impacts is critical to identifying the truly optimal combination of emisison reduciton strategies; this is true for all sectors but since transport and urban design have so many indirect impacts, it is particularly important for those two sectors. See: Paul G. Bain, et al. (2016), "Co-benefits of Addressing Climate Change Can Motivate Action Around the World," Nature Climate Change, Vol. 6(2), pp. 154-157; at https://go.nature.com/3uSRtm9. Co-Benefits of Climate Action (www.changingtheconversation.ca/co-benefits).	Noted.	TODD LITMAN	Victoria Transport Policy Institute	Canada
75783	8	19	8	22	The GRI website claims over 10000 reporters in over 100 countries and the UN Global Compact claims over 12000 companies in over 160 countries, so why not using those instead of the 2017 report that might be outdated	Noted. Reference updated	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
49727	8	23	8	33	The analyis of VNRs submitted in 2020 shows that nearly all of them make reference to transport and further, 47% of submitted VNRs of 2020 connect transport activities to climate action. Source: https://slocat.net/vnr/	Noted.	Nikola Medimorec	SLOCAT Partnership on Sustainable, Low Carbon Transport	Republic of Korea
79467	8	23	8	33	The analyis of VNRs submitted in 2020 shows that nearly all of them make reference to transport and further, 47% of submitted VNRs of 2020 connect transport activities to climate action. Source: https://slocat.net/vnr/	Noted.	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
70319	8	27			References (Richardson, 1990, VPTI, 2004; Williams, 2017) missing	Accepted. Reference updated	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
79309	8	27	8	27	The citation "VPTI, 2004" is not in the references. It may actually refer to the Victoria Transport Policy Institute (VTPI) which has publications that define sustainable transportation. Although there are many defintions of sustainabilty and sustainable transportation, I prefer, "sustainabilty recognizes the integrated nature of human activities and therefore the need to balance economic, social and environmental goals." This emphasizes that sustainability is not just an environmental issue; economic and social goals are equally important, so a policy that helps acheive environmental goals but is severely unfair or causes poverty is not truly sustainable. I suggest citing one of these: Todd Litman (2007), "Developing Indicators for Comprehensive and Sustainable Transport Planning," Transportation Research Record 2017, Transportation Research Board (www.trb.org), 2007, pp. 10-15; at www.vtpi.org/sus_tran_ind.pdf. Todd Litman (2018), Sustainability and Livability: Summary of Definitions, Goals, Objectives and Performance Indicators, VTPI (www.vtpi.org); at www.vtpi.org/sus_liv.pdf. Todd Litman (2021), Well Measured: Developing Indicators for Comprehensive and Sustainable Transport Planning, VTPI (www.vtpi.org); at www.vtpi.org/wellmeas.pdf.	Noted. Some are added	TODD LITMAN	Victoria Transport Policy Institute	Canada
17113	8	31	8	32	Not clear what the source / reference for the "analysis of corporate sustainability reports" is	Accepted. Iincluded the references: doi:10.3390/su70911504 https://doi.org/10.1080/03088839.2020.1754480	Giulio Mattioli	TU Dortmund University	Germany
30545	9	1	9	1	It is better to distinguish synergies and trade-offs for better understanding.	Accepted. Synergies are related to the interaction or cooperation of two or more organizations, substances, or other agents to produce a combined effect greater than the sum of their separate effects. Two lines separated: one for synergies and the other for trade-offs. Trade off refers to conflict of choices. It is characterized by an economic action that aims to solve a problem but entails another, forcing a choice.	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
15477	9	4	9	4	Not clear to me how transport topics "reduced stress from driving", "Improving road accessibility to disabled users" and "reduce time spent on transport mobility" fit into this framework and broader discussion. The solutions that come to mind include several conventional approaches around increased road capacity and vehicular throughput. The topics should be more focused on improving accessibility in general emphasising reduced travel distances and reduced need to use private motorised modes.	Accepted - Figure has been extensively revisited and redrawn. Iincluded the references: doi:10.3390/su70911504 https://doi.org/10.1080/03088839.2020.1754480 Di Vaio, A., & Varriale, L. (2020). SDGs and airport sustainable performance: Evidence from Italy on organisational, accounting and reporting practices through financial and non-financial disclosure. Journal of Cleaner Production, 249, 119431. https://doi.org/10.1016/j.jclepro.2019.119431 Wang, G., Li, K. X., & Xiao, Y. (2019). Measuring marine environmental efficiency of a cruise shipping company considering corporate social responsibility. Marine policy, 99, 140-147. Sukitsch, M., Engert, S., & Baumgartner, R. J. (2015). The implementation of corporate sustainability in the European automotive industry: An analysis of sustainability reports. Sustainability, 7(9), 11504-11531. https://doi.org/10.3390/su70911504 https://doi.org/10.1016/j.marpol.2018.10.028 https://sustainabledevelopment.un.org/content/documents/17109Synthesis_Report_VNRs_2017.pdf. ADD/EDIT REF. This reference should be edited as ITF 2019. It appears twice in the Reference list as: ITF International Transport Forum. (2019a). Transport Outlook 2019. https://doi.org/10.1787/transp_outlook-en-2019-en ITF International Transport Forum. (2019b). Transport Outlook 2019. https://doi.org/10.1787/transp_outlook-en-2019-en	Ryan Falconer	Auckland Council, New Zealand	Australia
6119	9	6			In general, I am surprised not to find any discussion of the potential role of road fuel prices. Recent evidence using a particularly large panel dataset from Liddle and Huntington (2020) suggests that road fuel price elasticities are fairly large—particularly large when compared to other price elasticities of demand like residential electricity (Liddle and Huntington 2021). For example, the long-run price elasticities of road gasoline and road diesel demand for OECD countries were -0.74 and -0.35, respectively; the long-run price elasticities of road gasoline and road diesel demand for non-OECD countries were both around -0.25 (Liddle and Huntington 2020). By contrast the long-run price elasticities of residential electricity demand for high-income and middle-income countries were only -0.22 and -0.08, respectively (Liddle and Huntington 2021). Liddle, B. & Huntington, H. 2020. 'On the Road Again': a 118 Country Panel Analysis of Gasoline and Diesel Demand. Transportation Research A: Policy and Practice, Vol. 142, pp, 151-167. Liddle, B. & Huntington, H. 2021. How Prices, Income, and Weather Shape Household Electricity Demand in High-Income and Middle-Income Countries. Energy Economics, Vol. 95, 104995.	Accepted. The text was reviewed.	brantley liddle	independent consultant	United States of America
17209	9	6	9	6	This is a very useful and well elaborated section. A further addition that would strengthen it is to check for any alternative sources of transport emissions beyond IEA and EDGAR (either global, regional, or subsectoral - e.g. for aviation) and compare these where possible to the reported numbers. This would be a nice quality check on the results shown here and elsewhere. One could also compare earlier years against AR5. For info, Ch7 (AFOLU) does this for Agricultural and LULUCF emissions (see section 7.2.1).	Accepted but still changing at this stage	William Lamb	Mercator Research Institute on Global Commons and Climate Change (MCC)	Germany
28547	9	6	9	18	I think it is very important to clarify that what is discussed here is only related with direct energy use and GHG emissions in transport, and excludes indirect energy use and emissions that are still directly related with transport. These are due to fuel production (e.g. occurring in refineries, likely included in Chapter 6: Energy systems), vehicle manufacturing and infrastructure construction - along with related material extraction/processing (likely included in Chapter 11: Industry). The part of transport in total energy demand is much larger the accounting is switched to a life-cycle perspective that includes major sectors of the economy like transport fuel production, road and rail construction and automotive manufacturing (including related supply chains).	Accepetd but still changing at this stage	Pierpaolo Cazzola	International Transport Forum	France
1273	9	8	9	15	Lines 8-10 seems to contradict line 13-15. How is it possible that global transport is in so many countries the largest energy consuming sector (and in many other the second largest energy consuming sector) and at the same time transport is 'only' the fourth largest sector of GHG emissions? Emissions from land-use can be an explaination as well as using energy products for feedstock, but is would be nice if this reasons are added.	Accepetd but still changing at this stage	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
70209	9	8	9	10	The statement is true from a production perspecitve. It should also be noted that, from an energy consumption perspective, transport is the largest GHG producing sector	Noted	Paul Wolfram	Yale University	United States of America
1271	9	9	9	9	The AFOLU abbreviation may not be clear to everybody.	Accepted. Updated. the Agriculture, Forest and Land Use (AFOLU).	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
70321	9	11	9	13	Congruence missing: "... increased fast over the last two decades, and since 2010, the sector's trends have increased faster than for any other end-use sector, averaging +1.9% annual growth since 2000." Please refer to the same base year (2000 or 2010)?	Accepted. since 2010. Base year 2010.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
15479	9	13	9	14	Reiterate the point in the previous sentence - transport is a fundamental sector both because of its contribution to overall GHG and because of historic, rapid growth in emissions from it. May also note, here that rising populations place added pressure on GHG moving forward, because of the net new travel demands that will arise.	Noted and already part of the text along the chapter	Ryan Falconer	Auckland Council, New Zealand	Australia
18459	9	14	9	15	40% of countries - it may be useful to provide a bit more context (e.g. are we talking about the largest countries? The most populous ones?)	Accepted but beyond the scope of changes at this stage	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
70323	9	15	9	18	What do all these references refer to? (Hasan,Frame, Chapman, and Archie, 2019) (Shah, Dawood, Jalil, and Adnan, 2019) (Xie, Huang, Tian, and Fang, 2019) (Avetisyan, 2018) (Halim, Kirstein, Merk, and Martinez, 2018) (Sudhir Sudhir Gota, Huizenga, Peet,Medimorec, and Bakker, 2019) (Makan and Heyns, 2018).	Noted. Clarifying: the references refers to emissions from road transport. See: Hasan, M. A., Frame, D. J., Chapman, R., & Archie, K. M. (2019). Emissions from the road transport sector of New Zealand: Key drivers and challenges. Environmental Science and Pollution Research, 26(23), 23937-23957. Differences changes in CO2 emissions among China transportation subsectors: Xie, R., Huang, L., Tian, B., & Fang, J. (2019). Differences in changes in carbon dioxide emissions among China's transportation subsectors: a structural decomposition analysis. Emerging Markets Finance and Trade, 55(6), 1294-1311. Decarbonising transport to achieve Paris Agreement targets: Gota, S., Huizenga, C., Peet, K., Medimorec, N., & Bakker, S. (2019). Decarbonising transport to achieve Paris Agreement targets. Energy Efficiency, 12(2), 363-386.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
79311	9	15	9	18	Spaces needed between Hasan and Frame and between Peet and Medimorec.	Accepted.	TODD LITMAN	Victoria Transport Policy Institute	Canada
78873	9	17	9	17	delete Sudhir Sudhir	Accepted.	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
23155	9		9		Table 10.1 : Column 1: the improvement of transport systems (and therefore their efficiency) should not be measured only in time spent but more generally in terms of level of service, or quality of service. This includes: reliability, comfort, connection to the web, etc. Speed is just one dimension of efficiency. Column 2 and 4: TOD stands for Transit Oriented Development	Noted. But It is beyond the scope of changing at this stage	Government of France	Ministère de la Transition écologique et solidaire	France
31661	9		9		Table 10.1: Under 'Basic human needs' " Energy access can contribute to poverty alleviation"- how is transport related-kindly explain Also" injuries and deaths from traffic accidents"- Does this mean reduce injuries and deaths from traffic accident? Please mention Under 'Sustainable resource use': "Share of renewable energy use"- since the table is on synergies and trade-offs it might be worth mentioning "increase share of renewable...." Under 'Universal values'- If possible please explain "partnership for the goals" so as to make it clear to the reader why it is a synergy? The table lacks aspects of tradeoffs.	Noted but beyond the scope of changes at this stage	Shreya Some	Ahmedabad University	India
31663	9				In-text citation incorrect format: P9L15-18; P11L10; P12L11 (Newman et al.....);P12L13; P12L37-38; P13L37 (Coe et al...); P13L41(semicolon in between two citations); P14L16-17; many more.... Please follow the guideline- user (first author et al). if more that two authors	Noted. Revised	Shreya Some	Ahmedabad University	India
73065	9				Add a new section 10.1.1.1, something like as follows. 10.1.1.1 International Transport and Equity. "Tourism epitomizes inequality," in that over half of global outbound travels and arrivals are between only 10 nations – that is, "essentially half of international tourism" is highly focused, and a significant share of it is done by a "hypermobile elite." (Becken 2020). In contrast, "the share of outbound travel from Least Developed Countries and Small Island Developing States is less than 2% of international travel." (Becken 2020). This calls into question a common justification for about 600 million tonnes of CO2 from global passenger aviation. Because the need to assist economic development of less developed nations is agreed, they should be afforded the ability to participate in global travel, which, to contain emissions, in turn requires "a reduction and contraction in travel by the traditional markets. (Becken 2020). (References: [1] Internal citation omitted; [2] Becken 2020, ref'd earlier.)	Accepted, but beyond the scope of chages to text at this stage	Larry Edwards	Larry Edwards Environmental Consulting	United States of America
15481	10	1	10	1	These figures are useful - but recommend adding 'figure c' showing per capita as well.	Noted. The Table is going to be updated	Ryan Falconer	Auckland Council, New Zealand	Australia
28549	10	1	10	5	Once more, these are only direct GHG, excluding fuel production, vehicle manufacturing and infrastructure construction. This should be clearly stated.	Noted. Sitl fixing the figure	Pierpaolo Cazzola	International Transport Forum	France
45569	10	1	10	1	It is not logical to show here the indirect emissions related to electricity use and not the much higher (in absolute terms) indirect emissions related to the use of oil products.	Noted. Still fixing the figure	Kornelis Blok	Delft University of Technology	Netherlands
70211	10	1	10	5	Figure 10.1. - it is inconsistent that indirect CO2 emissions from electricity and heat are listed, but not from fuel and vehicle production.	Noted. Still fixing the figure	Paul Wolfram	Yale University	United States of America
70325	10	1			Fig 10-1: Excellent chart, clear and comprehensive at the same time! Only question: Why so much "other incl. indirect N2O" in EURASIA? And reference / data source missing.	Noted. Still fixing the figure	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
72481	10	1	10	1	In panel b of Fig. 10.1, the lower part of the figure 0 to 0.5 (or 0 to 0.25) GtCO2eq/yr should be enhanced to render it redeable and clearly see which amongst the transport modes outsite road are the most important for each sub-geographic section	Noted. Still fixing the figure	Sylvain Pichat	University of Lyon, Ecole normale supérieure de Lyon, Laboratoire de Géologie (LGL-TPE)	Germany
45605	10	3	10	3	Shouldn't it read 'generated' instead of 'consumed'?	Noted. Still fixing the figure	Annika Bose Styczynski	O.P. Jindal Global University	India
28551	10	6	11	19	Again, this whole discussion is solely focused on direct GHG, excluding fuel production, vehicle manufacturing and infrastructure construction. This should be clearly stated.	Accepted and changes will be made	Pierpaolo Cazzola	International Transport Forum	France
52429	10	6	10	7	Reference is needed	Accepted. Added reference: Lamb, W. F., Wiedmann, T., Pongratz, J., Andrew, R., Crippa, M., Olivier, J. G. J., Wiedenhofer, D., Mattioli, G., Al Khourdajie, A., House, J., Pachauri, S., Figueroa, M., Saheb, Y., Slade, R., Hubacek, K., Sun, L., Ribeiro, S. K., Khennas, S., de la Rue du Can, S., ... Minx, J. C. (2021). A review of trends and drivers of greenhouse gas emissions by sector from 1990 to 2018. Environmental Research Letters. https://doi.org/10.1088/1748-9326/abee4e	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79313	10	6	10	12	You might want to add a sentence explaining that high atmosphere emissions have increased global warming effects, so aviation emissions are more harmful than surface transport per unit of fuel consumption or emissions.	Noted. The text refering to the Table is going to be changed.	TODD LITMAN	Victoria Transport Policy Institute	Canada
52431	10	7	10	9	Reference is needed	Accepted. Added ref: Lamb, W. F., Wiedmann, T., Pongratz, J., Andrew, R., Crippa, M., Olivier, J. G. J., Wiedenhofer, D., Mattioli, G., Al Khourdajie, A., House, J., Pachauri, S., Figueroa, M., Saheb, Y., Slade, R., Hubacek, K., Sun, L., Ribeiro, S. K., Khennas, S., de la Rue du Can, S., … Minx, J. C. (2021). A review of trends and drivers of greenhouse gas emissions by sector from 1990 to 2018. Environmental Research Letters. https://doi.org/10.1088/1748-9326/abee4e	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
69793	10	7	10	9	As one does not distinguish between national and international road transportation, it seems that a logical would be to consolidate international and domestic aviation, as well as international and inland shipping	Noted. The text refering to the Table is going to be changed	Cédric PHILIBERT	Institut Français des Relations Internationales	France
85381	10	7	10	7	Missing a reference to the source of data used.	Accepted. Added ref: Lamb, W. F., Wiedmann, T., Pongratz, J., Andrew, R., Crippa, M., Olivier, J. G. J., Wiedenhofer, D., Mattioli, G., Al Khourdajie, A., House, J., Pachauri, S., Figueroa, M., Saheb, Y., Slade, R., Hubacek, K., Sun, L., Ribeiro, S. K., Khennas, S., de la Rue du Can, S., … Minx, J. C. (2021). A review of trends and drivers of greenhouse gas emissions by sector from 1990 to 2018. Environmental Research Letters. https://doi.org/10.1088/1748-9326/abee4e	Neil Dickson	ICAO	Canada
78879	10	9	10	9	greater use of rail by passengers and freight (insert 'by') I would also question the reference to freight here as modal shift from road to rail is seldom associated with 'urban sprawl'.	Accepted but beyond the scope of changes at this stage	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
23157	10	10	10	12	It is true that aviation is the fastest growing source in relative terms but road is by far the fastest growing in absolute terms	Noted	Government of France	Ministère de la Transition écologique et solidaire	France
52433	10	10	10	12	Reference is needed	Accepted. Reference is going to be included	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
63219	10	11	10	11	(2,7%) should be either 2%, or 2.7% or 7%.	Accepted	Government of Canada	Environment and Climate Change Canada	Canada
46059	10	14	23	8	"systemic changes in the transport sector" are discussed in section 10.2; however, the much greater success of a paradigm shift in transport systems planning as implemented in the State of California, U.S.A. analysed e.g. in Lee & Handy 2018: Leaving Level-of-Service behind: The implications of a shift to VMT impact metrics, https://doi.org/10.1016/j.rtbm.2018.02.003 is missing. Please this aspect to this section.	Noted	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
1275	10	15			Indirect emissions from heat? What are these?	Noted. Already part of the text in other section	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
15483	10	15	10	17	Opportunity for emphasis - Indirect emissions are low today because of the low share of EV. This is expected to become more material in future, hence the need (especially where there are carbon-intense electricity grids) to decarbonise energy sector as well. There is covered in s10.2.4 and s10.4.5 but the issue should be signposted, here.	Noted. Already part of the text in other section	Ryan Falconer	Auckland Council, New Zealand	Australia
49729	10	15	10	19	The indirect emissions by transport should include the total petroleum well-to-refinery emissions and emissions caused by the crude oil extraction. It would result in a larger contribution of transport to global GHG emissions. See here: https://www.chalmers.se/en/departments/see/news/Pages/Crude-oil-carbon-footprint.asp	Noted. This issue is dealt in other chapter.	Nikola Medimorec	SLOCAT Partnership on Sustainable, Low Carbon Transport	Republic of Korea
79469	10	15	10	19	The indirect emissions by transport should include the total petroleum well-to-refinery emissions and emissions caused by the crude oil extraction. It would result in a larger contribution of transport to global GHG emissions. See here: https://www.chalmers.se/en/departments/see/news/Pages/Crude-oil-carbon-footprint.asp	Same comment as presented previously.	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
1277	10	17			Shipping was not mentioned above as a fast growing sector, only aviation and road transport. What is the growth rate of shipping?	Accepted and it is going to be included	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
23159	10	17	10	18	Aviation and shipping are the fastest growing emissions in relative terms, not in absolute terms	Noted	Government of France	Ministère de la Transition écologique et solidaire	France
45607	10	17	10	18	We don't know the speed at which the shipping sector is growing. Wouldn't it be better to say 'Accounting for the fact that shipping and aviation have been underrepresented in earlier reports and emissions from aviation are growing the fastest, this chapter dedicates ...	Accepted, but already part f the text here and elsewhere	Annika Bose Styczynski	O.P. Jindal Global University	India
15485	10	20	11	2	Appreciate that data is referred to in regional terms; however, intraregional differences should be noted - e.g. NZ trends have been upwards (road transportation GHG more than doubled 1990-2018 based on MfE data).	Accepted but beyond the scope of changes at this stage	Ryan Falconer	Auckland Council, New Zealand	Australia
45609	10	20	10	23	Remove the sentence: "Growth in transport related GHG emissions has taken place across most world regions except Asia Pacific and Eurasia" It only confuses the reader because it is inconsistent with line 23. No growth and slow growth is a difference.	Accepted, but already part of the text here and elsewhere	Annika Bose Styczynski	O.P. Jindal Global University	India
84145	10	20	11	2	Comparison for growth for passenger transport should always use passenger vehicle kilometers as a metric not totals from a sector or region.	Noted, but it is beyond the scope of changes at this stage	Kym Lennox	climate change equity	Australia
45603	10		10		The ICCT Vision 2050 contains an estimate of the CO2 emissions share of Light Duty Road Vehicles vs. Heavy Duty Road Vehicles in 2020. This could be helpful to better distinguish both sectors and assess the relevance of HDRVs. See page 5 of the report. Source: https://theicct.org/sites/default/files/publications/ICCT_Vision2050_sept2020.pdf	Noted, but it is beyond the scope of changes at this stage	Annika Bose Styczynski	O.P. Jindal Global University	India
72907	10		10		First graph percentage numbers could be put in front of the the legend to make correspondence between numbers and emission source clearer.	Noted. The figure is going to be changed	Antoine BONDUELLE	EE-Consultant	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
60551	11	0	11	0	Within teh ASI approach, many transport policies are carried out at urban level. Local policies highly contribute in delivering changes in the carbon emissions due to transports. The policies addresses each of the components of the ASI approach. See the contribution of Covenant of Mayors signatories in the paper Palermo V, Bertoldi P, Apostolou M, Kona A, Rivas S (2020). Assessment of climate change mitigation policies in 315 cities in the Covenant of Mayors initiative. SUSTAINABLE CITIES AND SOCIETY, vol. 60, ISSN: 2210-6707, doi: https://doi.org/10.1016/j.scs.2020.102258. Medium cities show to plan higher number of policies for transport sector than for buildings. Moreover, Regulation policies mostly concern the Transport and Building sectors indipendently of the size of local authority.	Noted	Valentina Palermo	JRC	Italy
52435	11	3	11	4	Reference is needed	Accepted. Reference was included	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52437	11	4	11	5	Reference is needed	Accepted,. Reference was included	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
78875	11	7	11	8	The expression 'freight travel' is very odd. Travel relates to the movement people not goods. Could also clarify the unit of measurement, which in this case is tonne-kms.	Accepted.	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
78877	11	8	11	10	this sentence suggests limited appreciation of the process of freight traffic growth and what might be done to restrain it. This is unfortunate as the ITF (2019) is projecting a 3.3. times growth in freight tonne-kms globally by 2050 which, if allowed to materialise, will make the decarbonisation of freight transport very difficult. There is a significant literature on the growth of freight transport and international trade, reviewed in the McKinnon (2018) and ITF (2019) - references which the chapter cites, among others.	Accepted but beyound the scope of changes at this stage.	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
23161	11	10	11	11	It should be precised whether the statement concerning emissions holds in relative or absolute terms.	Accepted, changes will be made to be clear.	Government of France	Ministère de la Transition écologique et solidaire	France
1281	11	13	11	15	Are these CO2 emissions from a well-to-wheel perspective? The "fifth of passenger transport globally" is this expressed as a distance based share or as a trip based share? The trip distance for the different modalities may differ a lot.	Accepted. The text was reviewed.	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
49731	11	13	11	19	In this pagraph referring to buses and railways as public transport/transit does not show the full picture and neglects informal transport services and other private-organised collective transport services. The best would be to use the expression "collective transport" to avoid such issues.	Accepted. The text was reviewed.	Nikola Medimorec	SLOCAT Partnership on Sustainable, Low Carbon Transport	Republic of Korea
79471	11	13	11	19	In this pagraph referring to buses and railways as public transport/transit does not show the full picture and neglects informal transport services and other private-organised collective transport services. The best would be to use the expression "collective transport" to avoid such issues.	Accepted. The text was reviewed.	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
1279	11	15			Sudhir Gota et al., 2019a is missing in the reference list. Or is Gota et al., 2019 reference?	Accepted. Reference included.	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
65001	11	16	11	16	Missing a full stop after 2017)	Accepted	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
15487	11	20	11	31	Little discussion of social justice and equity considerations. These could also come through in the discussion of technology - especially provision of access to EV - given affordability issues (at least in the short-medium term). Points of discussion include community leasing schemes.	Accepted but now is already part of the text here and in other chapters.	Ryan Falconer	Auckland Council, New Zealand	Australia
17117	11	20	11	41	This paragraph does not correctly identify measures into the "avoid", "shift" and "improve" categories. "E-rickshaws" are listed under "avoid" but they are "shift". "Reducing the length of trips" is classified under "shift" but should be "avoid". "reducing the carbon emissions of modes of transport" is listed under "shift" but it should be "improve". See Chapter 5 for a clearer definition of what the ASI categories mean.	Accepted, but already part of the text here and in other chapters	Giulio Mattioli	TU Dortmund University	Germany
79315	11	20	11	41	This paragraph introduces an important concept, "Avoid-Shift-Improve." I think it could be much clearer. Avoid-shift-improve is a way to priortize potential mitigation strategies, recognizing that Avoid tends to provide the greatest total savings and co-benefits, Shift provides somewhat less, and Improve the least; comparable to the "reduce, reuse and recycle" concept. It can more clearly explain which mitigation strategies fall into each of these categories. It seems implies that Avoid only reduces vehicle trips while Shift reduces vehicle travel by reducing trip lengths; I disagree. It is confusing and unfair to suggest that Avoid strategies "need to consider inclusive practices paying attention to issues of transport justice" which implies that there are no social justice issues associated with Avoid and Improve. The statement "Shifting includes prioritising a turn of trips from private passenger vehicles into public transport..." makes no sense - it must be a typo. Below is my suggested rewrite of the paragrah. I also suggest adding a table to show how strategies are categorized, which I've incorporated into the "Tables" tab. Since the road sector, both passenger and freight, is the greatest source of transportation GHG emissions, it offers the largest mitigation potential (Halim et al., 2018; Taptich, Horvath, and Chester, 2016). There is a wide range of possible transport emission reduction strategies. These can be categorized by 'Avoid- Shift-Improve' (ASI), which is comparable to "reduce-reuse-recycle" applied to all demand sectors in Chapter 5 (Hidalgo and Huizenga 2013). Avoid strategies reduce total vehicle-travel. This includes Smart Growth development policies that create more compact communities where travel distances are shorter, efficient transportation pricing and TDM programs that encourage vehicle travel reductions, and carsharing programs that help households reduce vehicle ownership. Shift strategies shift travel from higher-emitting to lower-emitting modes. This includes more multimodal planning that improves active and public transport modes, complete streets roadway design, High Occupant Vehicle (HOV) priority strategies that favor shared mode, Mobility as a Service (MaaS), and multimodal navigation and payment apps. Improve reduces per-kilometre emission rates. This includes hybrid and electric vehicle incentives, lower carbon and cleaner fuels, high emitting vehicle scrapage programs, and efficient driving and anti-idling campaigns (S. Gota, Huizenga, Peet, and Kaar, 2015; Lutsey and Sperling 2012). This framework is a way to priortize potential emission reduction strategies, recognizing that Avoid tends to provide the greatest total savings and co-benefits, Shift provides somewhat less, and Improve	Accepted, but already part of the text here and in other chapters	TODD LITMAN	Victoria Transport Policy Institute	Canada

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
15489	11	21	11	24	Can emphasise, here that a context-sensitive ASI response can and should contribute also to important broader transport sector outcomes such as reduced instances of deaths and serious injuries, environmental degradation and so on. Some co-benefits are referred to in other parts of the chapter; from line 10, p111 for example.	Accepted. Changes were made.	Ryan Falconer	Auckland Council, New Zealand	Australia
56785	11	22	11	37	In the discussion of Avoid-Shift-Improve, there should be a better linkage to the concept of accessibility, which was discussed in Chapter 8. It is not just about avoiding unnecessary motorized trips, but creating the conditons that provide accessibility to jobs, goods, and services.	Accepted. Changes were made.	Government of United States of America	U.S. Department of State	United States of America
64999	11	23	11	23	It might be worth picking either "public transport" or "shared transit" as it may be confusing what is being referred to when one is used in place of the other?	Accepted and changes were made.	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
84147	11	24	11	31	The text does not stress the significance as capacity to avoid demand due to passenger transport being solely a function of land use patterns. Improved service from localised land use to the community eliminates passenger transport demand. Pre-Industrial economies functioned without passenger transport with land use responding in providing everything locally. The productivity of our cities and economy over the internvening period did imporve due to the land use pattern that made almost nothing local. However, the todays productivity of many OECD nations is not longer linked and most likely will imporve where everything-is-local land use were to return. This land use approach would represent large scale avoidance approach for transport emissions.	Accepted. Changes were made	Kym Lennox	climate change equity	Australia
31665	11	26	11	30	Not sure if the example for e-rickshaw will come under Avoid. May be will better suits under improve	Accepted. Changes were made	Shreya Some	Ahmedabad University	India
61147	11	26	11	41	Here under the ASI discussion, the authors seem only discuss the solutions for road passenger transport. Inter-city and international transport, esp road freight, shipping, and aviation systems, are not mentioned here for ASI strategies. It is somehow the problem of ASI model itself when it was first developed. Experts who designed the ASI are mostly the experts from urban mobility field; they did not have much experitise (or did not involve enough experts) on freight, esp shipping, road freight, and freight aviation.	Accepted. Changes were made.	Su Song	Young Crane Consulting	China
23163	11	27	11	30	This is unclear whether rebound effects are addressed here implicitly, or not at all, we suggest a clarification	Accepted. Changes were made.	Government of France	Ministère de la Transition écologique et solidaire	France
17115	11	28	11	28	"Promotion of investment at the botoom of the pyramid" - not clear what pyramid is referred to	Accepted. Changes were made.	Giulio Mattioli	TU Dortmund University	Germany
11289	11	31	11	37	I suggest adding content on reallocation of road space here (after line 37) or elsewhere in this section e.g. "Well planned reallocations of road space, with more space dedicated to transit, walking and cycling, can be an effective part of 'shift' strategies (ITF 2021)" ITF (2021), Reversing Car Dependency: Summary and Conclusions, ITF Roundtable Reports, No. 181, OECD Publishing, Paris. www.itf-oecd.org/avoiding-car-dependency	Accepted, but beyond the scope of chages to text at this stage.	Eric Doherty	Ecopath Planning	Canada
52439	11	31	11	37	References are needed	Accepted. Todd Litman (2021), Win-Win Transportation Emission Reduction Strategies, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/wwclimate.pdf. Saeed Moshiri and Kamil Aliyev (2017), "Rebound Effect of Efficiency Improvement in Passenger Cars on Gasoline Consumption," Ecological Economics, Vo. 131, pp. 330-341 (https://doi.org/10.1016/j.ecolecon.2016.09.018).	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
79503	11	31	11	32	Suggest to add "combined rail/road freight transport" - so not all examples are for passengers.	Accepted. Changes in the text were made.	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
81557	11	37	11	37	It is important to specify which type(s) of "sharing and mobility as a service" the statement refers to. There are many different "mobility as a service" and "sharing" types (car-sharing, ride-sharing, ride-hailing, ...) that can have different impacts (including on the displacement of other types of mobility and modes) and various potentials for successfully realising "shifting" goals with positive environmental, climate and social impacts. This is rightly mentioned in other parts of the chapter.	Accepted. Changes in the text were made.	Marine Gorner	International Energy Agency (former)	France
47893	11	38	11	38	Improve usually refers to improve enrgy efficiency, another key aspect is reducing fuel carbon intensities	Noted.	Matteo Muratori	NREL	United States of America
84009	11	39	11	41	Contrary to this statement, the "improve" options constitute the disproportinally large part of the chapter. Much more consideration should be given to the "avoid" and "shift" options.	Accepted. How combinations of ASI with new technologies deployment can potentially lead from incremental interventions into low carbon transformative sectoral improvements	Michał Czepkiewicz	University of Iceland	Poland
29371	11	42	0	0	The topic of climate impacts on the transport sector is not developed further in the chapter: what about e.g. flood impact to EV?	Noted. Revised	Maria Pregnolato	University of Bristol	United Kingdom (of Great Britain and Northern Ireland)
49733	11	42	12	23	Useful to mention that transport adaptation to climate change appears in 29 first NDCs (16% of all first NDCs), and only 10 NDCs (4%) identify specific transport adaptation measures. Reference: https://slocat.net/tcc-gsr/	Accepted. Changes in the text were made.	Nikola Medimorec	SLOCAT Partnership on Sustainable, Low Carbon Transport	Republic of Korea
61149	11	42	12	23	In addition to the impact on infrastructure, there are also plenty of studies/evidences show that extreme high temperatures and local climate events or bad air quality also influence the pedestrian and cyclist, in terms of reducing their health wellbeing and activie transport activities (walking/cycing). The author(s) should find some literature to support this part.	Accepted. Active transport are also sensible to weather and climate conditions. Refrences: Bernard, P., Chevance, G., Kingsbury, C., Baillot, A., Romain, A. J., Molinier, V., ... & Dancause, K. N. (2021). Climate change, physical activity and sport: a systematic review. Sports Medicine, 1-19 and Vardoulakis, S., Salmond, J., Krafft, T., & Morawska, L. (2020). Urban environmental health interventions towards the Sustainable Development Goals.	Su Song	Young Crane Consulting	China
79473	11	42	12	23	Useful to mention that transport adaptation to climate change appears in 29 first NDCs (16% of all first NDCs), and only 10 NDCs (4%) identify specific transport adaptation measures. Reference: https://slocat.net/tcc-gsr/	Same comment as presented previously.	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
1233	11	48	11	48	Forzieri et al. is missing from list of references	Noted. Reference has been included. Forzieri, G., Bianchi, A., Silva, F. B. e, Marin Herrera, M. A., Leblois, A., Lavalle, C., Aerts, J. C. J. H., & Feyen, L. (2018). Escalating impacts of climate extremes on critical infrastructures in Europe. Global Environmental Change, 48, 97–107. https://doi.org/10.1016/j.gloenvcha.2017.11.007	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
46061	11	48	11	48	The reference Forzieri et al. (2018) is missing.	Noted. Reference has been included. Forzieri, G., Bianchi, A., Silva, F. B. e, Marin Herrera, M. A., Leblois, A., Lavalle, C., Aerts, J. C. J. H., & Feyen, L. (2018). Escalating impacts of climate extremes on critical infrastructures in Europe. Global Environmental Change, 48, 97–107. https://doi.org/10.1016/j.gloenvcha.2017.11.007	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
60549	12	0	12	0	on bridges and infrastructures critical role: "Pregnolato M.2019 Bridge safety is not for granted – A novel approach to bridge management. Engineering structures" https://doi.org/10.1016/j.engstruct.2019.05.035	Accepted. Reference has been included. Pregnolato M. 2019 Bridge safety is not for granted – A novel approach to bridge management. Engineering structures" https://doi.org/10.1016/j.engstruct.2019.05.035	Valentina Palermo	JRC	Italy
56787	12	1	12	23	This section examines climate impacts on the transport sector, with a focus on infrastructure. This section should include some discussion of the impacts of climate on current and future transportation fuel supply chains/infrastructure. This can include climate impacts (drought, precipitation pattern changes) on advanced biofuels, or impacts of climate and extreme events on the electricity grid. DOE has a number of reports examining climate impacts and extreme weather events on the electric grid. See, for instance: https://www.energy.gov/sites/prod/files/2019/09/f67/Oak%20Ridge%20National%20Laboratory%20EIS%20Response.pdf	Noted.	Government of United States of America	U.S. Department of State	United States of America
1229	12	4	12	4	Thaduri et al. and Forero-Ortiz et al. are both missing in the list of references	Noted. Added Refences Thaduri, A., Galar, D., & Kumar, U. (2020). Space weather climate impacts on railway infrastructure. International Journal of System Assurance Engineering and Management, 11(2), 267–281. https://doi.org/10.1007/s13198-020-01003-9 and Forero-Ortiz, E., Martínez-Gomariz, E., Cañas Porcuna, M., Locatelli, L., & Russo, B. (2020). Flood Risk Assessment in an Underground Railway System under the Impact of Climate Change—A Case Study of the Barcelona Metro. Sustainability, 12(13), 5291. https://doi.org/10.3390/su12135291	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
2211	12	4	12	4	Can you please add following statements to enhance opinions in this paragraph? "The climate impact on road performance and pavement deteriorations is enhanced by its interaction with traffic volumes, heavy vehicle transportation, geography, soil types and soil moisture (Song et al 2018, 2021)." (Reference: (1) Song, Y., Wright, G., Wu, P., Thatcher, D., McHugh, T., Li, Q., Li, S.J. and Wang, X., 2018. Segment-based spatial analysis for assessing road infrastructure performance using monitoring observations and remote sensing data. Remote Sensing, 10(11), p.1696.; (2) Song, Y., Thatcher, D., Li, Q., McHugh, T. and Wu, P., 2021. Developing sustainable road infrastructure performance indicators using a model-driven fuzzy spatial multi-criteria decision making method. Renewable and Sustainable Energy Reviews, p.110538.)	Accepted. Changes were made. Reference has been included: Song, Y., Thatcher, D., Li, Q., McHugh, T., & Wu, P. (2020). Developing sustainable road infrastructure performance indicators using a model-driven fuzzy spatial multi-criteria decision making method. Renewable and Sustainable Energy Reviews, 110538.	Yongze Song	Curtin University, Australia	Australia
10779	12	4	12	4	the reference (Forero-Ortiz, et al., 2020) seems to be missing	Accepted. Reference included.	Philippe Waldteufel	CNRS	France
46063	12	4	12	4	The reference Thadori et al. (2020) is missing.	Agreed. Reference has been included.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
56789	12	4	12	4	"Underground systems" are mentioned, but it would helpful to be explicit in the types of underground systems being referenced (i.e., underground transportation systems, underground transport networks, underground transit systems, etc.).	Accepted. Changes made in the text.	Government of United States of America	U.S. Department of State	United States of America
1231	12	7	12	7	Thornbush et al. is missing in list of references	Accepted. Reference has been included.	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
15491	12	7	12	11	This passage is not clear. Some restructuring needed to emphasise that rail (really, a range of forms of rapid transit), when used as structuring elements for urban growth, can mitigate climate change-related risks as well as emissions.	Noted.	Ryan Falconer	Auckland Council, New Zealand	Australia
52441	12	7	12	11	Sentence is too long and hard to follow	Accepted. The text was reviewed.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
29373	12	11	0	0	There are issues with the referencing system: sometimes there is et al. (for authors >2), sometimes not; sometimes there is a come after "et al," (and sometimes also before), sometimes a dot, sometimes both, sometimes nothing. It is needed a deep chec to all references.	Noted. We are checking all references.	Maria Pregnolato	University of Bristol	United Kingdom (of Great Britain and Northern Ireland)
52443	12	14	12	17	Language needs to be revised	Accepted.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
1235	12	17	12	17	Stephenson et al. is missing in ref list	Accepted. Stephenson, S. R., Wang, W., Zender, C. S., Wang, H., Davis, S. J., & Rasch, P. J. (2018). Climatic Responses to Future Trans-Arctic Shipping. Geophysical Research Letters, 45(18), 9898–9908. https://doi.org/10.1029/2018GL078969	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
29375	12	17	0	0	there is a bracket before "2018" at the end of the sentence	Accepted.	Maria Pregnolato	University of Bristol	United Kingdom (of Great Britain and Northern Ireland)

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79319	12	24	13	27	This discussion reflects a technology-based, automobile-oriented perspective. Much of what it describes, such as improved batteries, are incremental, not truely disruptive change. A more fundamental transportation planning transformation is the shift from "mobility-oriented" to "accessibility-oriented" analysis, and a broader range of planning goals to include affordability, social equity, public health and safety, local economic development, community livability, and environmental quality. The electric, shared, autonomous technologies cited in this section perpetuate high-mobility, low-accessibiltiy transport systems, are inherently resouce-intensive and expensive to use, and so tend to be regressive. The new planning pradigm favors high-accessibility transport options which minimize the amount of mobility required to meet our needs, and so favors slower but more affordable modes. The new transportation planning paradigm recognizes the inherent inefficiencies and inequities of automobile dependency and so challenges policies and planning practices that favor automobile travel over more resource-efficient modes, and sprawl over more compact development. It therefore justifies policy reforms that reduce automobile subsidies, and increases support for transportation demand management (what this chapter calls "behavior change") and Smart Growth develpment policies. I therefore recommend that this section of the report include discussion of the transportation planning paradigm shift and how it can be applied to evaluating transport emission reduction options. See: Brookings Institution (2016), Moving to Access Initiative, Brookings Institution (www.brookings.edu); at www.brookings.edu/research/reports2/2016/05/moving-to-access. Michelle DeRobertis, John Eells, Joseph Kott, and Richard W. Lee (2014), “Changing the Paradigm of Traffic Impact Studies: How Typical Traffic Studies Inhibit Sustainable Transportation,” ITE Journal (www.ite.org), May, pp. 30-35; at www.ite.org/membersonly/itejournal/pdf/2014/JB14EA30.pdf. Susan Handy (2020). What California Gains from Reducing Car Dependence. National Center for Sustainable Transportation (https://ncst.ucdavis.edu); at https://escholarship.org/uc/item/0hk0h610.	Accepted. Text has been changed	TODD LITMAN	Victoria Transport Policy Institute	Canada
1331	12	25	12	31	The reference of Sprei is not included in the reference list, but I assume it is the article "Disrupting mobility". In this article, Sprei mention that personal mobility is facing three potential disruptive innovations, which is something different that is stated here. In addtion, the conclusion of the article is that "shared mobility per se might not be attractive enough to truly disrupt the transportation system". In addition, sharing is not always good from a GHG perspective (see the ITF report Good to go?). So, I think it would be good to rephrase this paragraph.	Accepted. Text has been changed	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
17119	12	25	12	26	Sentence not clear	Accepted. Text has been changed	Giulio Mattioli	TU Dortmund University	Germany
65007	12	25	12	25	I am not convinced that they are "Driven" by demand, perhaps they are transformative when they find a demand because it was not likely the demand that started people working on EVs but rather a passion to do things better… for all our sakes… in spite of concealed or suppressed demand. Perhaps here the real point is that demand for EVs has been suppressed for decades and now because some early innovators have shown its much cheaper and cleaner for people to use EVs it is harder to suppress the demand?	Accepted. Text has been changed	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
84011	12	26	12	27	It is good to cover the potentially disruptive technologies, but equal footing should be given to the more traditional, better-known, and less-risky mitigation options mostly of the "avoid" and "shift" type	Accepted. This is considered in study cases	Michał Czepkiewicz	University of Iceland	Poland
48047	12	27	12	30	The sales of Flexible Fuel Vehicles (FFV) represented a major disruption in last decade in some countries, with impacts on the overall GHG emissions intensity of light vehicles fleet. Currently, there is at least 21 million FFV running in the U.S. and 31 million FFVs in Brazil. In Brazil, FFVs represents 69% the fleet and more than 90% of sales. It allowed huge substitution of fossil fuels by renewable fuels (Rodrigues 2016, Rodrigues 2017). It is worth highlighting that biofuels are replicable worldwide without any changes in engines. Additional references, to be taken into account in this reassessment, are presented below: Rodrigues, L., & Bacchi, M. R. P. (2016). Light fuel demand and public policies in Brazil, 2003–2013. Applied Economics, 48(54), 5300-5313. Rodrigues, L., & Bacchi, M. R. P. (2017). Analyzing light fuel demand elasticities in Brazil using cointegration techniques. Energy Economics, 63, 322-331. Therefore, the text should be updated as follows: “[…] Sprei (2018) suggests there are three converging disruptions in transport: electrification of vehicles, shared mobility and autonomous vehicles. In some countries FFV and blending mandates have played a major role in displacing fossil fuels”.	Accepted. This is considered in other section of this chapter	Marcelo moreira	UNICAMP - Agroicone	Brazil
50967	12	27	12	30	The sales of Flexible Fuel Vehicles (FFV) represented a major disruption in last decade in some countries, with impacts on the overall GHG emissions intensity of light vehicles fleet. Currently, there is at least 21 million FFV running in the U.S. and 31 million FFVs in Brazil. In Brazil, FFVs represents 69% the fleet and more than 90% of sales. It allowed huge substitution of fossil fuels by renewable fuels (Rodrigues 2016, Rodrigues 2017). It is worth highlighting that biofuels are replicable worldwide without any changes in engines. Additional references, to be taken into account in this reassessment, are presented below: Rodrigues, L., & Bacchi, M. R. P. (2016). Light fuel demand and public policies in Brazil, 2003–2013. Applied Economics, 48(54), 5300-5313. Rodrigues, L., & Bacchi, M. R. P. (2017). Analyzing light fuel demand elasticities in Brazil using cointegration techniques. Energy Economics, 63, 322-331. Therefore, the text should be updated as follows: “[…] Sprei (2018) suggests there are three converging disruptions in transport: electrification of vehicles, shared mobility and autonomous vehicles. In some countries FFV and blending mandates have played a major role in displacing fossil fuels”.	Accepted. This is considered in other section of this chapter	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
65005	12	27	12	27	Is it really a "reversing" or is it a "steering"? I don’t think we will be reversing GHG pathways but can definitely change their trajectory.	Noted. Text has been changed	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
65009	12	29	12	29	It is a real shame if "shared transit" is a "disruption" as it was the basis of the settlement of many of the worlds cities until car dependence had trams and trains pulled from service. Perhaps the disruption comes from the ease at which we can now access new types of shared transit services rahter than the service itself?	accepted. Text has been changed	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
17121	12	33	12	35	Sentence not clear	Agreed.	Giulio Mattioli	TU Dortmund University	Germany

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
84013	12	33	12	35	The section should not only review enabling conditions but also provide guidance on how to reduce potentially negative effects of these disruptions. Please do not treat the disruptions as always positive. Various rebounds and side effects might have negative effects on the climate, and other social and environmental issues.	Accepted. This issue is considered in other section of this chapter	Michał Czepkiewicz	University of Iceland	Poland
52445	12	38	12	41	Sentence is too long and hard to follow	Agreed.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
81559	12	38	12	38	"International Energy Agency (2017b)" seems to refer to Bioenergy Roadmap. More recent IEA references on the progress achieved in LIB may be of interest in: Global EV Outlook 2018, start page 59 (https://www.iea.org/reports/global-ev-outlook-2018), Global EV Outlook 2019, start page 165 (https://www.iea.org/reports/global-ev-outlook-2019); Global EV Outlook 2020, start page 185 (https://www.iea.org/reports/global-ev-outlook-2020).	Agreed.	Marine Gorner	International Energy Agency (former)	France
79149	12	40	12	41	The important missing point here (documented in doi:10.1088/1748-9326/abc3f2) is that auto sales peaked in 2017 at a growth rate exceeded by EV sales ever since, so EVs have taken more than all the sales growth, especially in 2020 when sales plummeted for fuel cars but surged for EVs. This is a classic setup for disruption and capital flight, so the automakers are racing to try to catch up, the oil companies that pay attention are petrified, and investors are voting with their feet (id.).	noted	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
85521	12	41	12	41	Very happy to see the word "exponential" here as this is often forgotten.	Noted	Auke Hoekstra	Eindhoven University of Technology	Netherlands
65011	12	45	12	45	Apart from the implication on the electricity grid and the revenue for road agencies it might be wise to make sure you make it clear why EVs are "Transformative". Is there a set of criteria that makes something transformative? While Evs are obvious I am not sure what they will transform, other than reduce fossil fule use and associated pollution?	Accepted. The text was reviewed.	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
23165	13	1	13	1	We suggest a clarification on the meaning of this sentence	Agreed.	Government of France	Ministère de la Transition écologique et solidaire	France
19099	13	15	13	27	The section recognises COVID-19. However, the pandemic should be given more prominence. Take the lower income countries. The lockdown was a unique opportunity to change the dynamics of transport and use the digital age as a distributing effect. Technology allows distribution of economic activity in time and space. People can work when and where they want - to an extent. But because of political expediency, that opportunity to change the transport sector is being lost. The lower income countries risk reverting to the old chaos of urban transport.	Noted.	Fred Amonya	Lyciar	United Kingdom (of Great Britain and Northern Ireland)
84015	13	28	16	15	The section should be given much more space and use it to re-iterate and emphasize the most important claims of the Chapter 8 in AR5, complemented with the newest literature, particularly on car-dependence . For many of the readers this will be the first IPCC report chapter on transportation they ever read, so there should be balance in what aspects are given space, even if they were covered in some previous report.	accepted and changes made	Michał Czepkiewicz	University of Iceland	Poland
15493	13	31	13	32	Not especially apparent where this discussion re ports is. More specific reference is required to related material.	accepted and changes made	Ryan Falconer	Auckland Council, New Zealand	Australia
17123	13	34	13	35	"but beneath is a rationale for why certain locations have higher densities of people" - not clear	Later versions clarified this.	Giulio Mattioli	TU Dortmund University	Germany
23167	13	37	13	38	We recommand that the term "time" should be replaced by level of service, or quality of service. Time, as a variable, is not enough to characterise the efficiency of a particular transport alternative (mode, route, etc.) in comparison with others. It should be noted that the generalised cost is a modelling concept used to try to reproduce the behaviour of travellers at an agregate scale (even though such models are now called disaggregate, they do not aim to reproduce correctly the decision of each traveller, but rather the volumes.) Generalised cost consists in practise of a time and a cost variable, and generally a constant; parameters of the generalised cost capture (as intended, but also unintentionally) all parameters to which travelers are indeed sensitive when making decisions regarding their mobility). The fact that price and time are the main variables of generalised cost function does mirror the importance of these variables in the decision process of travellers, but it mirrors at least as much the crudeness of the data and modelling methodologies of transport demand forecasters. It is highly advised to refer more generally to the quality of service which, by definition, encompasses all the parameters taken into account by travellers.)	Accepted but beyond the scope of change to text at this stage	Government of France	Ministère de la Transition écologique et solidaire	France
28461	13	37	13	38	"Both time and economic cost determine the modes of transport for both freight and people, called the generalised cost of transport" . this might be true for freight, however, for personal transport there are more factors affecting the mode choice: societal cost, environmental values (Bouman and Steg, 2019), habit/culture, social influence, status and traveling party. https://doi.org/10.1016/j.gloenvcha.2018.06.008 https://doi.org/10.1016/j.tranpol.2017.07.016 https://doi.org/10.1016/j.tbs.2019.08.003	Accepted but already part of the text here and elsewhere	Naud Loomans	Eindhoven University of Technology	Netherlands
75627	13	37	13	38	"Both time and economic cost determine the modes of transport for both freight and people, called the generalised cost of transport". It would be appreciated if other – relatively more implicit but increasingly critical to take into account – costs would be mentioned as well, such as social costs, environmental costs (Bouman and Steg, 2019), habit & culture, social influence and status.	Accepted but beyond the scope of change to text at this stage	Amira El-Feiaz	Technische Universiteit Eindhoven	Netherlands
85003	13	37	13	38	I think that for personal factors there are other factors affecting the mode of choice and should be also considered, or at least mentioned. These include societal costs, envirponmental values, habit, social influence among others. Societal costs are becoming increasingly important and that is why I think they should be included.	Accepted but beyond the scope of change to text at this stage	Sofia Rosero Abad	University	Netherlands
23169	13	40	13	40	This sentence is unclear, we suggest a clarification	accepted and changes made	Government of France	Ministère de la Transition écologique et solidaire	France
78881	13	43	13	44	ITF (2020) report estimated that in April / May freight tonne-kms dropped 36% and related CO2 emissions by 28% https://bit.ly/2Vb0FSB Could also mention that as around half of air cargo is carried in the bellyholds of passenger aircraft, the decline in passenger services sharply reduce air freight capacity. https://www.iata.org/en/iata-repository/publications/economic-reports/air-freight-monthly-analysis-may-20202/	Accepted but beyond the scope of change to text at this stage	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
56791	13	45	13	45	It's not clear here what "long-term impact" refers to. The long-term impact on GHGs? On global passenger movement? On passenger aviation? Freight by all modes? All of the above? Each are mentioned in the previous sentence.	accepted and changes made	Government of United States of America	U.S. Department of State	United States of America
23171	14	4	14	8	We recommand that the term "time" be developped. The analysis of past trends shows an increase in the distances travelled per person (and in CO2 emissions as a consequence), in a context of relatively stable mobility and constant time budget. This increase in distances is therefore linked to an increase in travel speeds, made possible by the spread of the automobile mode and the development of fast road infrastructures (Aurélien Bigo, 2020).	Accepted but beyond the scope of change to text at this stage	Government of France	Ministère de la Transition écologique et solidaire	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79321	14	4	14	20	This and other sections of the report use the term "city," although many of these issues also apply to suburbs, small towns and even villages. I therefore suggest changing "city" to "urban area" or "built environment" here and throughout the report, where appropriate.	Accepted but beyond the scope of change to text at this stage	TODD LITMAN	Victoria Transport Policy Institute	Canada
81927	14	4	14	20	This categorization suggests that in "walking fabric cities" walking is the dominant mode - which is not the case. Also, it suggest that cars are only dominant in low density automobile fabric cities, where distances of 50 kms must be overcome. We know that urban trips are made by car, even though they are on average under 10 km long. I have doubts that this categorizations is helpful for the discussion we need to move forward on how to get to less car-centered and invididually motorized transport systems. A closer look on what urban development policies are needed to create density as an important Avoid strategy would be more helpful here.	Accepted but beyond the scope of change to text at this stage	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
75629	14	9	14	10	"High density walking fabric over the past several millennia with time and space favouring walking and active transport but traveling only a few kms in any direction" . Especially in recent years research has pointed towards the promising and growing role of e-bikes, that have the potential to impact urban fabric. In this way, the gap between high density fabric and medium density transit fabric will be bridged with relative ease. It would be great if a mention of e-bikes could be integrated into this piece.	Accepted but already part of the text here and elsewhere	Amira El-Feiaz	Technische Universiteit Eindhoven	Netherlands
1249	14	19	14	20	"urban" (as heading of the empty fifth row) should be removed	accepted and changes made	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
28861	14	19	14	20	The formatting of Table 10.2 seems to have gone wrong, as there is a stray word "Urban" in the top-right corner. I think this should be connected to the second column heading - "Urban Walking Fabric".	accepted and changes made	Eoin Devane	United Kingdom Climate Change Committee	United Kingdom (of Great Britain and Northern Ireland)
52447	14	19	14	19	Last column labelled "urban" is empty	accepted and changes made	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
56793	14	19	14	20	In Table 10.2, what does high-med-low refer to regarding "economics of infrastructure and transport operations"?	accepted and changes made	Government of United States of America	U.S. Department of State	United States of America
85523	14	22	14	27	Very important to mention that urban design impacts car lock-in. You could consider mentioning this issue in the summary.	Accepted but already part of the text here and elsewhere	Auke Hoekstra	Eindhoven University of Technology	Netherlands
23173	14	25	14	25	We suggest a clarification on the type of behavior change implied	Accepted but already part of the text here and elsewhere	Government of France	Ministère de la Transition écologique et solidaire	France
72909	14	25	14	26	Not clear what rebound effect the author is referring too (on short term travel? On the choice of models?...)	Accepted but already part of the text here and elsewhere	Antoine BONDUELLE	EE-Consultant	France
6155	14	28	15	8	Following articles examine the difference of the effect of urban form on transport emission by region taking the case of Japan. These artciles support the discussion of urban form impact on transport emission. - Matsuhashi, K.; Ariga, T. Estimation of passenger car CO2 emissions with urban population density scenarios for low carbon transportation in Japan. IATSS Res. 2016, 39, 117–120. - Kii M. Reductions in CO2 Emissions from Passenger Cars under Demography and Technology Scenarios in Japan by 2050. Sustainability. 2020; 12(17):6919. https://doi.org/10.3390/su12176919	Accepted but beyond the scope of change to text at this stage	Masanobu Kii	Kagawa university	Japan
15495	14	28	15	8	Should refer to macro-economic factors that also have influence on travel - especially private vehicle travel. NB: some related discussion from line 36 on p16.	Accepted but beyond the scope of change to text at this stage	Ryan Falconer	Auckland Council, New Zealand	Australia
52449	14	28	15	4	Sentence is too long and hard to follow	Accepted but already part of the text here and elsewhere	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
10003	14				Table 10.2 The right column "Urban" did not have any meaning or references. What did "Urban" refers to? Because it had blank explanation in the table.	accepted and changes made	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
31667	14		14		Table 10.2: Kindly delete the extra last column on "urban"	accepted and changes made	Shreya Some	Ahmedabad University	India
17125	15	2	15	3	Recent relevant study on the impacts of ridehailing: Diao, M., Kong, H., & Zhao, J. (2021). Impacts of transportation network companies on urban mobility. Nature Sustainability, 1-7.	Accepted but beyond the scope of change to text at this stage	Giulio Mattioli	TU Dortmund University	Germany
46065	15	10	15	46	Cross-Chapter Box 6 is highly self-referential and should be tagged as "Validity of findings is limited at best".	Accepted but already part of the text here and elsewhere	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
79229	15	10			Cross-sector box 6 is excellent. Suggest integrating the box and Table 10.2 and related text into a broader Co-benefits of transport mitigation sub-section, which would communicate the need for a systems approach to transport mitigation, and highlight the interdependencies of transport with other sectors and services. Importantly this could also bring out the accessibility/equity co-benefits when integrating urban planning, service demand, and transport mitigation strategies. This cross-sector box would also align well with the co-benefits section in Chapter 8 since most of the quantitative evidence of co-benefits reported there relate to transport mitigation and health outcomes.	Accepted but already part of the text here and elsewhere	Martino Tran	UBC	Canada
52451	15	21	15	23	Reference is needed	accepted and changes made	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
10019	15	27		28	This sentence echoes our comment on Chapter 8 page 26. (Not only health, the co-benefit also result in terms of equity whereas the poor can walk and children can play outdoors for example.)	Accepted but already part of the text here and elsewhere	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
56795	15	30	15	36	Has benefits of urban planning been captured to reduce climate impacts in U.S.?	Accepted but beyond the scope of change to text at this stage	Government of United States of America	U.S. Department of State	United States of America
75785	15	34	15	36	Probably the statement on geo-engineering (CDR) does not belong here since that is an alternative much broader than cities and discussed elsewhere in the report (Chapter 12)	Accepted but already part of the text here and elsewhere	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
84151	15	34	15	36	The proposed geo-egineering systems are unproven approaches that should not be treated as real options in this report.	accepted and changes made	Kym Lennox	climate change equity	Australia
15497	15	37	15	38	And affordable housing policies supporting mixed income residential in highly accessible locations.	Accepted but already part of the text here and elsewhere	Ryan Falconer	Auckland Council, New Zealand	Australia

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
11291	15	38	15	39	I suggest adding the citation (ITF 2021) to this line "This involves taking road space from cars (Gössling et al 2016, Gössling 2020)" ITF (2021), Reversing Car Dependency: Summary and Conclusions, ITF Roundtable Reports, No. 181, OECD Publishing, Paris. www.itf-oecd.org/avoiding-car-dependency	accepted and changes made	Eric Doherty	Ecopath Planning	Canada
15499	15	38	15	40	Be clear that these sorts of responses during Covid have been variable and are not necessarily permanent. Whether they endure or not is key (e.g. under 'normal' conditions).	Accepted but already part of the text here and elsewhere	Ryan Falconer	Auckland Council, New Zealand	Australia
84153	15	41	15	43	Avoiding urban sprawl is essential and is 'necessary decarbonisation condition' but this can be done through numerous mechanisms to guide its outcome. Increasing fuel prices and marginal costs of motorised transport might be one in some economies, but they are not unique or specific enough to be singled out in this report. The political forces to not act on climate change will use such text in this report out fo context to slur it and establish ground for it to be ignored.	Accepted but beyond the scope of change to text at this stage	Kym Lennox	climate change equity	Australia
23175	15	42	15	42	The part of the sentence " increasing ful prices and marginal costs of motorised transports" is theoretically correct but important issues are left aside. First, the theoretical basis for this result is the general equilibrium assumption and a particular specification of the social welfare function. Second, it is acknowledged that the implementation of such a tax will result in a globally positive outcome (as per the specification of the social welfare function) but that there will be losers. Those losers are famously hard to identify effect, due to the general equilibrium characteristics of the economy: benefits and costs recirculate and the eventual outcome is impossible to identify in practise, neither by simulation, nor by measurement. But the presence of losers should call for compensation: what compensation should be done in practise is not discussed as much as it should be, and it should be discussed when advising the implementation of such instruments. Third, there is the matter of acceptability (this is related to the second point, but this is not exactly the same). It appears for example that norms on vehicles are more acceptable than taxes. Urban tolls are of limited acceptability; low emission zones seem to be a bit more acceptable. In general, a policy is feasible only if it is acceptable, at least in some places. The discussion of the "optimal" nature of carbon taxes shouldn't disregard those issues.	Accepted but beyond the scope of change to text at this stage	Government of France	Ministère de la Transition écologique et solidaire	France
29377	15	42	0	0	The authors of the box (I think) are listed; this does not happen with other boxes	accepted and changes made	Maria Pregnolato	University of Bristol	United Kingdom (of Great Britain and Northern Ireland)
10781	15	43	15	44	Admittedly, compactness should reduce emissions linked to transport. Howeveer, if you point out reduced thermal loss due to compactness, then you have to balance this against the adverse effects of compactness whenever cooling is needed, which is bound to happen more and more frequently. Certalainly the modelling structure described by Borck and Brueckner allows to test this situation.	Accepted but beyond the scope of change to text at this stage	Philippe Waldteufel	CNRS	France
31669	15		15		Suggest reframing phrases/sentences P15L6-7: "Assessments of how much can be saved by implementing urban 7 form changes suggest around 25% of GHG (Creutzig et al, 2015)"	Accepted but already part of the text here and elsewhere	Shreya Some	Ahmedabad University	India
15501	16	4	16	5	This needs more qualification. The performance of pooled mobility solutions, especially in suburban contexts, depends on the KPI adopted (net reduction in SOV trips? Costs to operate?), location and so on. From what I have seen, the results are mixed.	Accepted but already part of the text here and elsewhere	Ryan Falconer	Auckland Council, New Zealand	Australia
23177	16	4	16	5	We suggest to adapt the conclusion of this statement, which is highly theoretical. Such statements should come with the assumptions about the transport system, the regulation of other alternatives, and the measurement of efficiency.	Accepted but already part of the text here and elsewhere	Government of France	Ministère de la Transition écologique et solidaire	France
46067	16	4	16	5	Please add: The provision of high-speed cycle tracks and promotion of (electric) bicycles can also improve sustainable access to public transport stations for commuters and others in suburbs and more rural areas. (Reference: van Mil, J.F.P., Leferink, T.S., Annema, J.A. et al. Insights into factors affecting the combined bicycle-transit mode. Public Transp (2020). https://doi.org/10.1007/s12469-020-00240-2)	Accepted but already part of the text here and elsewhere	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
49735	16	7	16	15	Surprised to see very little on COVID-19 impacts, this seems to be the only paragraph. It might be valuable to briefly outline major impacts, for example from an early analysis: The strongest declines have been recorded in the use of public transport and among the regions, the strongest declines (60 to 80% below January levels) were in Latin American countries. High-income countries also faced on average stronger impacts than low and middle-income countries. Reference: https://slocat.net/covid-19-impact-mobility/	Accepted but already part of the text here and elsewhere	Nikola Medimorec	SLOCAT Partnership on Sustainable, Low Carbon Transport	Republic of Korea
56797	16	7	16	15	Althought there was a significant drop in light-duty, freight travel continued to be high and in some areas increased. If there is a more sustained shift in work/leisure behavior, this increase in freight may have significant impact due to the greater challenges in decarbonization of heavy-duty vehicles.	Accepted but already part of the text here and elsewhere	Government of United States of America	U.S. Department of State	United States of America
23179	16	9	16	9	In this article, e-micromobility is seen as a future potential and not as a current consequence of the COVID-19 crisis.	Accepted but already part of the text here and elsewhere	Government of France	Ministère de la Transition écologique et solidaire	France
84017	16	12	16	12	The limitations of new technologies stated in this paragraph should be the reason not only to invest in more technologies to enable these new technologies (e.g. providing chargers and ICT to enable e-micromonility) but also to support the more traditional (and less costly, less material and energy intensive, and with co-benefits for health & well-being) modes such as walking or cycling. The Covid-19 and the rise e-micromobility also poses a threat for public transportation, which should also get some attention in this section.	Accepted but already part of the text here and elsewhere	Michał Czepkiewicz	University of Iceland	Poland
23181	16	13	16	13	It is also possible that there will be a long term shift from public transportation to car if travellers continue to be afraid of contamination. If this risk is convincingly reduced to zero, it is reasonable to movement towards a situation closely resembling the initial one.	Accepted but already part of the text here and elsewhere	Government of France	Ministère de la Transition écologique et solidaire	France
28553	16	13	16	15	This sentence sounds very optimistic for transit, a sector that has been hugely affected by Covid-19 and may end up suffering from a lack of confidence for a longer period of time than cars, as pointed out by some surveys with a focus on China (already out of the pandemic). See for example: https://www.bcg.com/publications/2020/how-covid-19-will-shape-urban-mobility.	Accepted but already part of the text here and elsewhere	Pierpaolo Cazzola	International Transport Forum	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
70213	16	16	23	8	Section 10.2.2 on transport behavior is missing a discussion on vehicle fueling and charging behavior. For example, Huse et al. (https://www.nature.com/articles/s41560-018-0175-3) and Johns et al. (https://journals.sagepub.com/doi/10.1177/0013916507312423) have shown that drivers of flex-fuel vehicles strongly prefer to use gasoline over biofuel, even at price parity. Axsen et al. (https://www.sciencedirect.com/science/article/pii/S0301421510009389?via%3Dihub) show that, although off-peak charging can reduce marginal electricity emissions, it also leads to lower electricity consumption in plug-in hybrid electric vehicles and, as a consequence, higher gasoline consumption. Finally, Wolfram & Hertwich (https://dx.doi.org/10.1021/acs.est.0c03796) show the importance of charging versus fueling plug-in hybrids at the US fleet level, and conclude that it could significantly influence the feasibility of reaching an 80% emission reduction target of the US vehicle sector.	Accepted but beyond the scope of change to text at this stage	Paul Wolfram	Yale University	United States of America
81929	16	17	16	19	"Sharing economy" should be mentioned here as it will play a major role in transport transformation	Accepted but already part of the text here and elsewhere	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
12247	16	20	17	2	I'm surprised that the health benefits from active travel (i.e. reduced sedentary lifestyle) as a key benefit fro urban low-carbon transport mode choice are not mentioned here (nor in the whole chapter it seems!). I.e. The quantification of this pioneered by James Woodcock (2009, Lancet), Christian Brandt (Pasta project), Anna Goodman et al.	Accepted but already part of the text here and elsewhere	LInus Mattauch	University of Oxford	United Kingdom (of Great Britain and Northern Ireland)
84019	16	21	16	35	The section 10.2.2.1 on Behaviour and Practice (which is now one page long) should be much more developed, similarly as or even more than the section 10.2.2.2 (which has 2.5 pages) in terms of length and the level of detail. It should include the concepts and topics from Chapter 5 and apply them to the context of transportation. Particularly, the influence of social norms, habits, preferences, household compositions, etc. and their interactions should be given much more consideration. Much much more can be said about these issues than that "women are more sensitive to parking pricing than men". There is much literature on the topic that could be used in the chapter, from authors such as Felix Creutzig, Jillian Anable, Linus Mattauch, Giulio Mattioli, Christian Brand, Thomas Klinger, Martin Lanzendorf, Tim Schwanen, Frank Geels, Sebastian Bamberg, Susan Handy and many others. As a postdoctoral researcher in the topic, I am greatly unimpressed with how shallowly this topic has been covered here.	Accepted but already part of the text here and elsewhere	Michał Czepkiewicz	University of Iceland	Poland
81931	16	31	16	32	this is the only mention of women in transport and it doesn't do justice. There is much more to say on gender-specific transport behaviour and needs; also many more studies have been made. IF the topic is included, it should be done correctly, not only as a half sentence.	Accepted but already part of the text here and elsewhere	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
52453	16	33	16	35	Consider including more recent literature as well including: Dua, Rubal, and Kenneth White. 2020. "Understanding latent demand for hybrid and plug-in electric vehicles using large-scale longitudinal survey data of US new vehicle buyers." Energy Efficiency no. 13 (6):1063-1074. doi: 10.1007/s12053-020-09865-5. Dua, Rubal, Kenneth White, and Rebecca Lindland. 2019. "Understanding potential for battery electric vehicle adoption using large-scale consumer profile data." Energy Reports no. 5:515-524. doi: https://doi.org/10.1016/j.egyr.2019.04.013.	Accepted but beyond the scope of change to text at this stage	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
31671	16	36	16	47	Income elasticity is positive for normal goods. In this paragraph the value for UK >1 implying luxurious good in UK. This is worth mentioning here.	Accepted but beyond the scope of change to text at this stage	Shreya Some	Ahmedabad University	India
37255	16	36	16	41	Post COVID, it looks difficult to impose car sharing possible.	Accepted but beyond the scope of change to text at this stage	Arun kumar Nayak	Bhabha Atomic Research Centre Trombay Mumbai	India
37257	16	36	16	41	Promote of work from home/nearest place.	Accepted but beyond the scope of change to text at this stage	Arun kumar Nayak	Bhabha Atomic Research Centre Trombay Mumbai	India
37259	16	36	16	41	Restrict unnecessary movement.	Accepted but beyond the scope of change to text at this stage	Arun kumar Nayak	Bhabha Atomic Research Centre Trombay Mumbai	India
37261	16	36	16	41	Selling of vehicles shall depend upon the road capacity and pollution level of cities	Accepted but beyond the scope of change to text at this stage	Arun kumar Nayak	Bhabha Atomic Research Centre Trombay Mumbai	India
79323	16	36	17	2	I don't think this section provides adequate and clear information on factors that affect travel behavior. I suggest starting with a more positive statement concerning the ability of well-designed transportation demand management programs to affect travel behaivor in ways that reduce emissions and help achieve other SDGs. It should include a list of factors that affect travel decisions, and therefore potential TDM strategies: * Quality of resource-efficient modes, and the connections among these modes (TDM strategies: multimodal planning, increased investment in resource-efficient modes, better stations and terminals) * Relative convenience and speed (TDM strategies: bus and HOV priority; traffic speed reductions and traffic calming road design; complete streets policies; pedestrian/bicycle shortcuts, integrated navigation and payment apps, MaaS) * Relative price (TDM strategies: fuel taxes, road tolls and parking fees; pay-as-you-drive vehcile insurance and taxes; parking cash out and unbundling; transit fare discounts) * Relative accessibility (TDM strategies: more compact, mixed, walkable land use; more connected roadway networks) * Encouagement and marketing (TDM strategies: commute trip reduction and school transport management programs; targeted marketing to encourage travellers to try and use sustainable mobility options) See: Jonn Axsen, Patrick Plötz and Michael Wolinetz (2020), "Crafting Strong, Integrated Policy Mixes for Deep CO2 Mitigation in Road Transport," Nature Climate Change (https://doi.org/10.1038/s41558-020-0877-y). A. Carran-Fletcher, et al. (2020), Travel Demand Management: Strategies and Outcomes, Research Report 661, New Zealand Transport Agency (www.nzta.govt.nz); at www.nzta.govt.nz/resources/research/reports/661. CARB (2010-2015), Impacts of Transportation and Land Use-Related Policies, California Air Resources Board (http://arb.ca.gov/cc/sb375/policies/policies.htm). Center for Transportation Excellence (www.cfte.org) provide research materials, strategies and other resources for evaluating public transportation benefits.	Accepted but already part of the text here and elsewhere	TODD LITMAN	Victoria Transport Policy Institute	Canada

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79325	16	36	16	47	Information about the elasticity of vehicle travel with respect to income needs some important qualifers. As households increase from low- to moderate incomes their motor vehicle travel tends to increse significantly, but increases from moderate- to high incomes cause small increases in vehicle travel, and in many situations, vehicle travel tends to decline with income because wealthier households live in more multimodal communities and are able to choose more accessible, less automobile dependent neighborhoods and lifestyles.	Accepted but beyond the scope of change to text at this stage	TODD LITMAN	Victoria Transport Policy Institute	Canada
43777	16	40	16	41	It would be useful to define the term "elasticity" in this context, since it is used quite often throughout this section and not all readers might be aware of its meaning.	Accepted but already part of the text here and elsewhere	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
17127	17	1	17	1	The point about thermal comfort seems irrelevant to the transport chapter	Accepted but beyond the scope of change to text at this stage	Giulio Mattioli	TU Dortmund University	Germany
31673	17	11	17	27	Please spell out HSR here as mentioning the first time.	Accepted but already part of the text here and elsewhere	Shreya Some	Ahmedabad University	India
81561	17	13	17	15	In case of interest, more examples of the impact of the implementation of high-speed rail on certain routes on air travel on the same routes are available in figure 3.2, The Future of Rail (2019), https://www.iea.org/reports/the-future-of-rail.	Accepted but already part of the text here and elsewhere	Marine Gorner	International Energy Agency (former)	France
64829	17	20	20	2	Reduction of global transport demand is missing from the report. As stated in the report, GHG emissions from global maritime transport almost doubled during last 30 years. Different safety, social and environmental standards in developed countries (e.g. European Union) on one side, and developing countries (e.g. China, India, Pakistan, Bangladesh) on other side, leads to unfair competition advantage, transfer of production to developing countries and massive growth of global maritime and air transport of goods to Europe and the USA. This is in direct contradiction with global GHG reduction goals.Weak standards in developing countries cause serious social and environmental harms to local communities. In addition, it does not support UN SDG No. 1, 3, 8, 9, 10, 12, 13 and 17. Equalization of safety, social and environmental standards at certain generally-accepted minimum level in order to optimum localization of global production shall be emphasiszed and recommended to global policymakers.	Accepted but already part of the text here and elsewhere	Radek Svoboda	Czech Nuclear Society	Czech Republic
12587	17	28	20	2	Section 10.2.2.2: In addition to Dematerialization and Shared Economy, I think that the food delivery trend (and other similar services) should be included in the discussion. This is having a strong impact on daily mobility demand patterns of users, and may remain an important driver in the future for mobility habits in urban environments.	Accepted but already part of the text here and elsewhere	Michel Noussan	Fondazione Eni Enrico Mattei	Italy
78883	17	29	17	31	this sentence is difficult to follow, particularly with reference to 'geography of freight and urban fabric'. The reference to freight seems out of place here.	Accepted but already part of the text here and elsewhere	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
84979	17	32	17	32	Personal demand factors - an element that can be brought out better, and links with the text later on information technology, is the extent to which some people can work from home some or all the time as part of their jobs, and those who cannot. Also, it is important to recognise what proportion of trips are related to different trip purposes, and which are most amenable to change / behaviour change programmes.	Accepted but already part of the text here and elsewhere	Jameel Hayat	AECOM	United Kingdom (of Great Britain and Northern Ireland)
78885	17	33	17	36	here and at several other points in the chapter 'demand and efficiency' improvements since AR5 are associated with developments external to the transport system, such as the circular economy, dematerialisation and the share economy. There have been other developments internal to logistics systems and supply chains which have been strengthening their impact on the demand for and efficiency of freight transport since AR5. Three in particular are worth mentioning: the digitalisation of freight markets and operations, an increase in logistical collaboration across supply chains and the relaxation of truck size and weight limits permitting the growth of 'high capacity transport', particularly in Europe. Possible references are: digitalisation http://bit.ly/3bIDiZs collaboration: https://bit.ly/3rN7CHX HCT: https://www.itf-oecd.org/high-capacity-transport-0	Accepted but already part of the text here and elsewhere	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
79755	17	37	18	2	Circular economy para is quite weak considering its importance. Please discuss more elaborately the current lack of circularity in the transort sector and further challenges. For example, for the automobile industry, see: Aguilar Esteva, L., A. Kasliwal, M. Kinzler, H. Kim, G. Keoleian (2020) Circular economy framework for automobiles. Closing energy and material loops. Journal of Industrial Ecology, 2020, 1-13, DOI: 10.1111/jiec.13088	Accepted but already part of the text here and elsewhere	Stefan Bakker	KiM Netherlands Institute for Transport Policy Assessment	Netherlands
81937	17	37	18	2	Circular economy should not only be discussed IN the transport sector, but more importantly it's impact ON transport demand. Here, also new demand concepts like local production and industry policy promoting less fragmented value chaines should be included in the discussion	Accepted but already part of the text here and elsewhere	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
84023	17	37	18	2	The section lacks a discussion on limitations and bottlenecks in upscaling recycling and issues related to entropy and energy used for recycling.	Accepted but already part of the text here and elsewhere	Michał Czepkiewicz	University of Iceland	Poland
84021	17	38	17	38	The concept of "light weighting" could be applied here to discuss the trends of a growing share of SUV segment in vehicles, which has negative consequences for decarbonization (due to higher production-phase emissions and material requirements in both EVs and ICEVs, and higher operational emissions in ICEVs). The section (or section 10.8) could provide some outlook on policies aiming at reversing this trend and supporting the light-weithing of personal vehicles.	Accepted but already part of the text here and elsewhere	Michał Czepkiewicz	University of Iceland	Poland
70215	17	39	17	40	Vehicle lifetime extension as a mitigation stratgey needs more discussion. Although it can lead to less material use, it also extends the lifetime of current, less efficient vehicles, and could therefore in fact lead to higher emissions (https://www.resourcepanel.org/reports/resource-efficiency-and-climate-change).	Accepted but already part of the text here and elsewhere	Paul Wolfram	Yale University	United States of America
1283	18	3	18	3	The definition given of dematerialisation in the first line is not complete. Dematerialisation is also reducing the amount of material required for (a product or process). This definition seems to be used throughout the paragraph were dematerialisation is synonym to decreasing energy consumption (see line 8).	Accepted but already part of the text here and elsewhere	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
12589	18	3	18	25	Section “Dematerialization”. Maybe here a clear reference to specific examples may help. In addition to the smartphone, other goods have had a significant impact on daily citizens mobility (e-books, video streaming), and the shift from human mobility to data streaming (and all the relevant impacts) may be worth mentioning explicitly.	Accepted but already part of the text here and elsewhere	Michel Noussan	Fondazione Eni Enrico Mattei	Italy
23183	18	3	18	3	We suggest to replace the word "technology" by "digital technologies"	Accepted but already part of the text here and elsewhere	Government of France	Ministère de la Transition écologique et solidaire	France
78887	18	3	18	4	this is a rather odd and unclear definition of dematerialisation. Why not use the much cited UNEP definition 'the reduction of total material and energy throughput of any product and service, and thus the limitation of its environmental impact' This is a more generic definition than the one given, but it still doesn't embrace all the points made in this paragraph. For example, the growth of online retailing and its related impact on transport emissions (both freight and personal) is seldom framed as a 'dematerialisation' issue. As I mention in an earlier comment this trend has major implications for the decarbonisation of logistics and needs to be discussed separately and not simply mentioned under this 'dematerialisation' heading. Overall it is difficult to follow the line of argument in this paragraph, leaving the reader confused.	Accepted but beyond the scope of change to text at this stage	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
81935	18	3	18	25	This section should also mention dematerilization / digitization of (public) services as a lever to reduce transport demand	Accepted but beyond the scope of change to text at this stage	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
84025	18	6	18	6	The concept of "decluttering lifestyles" could and should be used to discuss the need and potential to reduce car ownership (regardless of propulsion system)	Accepted but already part of the text here and elsewhere	Michał Czepkiewicz	University of Iceland	Poland
78889	18	10	18	11	A World Bank report presents conflicting evidence, challenging the view that 3DP will shorten global supply chains https://openknowledge.worldbank.org/handle/10986/32453	Accepted but beyond the scope of change to text at this stage	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
49737	18	13	18	14	Great section. The paragraph on dematerialisation is interesting but it is worrying to see that content about the impact of online deliveries on CO2 emissions is burried here in a half sentence. The discussion about the impact of deliveries, on-line shopping and other freight activities should be discussed in more detail. A very good study on this topic (comparing last-mile deliveries vs. shopping trips): https://pubs.acs.org/doi/abs/10.1021/acs.est.9b06252	Accepted but already part of the text here and elsewhere	Nikola Medimorec	SLOCAT Partnership on Sustainable, Low Carbon Transport	Republic of Korea
79475	18	13	18	14	Great section. The paragraph on dematerialisation is interesting but it is worrying to see that content about the impact of online deliveries on CO2 emissions is burried here in a half sentence. The discussion about the impact of deliveries, on-line shopping and other freight activities should be discussed in more detail. A very good study on this topic (comparing last-mile deliveries vs. shopping trips): https://pubs.acs.org/doi/abs/10.1021/acs.est.9b06252	Accepted but already part of the text here and elsewhere	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
81933	18	18	18	18	mention of "load factors" missing	Accepted but already part of the text here and elsewhere	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
84027	18	24	18	25	Please discuss what such a reduction in material footprint would mean for transportation systems, particularly for car ownership and infrastructure provision. A quote from Lettenmeier et al.. 2014 (Table 5) might help: "The material footprint for mobility can be reduced from 17.3 to 2 tons/(person·a): -by making public transport and biking still more resource-efficient; -by reducing the role of private cars dramatically; -by limiting the amount of kilometres travelled to 10,000 km/(person·a); -by changing travel requirements for work and leisure, e.g., by a higher attractiveness of the living environment as well as the change of production and communication structures that allow a reduction in mobility and transports; -by the integrative management of mobility and ICT options."	Accepted but beyond the scope of change to text at this stage	Michał Czepkiewicz	University of Iceland	Poland
10009	18	26	19	13	In developing countries, we usually use the terms ”informal transportation, such as motorcycle taxi, tricycle, jeepney, etc.”. In the text or in the whole chapter, which part is belongs to this term? Was it included in the term of ”on-demand mobility”? If we see your example on on-demand mobility, it seemed that this term only focus on mobility that utilize apps/IT technology	Accepted but already part of the text here and elsewhere	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
84029	18	26	19	13	The section relies too much on wishful thinking about the "shared economy", especially when referring to "the notion of community well-being associated with the act of sharing instead of simply owning for oneself". In reality, the concept has been largely captured by for-profit corporations (most strikingly Uber, but also many others) with often detrimental effects on worikng conditions and workers rights of drivers and little positive impact on "community well-being". There is too little distinction between for-profit and not-for-profit sharing, and also not adequate consideratin of potential rebound and side effects, such as inducing car ownership and car traffic.	Accepted but already part of the text here and elsewhere	Michał Czepkiewicz	University of Iceland	Poland
56799	18	29	18	36	Have impacts of shared use been studied in terms of bleeding trips from transit in U.S.?	Accepted but already part of the text here and elsewhere	Government of United States of America	U.S. Department of State	United States of America
23185	18	30	18	30	Is on demand transport to be classified in the shared economy? It is often an offer of public transport.	Accepted but already part of the text here and elsewhere	Government of France	Ministère de la Transition écologique et solidaire	France
47897	18	30	18	30	On-demand mobility (mobility-as-a-service, ride hailing, TNC) is a huge topic and it is barely mentioned. Box 10.1 addresses this a bit, maybe mention it here?	Accepted but already part of the text here and elsewhere	Matteo Muratori	NREL	United States of America
129	18	31	18	33	If the demand for motorized mobility continues to grow depending on population growth as it has done in the past, electrified shared mobility alone will not lead necessarily to a decrease of emissions by OEMs. The reason is i.a. that the shared vehicle fleets need to be replaced faster than private vehicles (e.g. https://tuprints.ulb.tu-darmstadt.de/13243/1/Neef_TUPrints_2020_Diss.pdf p. 127 in the pdf for a rough estimate))	Accepted but already part of the text here and elsewhere	Mara Neef	Volkswagen AG	Germany
52455	18	31	18	33	Recent literature suggests that ride-haling negatively impacts transit and increases congestion and thereby emissions. Please check and consider including: Diao, Mi, Hui Kong, and Jinhua Zhao. 2021. "Impacts of transportation network companies on urban mobility." Nature Sustainability. doi: 10.1038/s41893-020-00678-z. Erhardt, Gregory D., Sneha Roy, Drew Cooper, Bhargava Sana, Mei Chen, and Joe Castiglione. 2019. "Do transportation network companies decrease or increase congestion?" Science Advances no. 5 (5):eaau2670. doi: 10.1126/sciadv.aau2670.	Accepted but already part of the text here and elsewhere	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
1285	18	33	18	36	It is not clear if the LCA mentioned here is for shared e-scooters or for private e-scooters, which makes a big difference in carbon footprint according to the recent ITF study (Good to go? Assessing the environmental performance of new mobility in cities). I think it would be good to include the ITF reference, as it is less positive about the carbon footprint of shared e-scooters than Charilaos et al. ITF conclude that the carbon footprint is about 122 gCO2-eq/km for the first generation and 106 gCO2-eq/km for the next generation shared e-scooters and 42 gCO2-eq/km for a privat e-scooter. Although there is still a gain with respect to ICE privat cars (which ITF estimate at 162 gCO2-eq/p-km), it is much less than the factor of 50 that is mentioned currently.	Accepted but already part of the text here and elsewhere	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
17129	18	33	18	34	Recent relevant study on the carbon impact of e-scooters: de Bortoli, A., & Christoforou, Z. (2020). Consequential LCA for territorial and multimodal transportation policies: method and application to the free-floating e-scooter disruption in Paris. Journal of Cleaner Production, 273, 122898. Note that they find a negative impact.	Accepted but already part of the text here and elsewhere	Giulio Mattioli	TU Dortmund University	Germany
56801	18	34	18	36	A reference is needed for the statement: "Atlanta is trialling tele-operated, semi-autonomous scooters."	Accepted but already part of the text here and elsewhere	Government of United States of America	U.S. Department of State	United States of America
23187	18	44	18	46	We recommand to clarify this sentence. Freight transportation, much as public transportation, has always heavily relied on sharing assets to provide flexible and efficient services in a cost effective ways. The coordination of demand and supply is a lot of work in this field, in particular for brokers and logistic service providers. It is very unclear how the "sharing economy" will change that or bring added value to that. Current examples actually draw added value from loopholes in freight transport law, e.g. in France where freight transport by bicycles falls outside some of the most critical regulation items, such as the need to declare oneself to the Ministry as a freight carrier and all the associated requirements.	Accepted but already part of the text here and elsewhere	Government of France	Ministère de la Transition écologique et solidaire	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
56803	18	44	18	47	"The sharing economy, as an emerging economic-technological phenomenon (Kaplan and Haenlein, 2010; Wang and Zhang, 2012) is likely to be a key driver of demand for transport of goods though data shows increasing container movement due to on line shopping (Suel and Polak, 2018)." Does "container movement" here refer to containers carried by ship and truck, (i.e., twenty-foot equivalent units)? What's the relation to the sharing economy and/or online shopping?	Accepted but already part of the text here and elsewhere	Government of United States of America	U.S. Department of State	United States of America
81939	18	44	18	47	How does online- shopping induced increase in container movement fit with sharing economy here? This is confusing	Accepted but already part of the text here and elsewhere	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
70327	18	45			"The sharing economy...is likely to be a key driver of demand for transport of goods..." I thought the whole section argued the opposite. Please rectify - or clarify!	Accepted . Text modified	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
1287	19	1	19	4	In these lines there is the implicit assumption that shared verhicles are electric ones. Of course, this is not always the case. Many sharing concepts currently involve gasoline based cars.	Accepted but already part of the text here and elsewhere	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
52457	19	1	19	4	Recent literature suggests that shared mobility could also make it easier to reduce emissions through increased adoption of higher fuel economy vehicles. Check and consider including: Bansal, Prateek, Akanksha Sinha, Rubal Dua, and Ricardo A. Daziano. 2020. "Eliciting preferences of TNC users and drivers: Evidence from the United States." Travel Behaviour and Society no. 20:225-236. doi: https://doi.org/10.1016/j.tbs.2020.04.002.	Accepted but already part of the text here and elsewhere	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
84881	19	4	19	6	Policies may be implemeted to prevent or reduce this potential modal shift out of transit. For instance, making traffic slower in the city (e.g. by reducing maximum speed or by decreasing the number of car lanes in the streets) while at the same time developping shared mobility systems could enable to reduce car emissions while at the same time keeping transit modal share high. See for example : Coulombel, N., V. Boutueil, L. Liu, V. Viguié, and B. Yin. 2019. "Substantial Rebound Effects in Urban Ridesharing: Simulating Travel Decisions in Paris, France." Transportation Research Part D: Transport and Environment, The roles of users in low-carbon transport innovations: Electrified, automated, and shared mobility, 71 (June): 110–26. https://doi.org/10.1016/j.trd.2018.12.006.	Accepted but already part of the text here and elsewhere	Vincent Viguie	CIRED, Ecole des Ponts ParisTech	France
17131	19	14	20	2	I find it hard to understand the inclusion of "decoupling" in Section 10.2.2.2 "New Demand Concepts". Decouplins is hardly a new concept, and is hardly just on the demand side. Also, the paragraph on decoupling is very short and not very informative.	Accepted but already part of the text here and elsewhere	Giulio Mattioli	TU Dortmund University	Germany
28713	19	14	19		Decoupling should be defined properly. Please consider the work of Ralph Luken on that issue. Also consider the litterature on the decoupling at Elservier's journal of cleaner production,...It is not only examined through UNEP processes. What are those processes? UNEP has collaborated with experts/professors from other institutions on that process. The easiest and more accurate description of decoupling should clearly shouw that what is decoupled in the economic growth. GDP growth is decoupled from energy and materials intensity. This description will align with Fig.2.2 on p.19.	Accepted but already part of the text here and elsewhere	louis lubango Mitondo	United Nations	Ethiopia
47895	19	14	19	14	often decoupling refers to freight demand-GDP relationship and there is a rich literature on the topic (see https://pubs.acs.org/doi/abs/10.1021/acs.est.6b04515), I think the term should be clarified and the relationship between mobility demand and economic growth treated a bit more in detail	Accepted but already part of the text here and elsewhere	Matteo Muratori	NREL	United States of America
72911	19	14	19	17	« Decoupling is a concept examined through UNEP processes that describes [not "enables"] environmental improvements happening without loss of economic activity ». « Demand has been seen in the past as inherently connected to growth in fossil fuels so decoupling has emerged as the concept aiming to show that economic activity can be positive while decarbonisation accelerates »	Accepted but already part of the text here and elsewhere	Antoine BONDUELLE	EE-Consultant	France
78891	19	14	20	1	this paragaph would benefit from a redraft explaining more clearly the different forms of decoupling: transport growth from economic growth, transport growth from energy growth, energy growth from emission growth. It is unfortunate that Figure 2.2 makes no reference to transport. Other graphs are available which show the decoupling of transport, economic and emission variables.	Accepted but already part of the text here and elsewhere	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
79327	19	14	20	2	The key point of economic decoupling is that it negates a common justification for automobile-oriented policies such as fuel subsidies, low vehcile and fuel taxes, and highway expansions. In fact, among countries and urban regions at similar levels of development there tends to be a negative relationship between per capita vehicle-kilometers and per capita GDP. This suggests that TDM policies that result in more efficient transportation support economic development in addition to reducing pollution emissions. See: Susan Handy (2020). What California Gains from Reducing Car Dependence. National Center for Sustainable Transportation (https://ncst.ucdavis.edu); at https://escholarship.org/uc/item/0hk0h610. Chuck Kooshian and Steve Winkelman (2011), Growing Wealthier: Smart Growth, Climate Change and Prosperity, Center for Clean Air Policy (www.ccap.org); at www.growingwealthier.info. Todd Litman (2014), The Mobility-Productivity Paradox: Exploring Negative Relationships Between Mobility and Economic Productivity, International Transportation Economic Development Conference; at www.vtpi.org/mob_paradox.pdf. Also see, Are Vehicle Travel Reduction Targets Justified? at www.vtpi.org/vmt_red.pdf.	Accepted but already part of the text here and elsewhere	TODD LITMAN	Victoria Transport Policy Institute	Canada
84031	19	14	20	2	How does this section relate to demand? Even if transportation emissions are decoupling from GDP growth in relative terms it might have some rebound effects in other sectors or even within transportation as reduced spending on car might be directed to flights among middle-income households in developed countries, see Ottelin et al. 2014, 2017) Ottelin, J., Heinonen, J., & Junnila, S. (2017). Rebound Effects for Reduced Car Ownership and Driving. Nordic Experiences of Sustainable Planning: Policy and Practice, 263–283. https://doi.org/10.4324/9781315598529 Ottelin, J., Heinonen, J., & Junnila, S. (2014). Greenhouse gas emissions from flying can offset the gain from reduced driving in dense urban areas. Journal of Transport Geography, 41(September 2016), 1–9. https://doi.org/10.1016/j.jtrangeo.2014.08.004	Accepted but already part of the text here and elsewhere	Michał Czepkiewicz	University of Iceland	Poland

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
28715	19	17	19		The description of dcoupling has improved here. Still, economic growth should be added instead of economic activities (which is too vague). The term decarbonization also too limited. Decoupling infer energy and/or materials effciency in GDP growth or reducing energy and/or materials intensity in such economic (or GDP) growth. This change will reflect what is outlined in Fig. 2.2. It would also be helpful to distinguish between absolute decoupling and relative decoupling. In a absolute decoupling, GDP increases, while energy and materials (carnon or others) decrease or remain constant. In relative decoupling, GDP increases at higher rate and energy and/or materials increase but at much lower rate.	Accepted but already part of the text here and elsewhere	louis lubango Mitondo	United Nations	Ethiopia
84033	19	18	19	19	The section only discusses and provides examples of relative decoupling. Such level of decoupling is insufficient for decarbonization rate compatible with climate change mitigation. What is needed is absolute decoupling (emissions going down while GDP goes up) and not only that - what we need is *sufficient* absolute decoupling - going down to levels compatible with keeping warming below 1.5 degrees. The sufficient absolute decoupling of emissions from GDP growth might not be possible or at least it is very unlikely withing a time frame short-enough to meet mitigation targets (see Raworth 2017 "Doughnut economics" and Tim Jackson 2009 "Prosperity without growth" for an introduction, and Hickel and Kallis 2019 "Is Green Growth Possible?" and other sources for a more detailed consideration). How this section should relate to demand is, in my opinion, by emphasizing that technological improvements are not enough and reductions in demand are necessary for meeting mitigation targets	Accepted but already part of the text here and elsewhere	Michał Czepkiewicz	University of Iceland	Poland
49739	19	20	19	24	The figure does not feature transport. I recommend to use the figure 14 ot this report: https://slocat.net/tcc-gsr/	Accepted but beyond the scope of change to text at this stage	Nikola Medimorec	SLOCAT Partnership on Sustainable, Low Carbon Transport	Republic of Korea
63221	19	20	19	20	The title of the figure should be Figure 10.2 instead of 2.2.	Accepted but already part of the text here and elsewhere	Government of Canada	Environment and Climate Change Canada	Canada
79477	19	20	19	24	The figure does not feature transport. I recommend to use the figure 14 ot this report: https://slocat.net/tcc-gsr/	Accepted but beyond the scope of change to text at this stage	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
17133	19	25	19	28	The statement about "evidence of decoupling for both developed and developing countries" could be misleading if more information is not provided. Analysis included in Chapter 2 finds little to no decoupling in the transport sector in the period 2008-2018, and finds that transport is one of the sectors where the coupling between GDP and emissions is most pronounced. A discussion of (de)coupling in the transport sector should provide the big picture, and not just emphasise the odd positive developments.	Accepted but already part of the text here and elsewhere	Giulio Mattioli	TU Dortmund University	Germany
23189	19	26	19	27	However, there are institutions such as the European Environment Agency that believe that a full decoupling of economic growth and resource consumption may not be possible (https://www.eea.europa.eu/themes/sustainability-transitions/drivers-of-change/growth-without-economic-growth).	Accepted but already part of the text here and elsewhere	Government of France	Ministère de la Transition écologique et solidaire	France
84035	19	26	19	28	What kind of decoupling? Of transportation emissions from whole-economy GDP? Please clarify. If yes, please state if aviation emissions are included, and better yet, separately provide discussion of decoupling in aviation and road transport.	Accepted but already part of the text here and elsewhere	Michał Czepkiewicz	University of Iceland	Poland
84037	19	28	20	2	Do you mean decoupling of transport emissions from the specific "Net Zero urban economic activity" or total GDP in these cities? Do these calculations include aviation? Please clarify. I have looked at the Newman, Beatley, and Boyer 2017 book and found only data on decoupling car use from GDP in two US cities (Portland and Washington DC). Perhaps car use has saturated in these cities and stopped growing for reasons other than the elusive "decoupling"? Please elaborate on that and on the implications of this section on mitigation actions across the ASI spectrum.	Accepted but already part of the text here and elsewhere	Michał Czepkiewicz	University of Iceland	Poland
27805	19		19		Figure 10.2 could be based on more recent data, as presented in previous Chapters and for the same regions as in previous Chapters.	Accepted but already part of the text here and elsewhere	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
1291	20	3	22	6	In section 10.2.3. about autonomous vehicles, I miss the discussion about the distance that people are driving. There is argued that people are going to live farther away from their work for instance. In addition, people can chose to go by car rather than by train because the have a higher productivity in the car. Liu et al., 2019 (https://doi.org/10.1016/j.enpol.2019.06.013) gives an overview of many different reasons why distance can be affected by autonomous vehicles.	Accepted but already part of the text here and elsewhere	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
79329	20	3	22	6	The discussion of new technologies, particularly autonomous vehicles, is overly optimistic concerning pollution emissions and other external costs. Because they make travel more convenient and can generate many "empty" vehicle-kilometers, with current policies AVs are likely to significantly increase vehicle travel and associated congestion, roadway costs, crash risk and pollution emissions. This increases the importance of TDM policies that limit vehicle travel. See: Shared Mobility Principles for Livable Cities (www.sharedmobilityprinciples.org). Principles to guide decision-makers and stakeholders toward the best outcomes for new mobility options. Caroline Rodier (2018), Travel Effects and Associated Greenhouse Gas Emissions of Automated Vehicles, UC Davis Institute for Transportation Studies (https://ncst.ucdavis.edu); at https://bit.ly/2w1rVsK. Morteza Taiebat, Samuel Stolper and Ming Xu (2019), "Forecasting the Impact of Connected and Automated Vehicles on Energy Use: A Microeconomic Study of Induced Travel and Energy Rebound," Applied Energy, Vol. 247, pp 297-308 (https://doi.org/10.1016/j.apenergy.2019.03.174). Stefan Trommer, et al. (2016), Autonomous Driving: The Impact of Vehicle Automation on Mobility Behaviour, Institute of Transport Research (www.ifmo.de); at http://bit.ly/2kIAOOQ.	Accepted but already part of the text here and elsewhere	TODD LITMAN	Victoria Transport Policy Institute	Canada
15503	20	4	21	6	Propose that there is info provided explaining some potential timeframes for substantive impacts from new technologies; vehicle automation in particular. Commentary over recent years has tended to be optimistic but practice is not really bearing this out. In the context of efforts to dramatically reduce GHG and with rapidity, how material will these technologies be as part of the response?	Accepted but already part of the text here and elsewhere	Ryan Falconer	Auckland Council, New Zealand	Australia
81941	20	7	20	8	it could be clearer how ICT and shared economy help with the adoption of EVs. E.g. through deployment of shared, on-demand vehicles, shared EV micro-vehicles, but also through better grid integration options for charging infrastructure.	Accepted but already part of the text here and elsewhere	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
1289	20	8	20	8	Abbreviation of IOT is not introduced yet. Also in box 10.1 it is written as IoT.	accepted and changes made	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
28555	20	10	22	6	Regarding the environmental (and in particular climate) impact of "smart city" technology, especially new mobility modes: this report clearly shows that ride-sourcing vehicles (and taxis) currently have the highest energy and GHG emission impacts per passenger km of all urban mobility options: https://www.itf-oecd.org/good-go-assessing-environmental-performance-new-mobility. The report flags the importance to increase loads and shift technology (also underlining that high mileage vehicles are best placed to shift first toward EVs) to improve the environmental performance of these solutions. I think these considerations should clearly be mentioned in this section. The report also covers climate impacts of other forms of "new mobility, in particular micro mobility.	Accepted but already part of the text here and elsewhere	Pierpaolo Cazzola	International Transport Forum	France
28557	20	10	22	6	Regarding the envioronmental (and in partocualr climate) impact of "smart city" technology, especially new mobility modes: this report clearly shows that ridesourcing vehicles (and taxis) currently have the highest energy and GHG emission impacts per passenger kilometre of all urban mobility options: https://www.itf-oecd.org/good-go-assessing-environmental-performance-new-mobility. The report flags the importance ot increase loads and shift technology (also underlining that high mileage vehicles are best placed ot shift first toward EVs) to improve the environmental perfromance of these solutions. I think these considerations should clearly be mentioned in this section. The report also covers climate impacts of other forms of "new mobility, in particular micromobility.	Accepted but already part of the text here and elsewhere	Pierpaolo Cazzola	International Transport Forum	France
84039	20	10	20	10	Large growth of what? Population? GDP? Please be more specific	Accepted but already part of the text here and elsewhere	Michał Czepkiewicz	University of Iceland	Poland
82169	20	12	21	11	The description of Box 10.1 mentions that it discusses technologies "being adopted rapidly by cities accross the world". However, the short description of the different technology options dont give examples of cities where these technologies have already been adopted or how succesful they ahve proved, what challenges they have encountered or possible solutions to these challenges. It just describes how this technologies could be helpful in the future. Moreover, the text is often writen with words as "will" indicating future situations, scenarios, rather than situations that have already been happening (even if at small scale or in a small gepgraphic area) since AR5, as the description of the box mentions.	Accepted but already part of the text here and elsewhere	Sofia Rosero Abad	University	Netherlands
12591	20	14	21	11	Box 10.1: I think autonomous vehicles should be included into the list. They are still at a preliminary phase, but also blockchain has seen very few applications in transport systems today.	accepted and changes made	Michel Noussan	Fondazione Eni Enrico Mattei	Italy
70329	20	14			Box 10-1: A balanced discussion of pros' and cons' of smart cities/technologies is missing. If "smart" leads to reductions in generalised user costs (as can be expected!) then there is likely more traffic (by cars) on the roads, hence higher absolute fuel consumption (even if more efficient). Please add balance to the review. OK, reading on I find words of caution ... maybe the box is ok as such and you just need to add a short remark to the discussion in ll 15ff.	accepted and changes made	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
70331	20	14			A key reference is missing: Dan Sperling: "Three Revolutions: Steering Automated Shared & Electric Vehicles To A Better Future", 2018	Accepted but beyond the scope of change to text at this stage	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
4033	20	28	20	37	MaaS is lost somewhat in the 'smart city' section, and lacks any meaningful discussion around what is required, and why this is so challenging. For instance: oIt's very challenging to negotiate commercial agreements with TPs who see you as disintermediating them oTechnical integrations are time-consuming and expensive in the absence of agreed open data standards	Accepted but already part of the text here and elsewhere	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
56805	20	28	20	30	Mobility as a Service: What has U.S. done to capture the benefits/costs of this?	Accepted but already part of the text here and elsewhere	Government of United States of America	U.S. Department of State	United States of America
84041	20	28	20	37	Please write more about potential negative outcomes of private for-profit "shared mobility" apps	Accepted but already part of the text here and elsewhere	Michał Czepkiewicz	University of Iceland	Poland
84981	20	28	20	37	How effective will MaaS really be? This would benefit from one or more case studies to bring this out better, and the links to integrating modes, information, behaviour change etc.	Accepted but already part of the text here and elsewhere	Jameel Hayat	AECOM	United Kingdom (of Great Britain and Northern Ireland)
85567	20	37	20	37	A concept that I'm still missing and could be attached here are microhubs. The idea is simple: small packages that need to be delivered to the city are distributed using a small dispatch location that can be mobile and extra small vehicles transport the package the last mile. E.g. a truck parks somewhere in the city and drones distribute packages in the direct environment of the truck. This saves large amounts of GHG emissions and also reduce local air pollution from delivery vehicles because the new vehicles are so much smaller. Some sources: https://doi.org/10.3390/su12177213 https://doi.org/10.3390/su13042067 https://doi.org/10.3390/su9081324	Accepted but beyond the scope of change to text at this stage	Auke Hoekstra	Eindhoven University of Technology	Netherlands
84043	20	38	20	45	Please write more about bottlenecks for using big data in urban planning. Many of the big data sources potentially available and usable by cities (e.g. Google Maps API) are not available for public institutions. There are also risks (e.g. privacy) that come with heavy reliance on such big data sources.How to overcome these bottlenecks and mitigate risks?	Accepted but beyond the scope of change to text at this stage	Michał Czepkiewicz	University of Iceland	Poland
79231	20				Section 10.2.3 currently focuses on AV implications of economy. This could be complimented by more discussion and modelled evidence on the potential energy and carbon mitigation along with the mnay uncertainties of full scale deployment e.g. congestion from large AV fleets, etc. See: Kopelias, P., Demiridi, E., Vogiatzis, K., Skabardonis, A., & Zafiropoulou, V. (2020). Connected & autonomous vehicles–Environmental impacts–A review. Science of the total environment, 712, 135237; Greenblatt, J. B., & Saxena, S. (2015). Autonomous taxis could greatly reduce greenhouse-gas emissions of US light-duty vehicles. Nature Climate Change, 5(9), 860-863; Fagnant, D. J., & Kockelman, K. M. (2014). The travel and environmental implications of shared autonomous vehicles, using agent-based model scenarios. Transportation Research Part C: Emerging Technologies, 40, 1-13.	Accepted but beyond the scope of change to text at this stage	Martino Tran	UBC	Canada
23191	21	1	21	1	We recommand to develop the following points : how the blockchain is specifically needed to do all of that. All kinds of data storing and authentification protocols and techniques exist and the superiority of the blockchain is not discussed. Also, the relationship with the impact of transport on climate change is absent. If the implied idea is that the increase in data quality and the reduction of transaction cost will improve the environmental efficiency of transportation, there are two risks: first, that of an important rebound effect. Second, that of a shift towards smaller and/or less environmentally efficient techniques, which would benefit more from the technology. This argument stands for all ITS in general.	Accepted but beyond the scope of change to text at this stage	Government of France	Ministère de la Transition écologique et solidaire	France
43093	21	1	21	11	Here we should add that the evidence indicates that distributed ledger technologies are energy intensive systems and their impact on GHG emissions needs to be considered.	Accepted but already part of the text here and elsewhere	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
65013	21	7	21	7	Perhaps expand TAC to 'Transit Activated Corridor' as this is the first time the term is used.	Accepted but beyond the scope of change to text at this stage	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
23193	21	12	21	14	There is no convincing rationale regarding how smart technologies will improve the environmental efficiency of transport. Also, for freight transport, digitalisation has gone hand in hand with just in time processes, a general, massive and long term shift of supply chain management from homogenous, inert, push-oriented supply chains to heterogenous, lean and pull-oriented supply chains. This is especially visible with e-commerce, but from that perspective e-commerce is just the tip of the iceberg. In general, it is enormously dangerous to expect smart technologies to improve things by themselves. There is no evidence of this in the past, quite the contrary, except for some epiphenomena.	Accepted but already part of the text here and elsewhere	Government of France	Ministère de la Transition écologique et solidaire	France
56807	21	12	21	14	Has U.S. fully utilized smart technology to streamline whole trip travel to fully exploit potential GHG reductions?	Accepted but beyond the scope of change to text at this stage	Government of United States of America	U.S. Department of State	United States of America
47899	21	15	21	16	Needed refs	Accepted but beyond the scope of change to text at this stage	Matteo Muratori	NREL	United States of America
72905	21	15	22	6	Given the potential of autonomous vehicles to disrupt the transport sector, the section is relatively short. Suggestion to add point of vigilance on possible positive impact of autonomous vehicles on GHG emissions. Some projection predict increased travel because of increased convenience and speed resulting in higher GHG emissions. AV's potential for higher velocity could have negative impact : 1) Because energy intensity of travel increases with speed. 2) Postpones peak car by improving traffic	Accepted but beyond the scope of change to text at this stage	Antoine BONDUELLE	EE-Consultant	France
84983	21	15	21	22	Autonomous vehicles - the role of these and their impact is not discussed in any detail, and should be strengthened, together with how this links to land use and trip patterns.	Accepted but beyond the scope of change to text at this stage	Jameel Hayat	AECOM	United Kingdom (of Great Britain and Northern Ireland)
84045	21	16	21	18	Please reflect on the effect of plane automation on emission levels. Has it increased or decreaded the emission levels? Rhetorical question	Accepted but beyond the scope of change to text at this stage	Michał Czepkiewicz	University of Iceland	Poland
65015	21	22	21	22	It might be worth mentioning here that AV for private vehicles will likely cause more congestion and create more problems than it solves with driver assist accounting for most of the safety benefits... and that the future is using AVs for mid-tier shared transit to avoid prohibative driver costs from smaller more regular services, which typically mean less services. Although its mentioned in the next paragraph the point is a bit lost.	Accepted but already part of the text here and elsewhere	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
84985	21	27	21	27	Uber and Lyft, and indeed taxis in general - there is potentially more scope for such vehicles to come under legislation regarding limiting emissions or specifying engine type.	Accepted but already part of the text here and elsewhere	Jameel Hayat	AECOM	United Kingdom (of Great Britain and Northern Ireland)
23195	21	29	21	30	More broadly than Blockchains, the assessment of the carbon footprint of the digital part of the smart mobility should be further measured	Accepted but beyond the scope of change to text at this stage	Government of France	Ministère de la Transition écologique et solidaire	France
56809	21	29	23	32	The analysis of hydrogen production and related energy/emissions-intensity is very convincing. Something similar for blockchain would be helpful if such information is available. Right now, there is the following on page 21, lines 29-32: "The use of some smart technologies can also be energy intensive in itself, e.g., first generation Blockchains based on proof-of-work (which is now shifting to much less energy intensive methods such as proof-of-stake), though this can be significantly less than the energy saved in travel and freight as well as better use of shared solar (Sedlmeir et al., 2020)." What is the current generation of Blockchain? How does proof-of-state compare? Blockchains are extremely energy intensive. Is that incorrect?	Accepted but beyond the scope of change to text at this stage	Government of United States of America	U.S. Department of State	United States of America
1247	21	33	21	33	the end of the line should read: "and the automation of long-haul" (trucks)	accepted and changes made	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
78893	21	33	21	36	Hancock et al is not in the reference list. ITF report on the move to driverless trucks would also be relevant here https://www.itf-oecd.org/managing-transition-driverless-road-freight-transport	Accepted but already part of the text here and elsewhere	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
84047	21	34	21	36	Why should the idea to allow automated long-haul trucks to move through cities be "worked out" at all? Why should these vehicles be allowed to move through cities? Why is this idea even discussed in this report?	Accepted but beyond the scope of change to text at this stage	Michał Czepkiewicz	University of Iceland	Poland
23197	21	36	21	36	The reference used in this line is missing from reference list at the end of report Hancock et al 2019 On the future of transportation in a era of automated and autonomous vehicles	Accepted but already part of the text here and elsewhere	Government of France	Ministère de la Transition écologique et solidaire	France
81943	21	36	21	38	Drones for people need a discussion on energy intensity per passenger and their potential adverse effect on transport transformation, not only on air space.	Accepted but beyond the scope of change to text at this stage	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
78895	21	37	21	38	This is only one of several factors likely to constrain the use of drones for parcel delivery in urban areas as discussed in this journal paper: https://bit.ly/3rQSXvs	Accepted but beyond the scope of change to text at this stage	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
49741	21	39	21	47	The paragraph includes a few worrying statements and assumptions. It gives the impression as there's a basic need to drive a car in a city. I understand that the example focuses on automobile city fabric but nevertheless, it should be emphasized that autonomous vehicles need to support the overall transport system. Here a reference to the commonly-accepted Shared Mobility Principles would be helpful: https://www.sharedmobilityprinciples.org/	Accepted but already part of the text here and elsewhere	Nikola Medimorec	SLOCAT Partnership on Sustainable, Low Carbon Transport	Republic of Korea
79479	21	39	21	47	The paragraph includes a few worrying statements and assumptions. It gives the impression as there's a basic need to drive a car in a city. I understand that the example focuses on automobile city fabric but nevertheless, it should be emphasized that autonomous vehicles need to support the overall transport system. Here a reference to the commonly-accepted Shared Mobility Principles would be helpful: https://www.sharedmobilityprinciples.org/	Accepted but already part of the text here and elsewhere	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
81945	21	39	22	6	The discussion on AVs must address the need for sharing them and the danger of urban sprawl and additional vkm/pkm travelled	Accepted but already part of the text here and elsewhere	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
31675	21		21		Box 10.1: paragraph on 'Blockchain or Distributed Ledger Technology' is not very clear; also please spell out TAC	Accepted but already part of the text here and elsewhere	Shreya Some	Ahmedabad University	India
1221	22	5	22	5	"more sanguine" should be "less optimistic" (sanguine = optimistic)	Accepted but already part of the text here and elsewhere	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
23199	22	5	22	5	Concerning the word "sanguine". Is it sanguine of pessimistic	Accepted but already part of the text here and elsewhere	Government of France	Ministère de la Transition écologique et solidaire	France
31677	22	6	22	6	SDG's' it will be SDGs- P4L5; also in P95L25; P96L4; P108 (table 10.8, column 3 row 5);P113L16	Accepted but already part of the text here and elsewhere	Shreya Some	Ahmedabad University	India
53569	22	7	22	7	It is not clear to me as a reader what "The transport-energy nexus" means. It sounds like a term some researcher is trying to create to get more citations. Perhaps rename this section to "energy efficiency of different decarbonization strategies" or some other clear title.	Accepted but already part of the text here and elsewhere	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79787	22	7	23	8	The recent work of Gryparis et al : "Electricity demand and carbon emission in power generation under high penetration of electric vehicles. A European Union perspective," Energy Reports, Vol.6, Sup.6, 2020, pp475-486, https://doi.org/10.1016/j.egyr.2020.09.025, have shown that the electricity demand and of course the related GHG emissions will be increased at EU level as the penetration of EVs will be increase under the current generation status, while will be reduced if the generation follows the decarbonization trends. This option should be clearly presented and stated in the subsection "10.2.4 The transport-energy nexus: understanding cross-sectoral implications and opportunities", as the decarbonnisation of the power generation is of paramount importance to achieve positive GHG emissions reduction from the adoption of electric vehicles. Otherwise the gains from removing the GHG's from transport and transfer them to power generation will result obviously in less positive, or even negative effects in some cases.	Accepted but beyond the scope of change to text at this stage	Constantinos Psomopoulos	University of West Attica, Department of Electrical and Electronics Engineering	Greece
49743	22	9	22	21	To add about the transport-energy nexus a focus on renewable energy would be important to climate change mitigation. So far, transport contributes the least to renewables, because it is the least diversified energy sector and has the lowest share of renewable energy in its final consumption. Reference: https://www.ren21.net/gsr-2020/	Accepted but beyond the scope of change to text at this stage	Nikola Medimorec	SLOCAT Partnership on Sustainable, Low Carbon Transport	Republic of Korea
53571	22	9	23	8	This section is missing a discussion of the energy efficiency of synthetic hydrocarbons / electrofuels. Probably worth mentioning that electrification/hydrogen isn't at all a strategy for reducing emissions from already existing ICE vehicles. Unless they can somehow by retrofitted, which I've not seen anyone do yet.	Accepted but already part of the text here and elsewhere	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
79481	22	9	22	21	To add about the transport-energy nexus a focus on renewable energy would be important to climate change mitigation. So far, transport contributes the least to renewables, because it is the least diversified energy sector and has the lowest share of renewable energy in its final consumption. Reference: https://www.ren21.net/gsr-2020/	Accepted but already part of the text here and elsewhere	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
79491	22	12	22	15	Worth mentioning upfront that more than 90% of the renewable energy share in transport comes from biofuels and that are also expected to play a big role in delivering carbon emission reductions (see Figure 3 in REN21 GSR 2020: https://www.ren21.net/gsr-2020/assets/pipe/?asset=Figure_03&type=png&cat=c&ind=01&id=figure_3)	Accepted but beyond the scope of change to text at this stage	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
83859	22	12	22	15	Worth mentioning upfront that more than 90% of the renewable energy share in transport comes from biofuels and that are also expected to play a big role in delivering carbon emission reductions (see Figure 3 in REN21 GSR 2020: https://www.ren21.net/gsr-2020/assets/pipe/?asset=Figure_03&type=png&cat=c&ind=01&id=figure_3)	Accepted but beyond the scope of change to text at this stage	Hannah E. Murdock	REN21	France
43095	22	13	22	19	It can be argued that low carbon hydrogen can be produced via several pathways, including steam methane reforming with carbon capture, storage and utilisation.	Accepted but beyond the scope of change to text at this stage	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
65017	22	14	22	14	Put on the same level like this it may be seen that EVs and H2 are of similar feasibility for transport which is not the case and should perhaps be noted here so as not to give the wrong impression, as explained in the following paragraphs.	Accepted but already part of the text here and elsewhere	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
52535	22	15	22	16	The sentence undermines cleaner fossill fuel technologies for electricity generation. Include this option in the discussion.	Accepted but beyond the scope of change to text at this stage	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
56811	22	19	22	20	Have considerations been given to the impact of electrification needed to support climate goals on the overall electric grid? Significant investment appears to be warranted. This could be a win-win for U.S. given reduction in potential wildfires from poor transmission lines. Investment in the electric grid would provide the opportunity to harden the grid from natural and human threats and to reduce the threat of wildfires and outages, while increasing output for electrification needs.	Accepted but beyond the scope of change to text at this stage	Government of United States of America	U.S. Department of State	United States of America
79151	22	22	22	44	In 2000, two Tier Ones and RMI designed a midsize SUV, with the inferior fuel cell and powertrain of that era, to need 0.64 kgH2/100 km, implying a need <<1 for an Avcar (Lovins & Cramer, "Hypercars®, hydrogen, and the automotive transition," Intl. J. Veh. Design 35(1/2):50–85, 2004, https://www.rmi.org/insight/hypercars-hydrogen-and-the-automotive-transition/). The curb mass was 857 kg but would be ≤740 today; indeed, Toyota's 2007 1/X concept car weighed just 420 kg as a PHEV or 400 kg as a HEV. Thus your assumed H2 intensity and fueling needs can vary 2–3x with tractive load, which it's highly advantageous to reduce that dramatically, as my SAE paper showed ("Reframing Automotive Efficiency," SAE Int. J. Sust. Trans., Energy, Env., & Policy 1(1):59–84 (2020), 5 May 2020, doi:10.4271/13-01-01-0004). This needs to be explicit: your analysis is right for today's typical vehicles but not for, say, the 2013 BMW i3 (carbon-fiber body at no extra cost, offsetting the weight and cost of the batteries, id.). The Yates et al mention of H2 transportation (22:28) is irrelevant if the H2 is produced, as it normally would be, on the forecourt rather than in some remote site. H2 compression becomes minor wiht a vehicle efficient enough to need 350 not 700 bar H2 (both refs above), a fuel cell that yields pretty high pressure, and optionally an onboard turboexpander for pressure letdown. So while I agree that GH2 and LH2 are less attractive than batteries, the 22:22–38 data are valid only for normally inefficient vehicles, which are neither desirable nor inevitable. Likewise, you use a standard Ricardo number of ~22 kWh/100 km at retail (22:39), but the ubiquitous Tesla Model 3 uses 13.9 onboard and 16.6 nominal to the EVSS, but the 5-seat Lightyear One sedan entering the market in 2021 uses 10.4 and the 2-seat Aptera 3-wheeler ≤6.2 (to declare an interest, I advise both these firms). So as with hydrogen (same IJVD and SAE J-STEEP references as above), electricity use is highly sensitive to platform efficiency—in this case by 2–4x compared to your Ricardo number—and you should say so.	Accepted but beyond the scope of change to text at this stage	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
84183	22	22	22	29	With regard of the phrase (lines 26-29) "For every 1 kilogram of hydrogen, a 100% efficient electrolyser is suggested to require around 40 kWh of electricity before considering the energy requirements for water purification, hydrogen compression, and transportation (Yates et al. 2020). In reality, electrolyser electricity consumption targets are closer to 55 kWh per kg (US DOE, 2020)." I suggest to consider also other more efficient electrolyser solution like: A technique developed by ICCOM-CNR foresees the consumption of 18.5 kWh: this technique sees the production of hydrogen starting from an aqueous solution of alcohols such as ethanol, glycerol or other alcohols extracted from biomass. The reaction takes place in what has been called an "anodic electrolyser" made up of palladium nanoparticles, deposited on three-dimensional architectures of titanium nanotubes. Y.X. Chen, A. Lavacchi, H.A. Miller, M. Bevilacqua, J. Filippi, M. Innocenti, A. Marchionni,W . Oberhauser, L. Wang and F. Vizza, "Nanotechnology makes biomass electrolysis more energy efficient than water electrolysis", Nature Communications, 2014, [av. at <http://www.nature.com/ncomms/2014/140603/ncomms5036/abs/ncomms5036.html >].	Accepted but beyond the scope of change to text at this stage	Mario Valentino Romeri	Independent consultant	Italy
43149	22	26	22	28	For every kg of H2, a 100% efficient electrolyser is suggested to require around 40kWh of electricity'. Well… 1 kg of hydrogen contains 33.33 kWh of energy. Therefore, if the efficiency is 100%, to produce 1 kg of H2 (33.33 kWh) it would require 33.33 kWh of electricity. I would eliminate the statement, as the point gets across well when it is said below that to produce 1 kg of H2 requires 67kWh. This is the same as to produce 33.33 kWh of H2, requires 67 kWh of electricity, or the energy efficiency of producing hydrogen is 49.7%.	Accepted but beyond the scope of change to text at this stage	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
84155	22	26	22	44	The discussion ignores the issue that energy has a location. Japan can not product renewable energy of any material scale to address either an electric or hydrogen fleet. Various countries can produce renewable energy well beyond their needs. Hydrogen is likely to be vector to relocate the energy to Japan (which the Japanese have recognised and integrated into their policies). It is unlikely that it is better to place all of the imported hydrogen into the grid to then power vehicles. Having embedded the 67KWh of electricity in making each kg of H2, it is likely that there are many use cases for it to be consumed in the transport sector of Japan directly. The underlying 22kWh vs 67 KWh comparison isn't relevant because the energy generation and energy consumption have locations that are not conveniently proximate.	Accepted but beyond the scope of change to text at this stage	Kym Lennox	climate change equity	Australia
75787	22	27	22	27	Perhaps it is good to change it to lower heating value (the requirement would be 33.3 kWh/kg) or specify explicitly that is higher heating value	Accepted but beyond the scope of change to text at this stage	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
1293	22	29	22	33	It is a bit confusing that both 55 kWh/kg and 67 kWh/kg are mentioned as the energy requirement for hydrogen production. Is the difference due to the energy requirement for water purification, compression and transport? This should be made more specific.	Accepted but already part of the text here and elsewhere	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
75789	22	31	22	31	The correct value is 0.18 Mt of hydrogen for 1 million vehicles (factor 1000 is missing). The 12 TWh of electricity seems to be with the right number rather than the 180 Mt of hydrogen mentioned in the text	Accepted but beyond the scope of change to text at this stage	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
82073	22	34	22	38	I think here it is important to add information on how this electricity requirement can be achieved, i.e. what percentage of this expected electricity requirement can actually come from renewables and how much electricity will still come from grey energy sources. Would there be enough green electricirty produced and available to rip out the benefits of electric mobility? or would electric mobility end up increasing the amount of grey energy requirement for its production? This is comming back to my previous comment about the importance of giving more clarity on the expected energy mix.	Accepted but beyond the scope of change to text at this stage	Sofia Rosero Abad	University	Netherlands
12593	22	35			Using cars figures in the US may be misleading, since a large part of personal vehicles are classified as “trucks” in the region. Thus, the energy requirement for passenger mobility will be much higher. Please consider modifying this estimate.	Accepted but beyond the scope of change to text at this stage	Michel Noussan	Fondazione Eni Enrico Mattei	Italy
65021	22	39	22	44	[Private Opinion] Honestly this should really be the end of conversations around using Hydrogen as a vehicle fuel shouldn’t it, what more is needed to take this red herring out of the conversation space (or at least relegated to its niche space) so we can focus on the real systemic issues of car dependence? Also Hydrogen fuel cells can't be used as storage for the grid... perhaps the IPCC can come out with a strong statement that H2 is a niche option for transport (as it states on page 32, line 18) that is likely to be completely displaced by electrification, otherwise this discourse will continue, wasting valuable time and resources. Actually it would be very interesting to find out why H2 is getting any attention at all given its significant shortcomings... all I can think of is that it keeps the transport and electricity sectors separate as its just another physical fuel to replace another physical fuel... but this is just not going to get us where we need to be, we need near complete electrification of vehicles if we hope to curb global warming... if the barrier is wanting to avoid connecting the transport and energy sectors then we need to tackle this directly rather than let red herrings keep getting air time.	Accepted but beyond the scope of change to text at this stage	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
65019	22	41	22	41	Perhaps add (compared to Hydrogen which is 12 TWh)…	Accepted but beyond the scope of change to text at this stage	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
47901	22	42	22	42	Why 110M vehicles in the US? I understand that this is an example, but there are ~250M LDV in the US, 110 seems a random number should you do 1M, 100M or the whole fleet?	Accepted but beyond the scope of change to text at this stage	Matteo Muratori	NREL	United States of America
5491	22	44	22	44	Delete "Renewable". The statement is true even if the source of energy is not renewabe	Accepted but already part of the text here and elsewhere	Michel SIMON	Retraité/ Pdt d'association	France
47903	22	47	22	47	Critical element missing: even without V2G, smart and managed EV charging can provide great value in supporting the grid and integrating renewables. See: http://www.cleanenergyministerial.org/sites/default/files/2020-09/2020-9-15%20CEM%20Horizontal%20Accelerator%20FINAL%20FOR%20POSTING.pdf, https://iopscience.iop.org/article/10.1088/1748-9326/abcb38/meta, https://doi.org/10.1088/2516-1083/abe0ad, and many more refs	Accepted but beyond the scope of change to text at this stage	Matteo Muratori	NREL	United States of America
53573	23	1	23	2	It's true that peak shaving can be used to produce hydrogen, but the focus of this report is on paths that can decarbonize society. To run all trucks in a country on hydrogen with electricity as input would require very large amounts of energy. For instance, for the UK the national energy production would roughly need to be doubled. Peak shaving does not seem like a strategy that can reach these energy levels. Furthermore, that hydrogen production can be used for peak shaving is not a sufficient arguement that it should. Perhaps that energy could more cheaply (including losses) be stored in batteries or with pumped hydro?	Accepted but beyond the scope of change to text at this stage	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
69795	23	2	23	3	McDonagh 2019 is not found in the reference list. The production of hydrogen by electrolysis is more efficient at less-than-nominal power, entailing lower heat losses, hence the production from variable renewables is likely to be as efficient or more efficient than from constant power at nominal rate. If variability might have a detrimental effect, it is more likely to be relative to the technical life-time of electrolyser stacks.	accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
81027	23	9	23	9	Add a specific paragraph about freight: "In the freight transport sector, studies illustrate how systemic transformations of the supply chains and infrastructures could contribute to reduce the need for long-haul trucks and therefore also reduce the pressure on autonomy range and specific technological challenges for these trips (quantity of biofuels or hydrogen, electric charging systems…) (Reference example: Yann Briand, Johannes Svensson, Martin Koning, François Combes, Gwennaël Lamy, Prabodh Pourouchottamin, Jean-Michel Cayla, Julien Lefevre (2019). Deep decarbonization pathways of freight transport in France, Descriptive Report, IDDRI.)	Later versions clarified this.	Yann BRIAND	Iddri, Sciences Po	France
8317	23	10	44	8	Section 10.3 seems overly long and detailed. I think such a fine-grained description of different technologies is not required for this report, interested readers may consult the literature. In my view, it'd be more important to clearly render the key insights, i.e. which technologies seem feasible based on which criteria.	Accepted. The section has been reorganised and more technologies added to cover the landscape. In addition the feasibility for different transport modes added in the writeup	Michael Jakob	MCC Berlin	Germany
8319	23	10	44	8	The assessment of road transport technologies does not reflect some of the most recent developments, in particular with regard to heavy duty vehicles. Battery-electric as well as fuel cell HDVs now seem technically and economically feasible in about a decade	Have added into Section 10.3 text for Ammonia and Methanol fuel cells. Ammonia as a fuel for ICEs has also been added to give a complete picture.	Michael Jakob	MCC Berlin	Germany
15505	23	10	44	8	I did not see discussion of potential impacts of heavier vehicles (from battery pack weights) on road pavements and the renewals implications that can come with this (embodied emissions). Thus, innovation in pavements and renewals will be required to offset any implications from heavier vehicles. Covered in other chapters?	Noted	Ryan Falconer	Auckland Council, New Zealand	Australia

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
28573	23	10	23	17	This section talks about hydrogen and fuel cells and biofuels sepaprately, and omits entirely a range of options that could allow to benefit from the integration of low-carbon hydrogen and biogenic carbon from biomass to produce low-carbon fuels. The section also omits entirely a discussion on drop-in electrofuels. These are major problems, in my opinion.	To illustrate the range of options and integration between low carbon hydrogen and biogeneic carbon a figure has been added that shows linkages between fuel production and different drive train technologies. A section on e fuels is also seperately provided now	Pierpaolo Cazzola	International Transport Forum	France
79757	23	10	32	10	Please discuss electric road systems, potentially a key option for road freight decarbonisation. Also in 10.14 please	Discussed in 10.4.3	Stefan Bakker	KiM Netherlands Institute for Transport Policy Assessment	Netherlands
82075	23	10	44	8	I think this Chapter could benefit from a timeline of options for mobility, i.e. MIXED options/pathways towards the future. Such a timeline should show how the different options for mobility need to be used and fit together at different moments iin time and how they can help for the transition. This would show that there is no one 'sivler bullet' to solve the mobility problem but it depends more on the combination of different options at different times (depending on their availabilities and TRLs).	The Figure proposed by Jake could help if we can also show how the transitions in future can happen	Sofia Rosero Abad	University	Netherlands
28749	23	11		12	I miss a sentence here on why biomethane is not considered an option (perhaps this is explained in other chapters). [I can see an explicit reference to 'bio-based natural gas' on page 81 (line 21), but this alternative fuel is listed separately from 'biofuels'].	Biomethane is mentioned as a option for road transport in Table 10.5	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy
65023	23	12	23	12	Isn't saying "advanced internal combustion engines" just like saying "Clean Coal"?	The sentence has been revised and now there is no advanced ICE in the sentnece	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
15507	23	18	32	10	Add to discussion of externalities, that these are not unique to resource extraction for batteries - noting myriad externalities associated with extraction of fossil fuels.	The comparison with Steel and Aluminium has been provided to clarify this	Ryan Falconer	Auckland Council, New Zealand	Australia
37263	23	18	23	23	New mention-nuclear technology should be targeted for rail and road transport.	Declined Only those technologies which are at a TRL level above 6 included	Arun kumar Nayak	Bhabha Atomic Research Centre Trombay Mumbai	India
37265	23	18	23	23	Micro reactors and nuclear batteries would play major roles in these sectors	Declined Only those technologies which are at a TRL level above 6 included	Arun kumar Nayak	Bhabha Atomic Research Centre Trombay Mumbai	India
63223	23	18	32	10	Section 10.3.1 We would suggest to add in recent studies related to cold weather impacts on battery capacity, charge times and efficiency at sub-zero temperatures … Something that has still not been solved	Noted. Trying to identify literature for this	Government of Canada	Environment and Climate Change Canada	Canada
64831	23	18	27	4	Presented evaluation of battery-based electromobility is not complete without including its side effects. Environmental impact of relatively low battery lifetime, missing recycling facilities, unresolved back-end, inevitable major investments into higher capacity and robustness of electricity distribution systems for mass battery charging, substantial increase of electricity consumption, etc. shall be taken into the account when evaluating the electromobility contribution to GHG reduction.	The externalities related to LIBs are discussed and recylcyling and reuse has also been discussed. The issues related to robusteness of grid etc are covered within charging infrastructures	Radek Svoboda	Czech Nuclear Society	Czech Republic
43097	23	21	23	22	(1) high energy density for long distance travel and lower impact on vehicle payload.	Rejected unclear comment	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
10007	23		44		Sub-Chapter 10.3 1. Did electric vehicle and fuel conversion coherent to manage the mobility demand as stated in sub sub-chapter 10.8.1? Did electric vehicle and fuel conversion create a new market or pushed to issue compulsory regulation (single market)? 2. Each of battery vehicles has a lifetime. In order to make coherent with other chapter, you should notice the sustainable e-waste management on battery vehicles. How it will be?	Accept : EV in itself can't manage mobility demand and are discussed in Section 10.2. We do highlight issues with battery waste and need to promote reuse and recycling	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
15509	24	1	24	3	Is there a way to simplify this figure or perhaps otherwise put it in a technical appendix? Its too complicated for body text and hardly explained.	Noted.	Ryan Falconer	Auckland Council, New Zealand	Australia
43779	24	6	24	8	I would add that "primary" means "non-rechargeable".	Accepted. Added non-rechargeable	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
65025	24	6	24	6	Perhaps define a 'Primary Battery'?	Accepted. Added non-rechargeable	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
79153	24				Fig. 10.3 is missing all the rechargeable alkalines enabled by e.g. Ionic Materials' solid polymer electrolyte, such as MnZn and MnAl. Eliminating the liquid electrolyte also gets rid of many issues that make good batteries so hard, such as dentrites, migration, and corrosion, and enables chemistries containing nothing costly, scarce, toxic, or flammable. And I don't think the safe Li-air option enabled by their solid polymer electrolyte has the specific-power limit mentioned at 26:19. I haven't looked up Cano et al 2018, but wonder why they assumed dual-battery rather than ultracap buffering. (In passing: under the misspelled "Ultracapacitor" heading, a European inventor claims to have a nanostructured device, probably an ultracap, with greater energy density than liquid fuel. This is not barred by the laws of physics, so I can't exclude the possibility he might. If so, and if safe and affordable, it would electrify everything including longhaul airplanes.)	Noted. Will take it along with revision for Figure 10.3	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
43781	25	3	25	3	I think "per unit mass" is more appropriate than "per unit weight".	Agree . Changed Weight to Mass	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
53575	25	3	25	3	Clarification that several factors will contribute to lowered cost of batteries, not only declining upfront purchase cost. Longer life (measured in charging cycles), reduced wear at greater charge rates, and better value recovery at end of life are expected to contribute as much. Batteries that last longer and tolerate higher charging power also mean that capacity buffers that are left today can be shrunk, which enables smaller and cheaper batteries.	Noted. Will identify literature that supports this point	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
70333	25	4			"improvements will occur".... ; is there enough certainty for such a predictive statement?	The statement is based on paper of Placke et al., 2017	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
70335	25	6	25	17	If focus is on LIB why this "historic" discussion of preLIB? Sounds inconsistent.	Noted. Will take a call on this after TSU review. Some shortening has already been done for Pre LIB section	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
28751	25	12			"hybrid electric vehicles (EVs)" --> HEVs	Accepted. Done	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
63225	25	12	25	12	hybrid electric vehicles should be called (HEV) instead of EV.	Accepted. Done	Government of Canada	Environment and Climate Change Canada	Canada
28753	25	18			To further diversity your references, you may wish to cite in the LIB section also https://doi.org/10.1016/j.rser.2018.03.002	Accepted and will add the reference after TSU review. Zubi, G., Dufo-Lopez, R., Carvalho, M., & Pasaoglu, G. 2018. The lithium-ion battery: State of the art and future perspectives. Renewable and Sustainable Energy Reviews, 89: 292-308.	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy
47109	25	18	25	21	Chapter 10, page 25, line 18-31, the discussion of li-ion battery (LIB) "in 2018 the cost had come down to about 176 USD per kWh (Goldie Scot, 2019) and further since then (Figure TS.8)." However, the subplot in Figure TS.8 from Technical Summary titled "Electric LI-ON battery packs" shows LIB cost at around $75/kWh in 2018, which contradicts cited data from Goldie Scot 2019, and the subplot in Figure TS.8 has no other citation to support the extreme low cost for LIB packs, and none of the citations (including Goldie Scot 2019, Schimdt 2017, International Energy Agnecy 2019a) related to LIB cost in this paragraph supports cost values show in the subplot in Figure TS. 8 for "Electric LI-ON battery packs". As is, Fig TS.8 is incorrect. Either it needs to be corrected, or using Fig TS.8 should not be included as supporting information.	Noted.	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
53577	25	18	25	31	It would be extremely informative if it would be possible to include a lifetime cost development curve over time for batteries (not only figures for upfront purchase cost). It would be calculated something like (purchase_cost - residual_value) / charge_cycle_life_time	Rejected. Beyond the scope of the synthesis	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
78755	25	18	26	2	Greim et al. (https://www.nature.com/articles/s41467-020-18402-y) have studied in much detail the criticality of LIB and found even in highly ambitious BEV scenarios that the lithium demand can be managed, while very high collection and recycling rates are mandatory; and other measures, such as longer lifetimes etc. did not have much impact on the overall criticality. This further confirmation of the doability of the BEV pathway should be helpful for this section.	Accept Wil add reference in the text after TSU review Greim, P., Solomon, A. A., & Breyer, C. 2020. Assessment of lithium criticality in the global energy transition and addressing policy gaps in transportation. Nature Communications, 11(1): 4570.	Christian Breyer	LUT University	Finland
4035	25	21	25	21	Stats on battery costs are out of date. There are many reputable sources with updated figures (such as BNEF which is referenced throughout): https://about.bnef.com/blog/battery-pack-prices-cited-below-100-kwh-for-the-first-time-in-2020-while-market-average-sits-at-137-kwh/	Accept Will revise battery costs	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
79155	25	21	25	21	Surely it's worth mentioning that according to BloombergNEF's authoritative market data, three major OEMs in 2020 (VW, Tesla, CATL) all got their LIB pack prices to ≤$97, lowest $96/kWh, in 2018 $, while the average was $122. Your sources projecting $100/kWh in 2030 were a decade off. Tesla's 22 Sep 2020 Battery Day brief made a convincing case, also to Sandy Munro, for a 56% pack-level cost drop from its 2468 format at scale (https://tesla-share.thron.com/content/?id=96ea71cf-8fda-4648-a62c-753af436c3b6&pkey=S1dbei4). The lag between your peer-reviewed sources and canonical market data seriously reduces policymakers' and public understanding of how fast this field is moving; it's ironic that 26…27 cites a 2015 reference for the importance of technology readiness of batteries, when virtually all 2015 projections proved so wrong. And of course the 2–4x vehicle efficiency gains described in my comments on 22:22–44 and 5:21–25 make battery price 2–4x less important, so you need to mention that sensitivity to tractive load (for the same range) as well.	Accept Will revise battery costs	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
4037	25	26	25	27	"Schmidt et al. (2017) project that the cost of LIBs will be around 100 USD per kWh in 2030, however, some are projecting prices around 80 USD per kWh by 2030 (International Energy Agency 2019a). Price parity between EVs and equivalent combustion engine vehicles is expected at LIB prices of around 100 USD per kWh." -As above, late 2020's or 2030 is very late to hit $100kwh (see above article – BNEF is forecasting that average prices will be at this level by ~2023) Obviously price parity will vary by country and will depend on any incentives available, but this indicates that price parity may not occur until 2030 which sounds very late (market view is ~2025) -It is also worth noting the concept of TCO, which we believe will become much better understood by the public in the coming years	Accept Will revise battery costs	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
47905	25	26	25	26	It was surprising to not see BNEF being referenced when tlking about battery pricing, it is a key ref that should be added: https://about.bnef.com/blog/behind-scenes-take-lithium-ion-battery-prices/; https://about.bnef.com/electric-vehicle-outlook/	Reject : BNEF has been used	Matteo Muratori	NREL	United States of America
63227	25	26	25	27	A 2020 BloombergNEF study shows that the battery pack prices, which were above $1,100 per kWh in 2010, have fallen 89% in real terms to $137 per kWh in 2020; it also forecasts that the average prices will be close to $100 per kWh by 2023 (https://about.bnef.com/blog/battery-pack-prices-cited-below-100-kwh-for-the-first-time-in-2020-while-market-average-sits-at-137-kwh/), which is quicker than the two studies quoted in the report.	Accept Will revise battery costs	Government of Canada	Environment and Climate Change Canada	Canada
85525	25	26	25	27	Please specify that you are talking about pack prices, not cell prices. You mention that peer reviewed sources from 2017/2018 predict battery price will be 100 USD by 2030 and mention the IEA 2019 as a source that predicts 80 USD by 2030. However, the IPCC also uses Bloomberg New Energy Finance (BNEF) in multiple locations already and their yearly battery survey is considered to be the most authorative source on battery prices by the EV industry and community. (summary here: https://about.bnef.com/blog/battery-pack-prices-cited-below-100-kwh-for-the-first-time-in-2020-while-market-average-sits-at-137-kwh/) It finds that average *pack* prices where $137 in 2020 over all categories and $126 for electric vehicles. They predict a price of $101 for all categories by the end of 2023 and find there is a clear path to achieve that. On a *cell* level the price is already $102 (and probably slightly lower for the EV category). They expect $58 on the pack level in 2030 but don't know yet what path developments will take to achieve that. I could imagine adding this insight to line 27. For example: "however, recent market reports are projecting pack prices of 80 USD in 2030 (IEA 2019a) or even 58 USD in 2030 (BNEF 2020x)."	Accept Will revise battery costs	Auke Hoekstra	Eindhoven University of Technology	Netherlands
52459	25	27	25	29	Is the price parity argument based on upfront price or total cost of ownership? Clarify and provide suitable references to support the statement.	Accept. Will clarify this	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
53579	25	27	25	27	For the claim about price parity, specify what region this was calculated for. Diesel prices, electricity prices and policy instruments vary so much around the world that price parity is only partially dependent on technology development.	Accept. Will clarify this	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
85527	25	27	25	29	I find this use of 100 USD/kWh as the yardstick for price parity between EV and ICE a bit beneath the IPCC. Obviously it depends on the use case (more km make for a shorter payback time but range requirements can be detrimental), the country (with its taxes on petrol and electricity), the car segment (break even is reached faster for expensive cars with large motors), and many more factors. Also this number of 100 USD/kWh has been doing the rounds for a long time and is suspiciously conveniently rounded. But it's not complete nonsense either. If you really want to keep it in I could imagine rephrasing it as: "Price parity between EVs and equivalent combustion engine vehicles for the majority of use cases and car segments is often assumed to be at LIB prices of around 100 USD per kWh."	Accept. Will clarify this	Auke Hoekstra	Eindhoven University of Technology	Netherlands
28717	25	28	19		Please specify the kind of decoupling that is happenening. Relative decoupling is well-known and documented. Alsolute decoupling is very scarce. You may wish to pint out Buthan as a rare case.	Reject : Line reference is wrong	louis lubango Mitondo	United Nations	Ethiopia
28755	25	28			What is the underlying electric driving range and/or battery capacity?	Accept. Will clarify this	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy
47111	25	30	25	30	As mentioned above, the "Electric LI-ON battery packs" part of figure TS.8 is both incorrect and not supported with citation. As such, it should not be used as a reference here.	Noted.	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
81563	25	32	25	35	Updated EV and battery material scenarios are available in the Global EV Outlook 2020 (the reference currently cited is Global EV Outlook 2019). The EV30@30 scenario has been updated to the Sustainable Development Scenario and provides updated material demand insights. https://www.iea.org/reports/global-ev-outlook-2020.	Accept : Will revise	Marine Gorner	International Energy Agency (former)	France
79233	25				For section 10.3.1.1. Lots of excellent information on the progress of different battery technologies, a summary plot for this section of technology learning curves for battery types would be very useful to communicate cost reductions to date, and estimated cost reductions necessary per battery type to achieve widespread deployment.	Noted: Will look for literature on this	Martino Tran	UBC	Canada
53581	26	1	26	2	It's not true that no governments focus on battery recyclability. The EU is introducing legislation around this, and I think some asian countries have pretty strong focus on it as well (not sure if at industry or government level)	Accept : Will revise	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
1295	26	3	26	25	All-solid-state-batteries are mentioned, but no details are given. It would be nice of a short paragraph is added about this technology, like it is done for zinc-air batteries.	Noted: Will look for literature on this	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
53583	26	4	26	4	cursive ph in sulphur	Accepted : Done	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53585	26	7	26	7	cursive ph in sulphur	Accepted : Done	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
10783	26	33	26	35	Would you say that as far as batteries go the prevailing situation of LIB is close to a lock-in?	Yes in terms of TRL LIBs are quite ahead	Philippe Waldteufel	CNRS	France
53587	26	33	26	35	Incorrect claim that LIB are at insufficient TRL to be applied in heavy duty trucks. Such products are in series production from several manufacturers, and the limit to customer adoption is lack of charging infrastructure. The best business case is for the vehicles that are used most, e.g. long haul trucking, as CAPEX is higher than ICE and OPEX is lower, but this is also the segment for which charging infrastructure needs to have the greatest coverage.	TRL for BEV with respect to Heavy Duty Vehicles moderated. However looking at the trends from TRL improvement for cars (Nykvist et al.,2019) this will depend on the further reduction in battery costs and higher energy densities.	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
69797	26	33	26	35	LIBs are already being used for short haul shipping (e.g. ferries) and heavy trucks. The current sentence is ambiguous as it is not clear that "long hault" is meant to apply to marine ships and heavy duty trucks as much as to aviation.	Sentence has been rewritten to seperate heavy duty vehicles from shipping.	Cédric PHILIBERT	Institut Français des Relations Internationales	France
69799	26	35	26	37	LIBs are replacing lead acide batteries for e-scooters already.	Revised the sentence to reflect this reality	Cédric PHILIBERT	Institut Français des Relations Internationales	France
85529	26	35	26	41	The tekst states: "LIBs are unlikely to significantly replace the lead acid batteries which have been used extensively till now for auxiliary power applications and in some low-cost electric vehicles." Now I understand that replacement will take time, especially with LIB being still relatively scarce and wholesale contracts dominating the market. But if you think about it this contradicts what is described elsewhere about LIB. For large automakers, lithium ion batteries that are bought in bulk are already cheaper than lead acid, especially if you acount for usable capacity, and then LIB lasts about five times longer. So I know Cano is a good source but I would bring the entire paragraph in line with Ding at al (line 41). A simple example here claims LIB is already cheaper at 500 USD/kWh. It's not peer reviewed but shows the elementary calculation behind the assertion. https://www.powertechsystems.eu/home/tech-corner/lithium-ion-vs-lead-acid-cost-analysis/	Revised the sentence to show that LIB are going to replace lead acid batteries	Auke Hoekstra	Eindhoven University of Technology	Netherlands
69801	26	41	26	41	One important innovation derived from the improvements in LIBs has been the emergence and successful deployment of electically-assisted cycles.It is difficult however to appreciate to which transport mode they substitute the most: standard cycling, walking, or use of motorised transport modes, but probably a mix, meaning they have some effects in mitigating GHG emissions. They also contribute to accomodate the public with electric vehicles.	We have mentioned electric assisted cycles relying on LIBs.	Cédric PHILIBERT	Institut Français des Relations Internationales	France
28757	27	5			I miss cost information in this section (especially for high-power charging -page 18, line 18-). [I can see that cost info on infrastructure is provided in the section on H2].	Accepted and changes made	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy
47907	27	5	27	5	This section seems to lack some seminal refs on charging infrastructure: https://doi.org/10.1016/j.trc.2013.11.001, https://doi.org/10.1016/j.trd.2013.02.014, https://doi.org/10.3141/2252-07, and recent works in: https://doi.org/10.1016/j.trd.2020.102609	Accepted and changes made	Matteo Muratori	NREL	United States of America
65027	27	13	27	15	Since 2017 when this reference is from the average range has jumped form around 100km to 400km making public charging infrastructure a marginal service at best (as it says in line 33 as 10% of charging and this will likely decrease rather than increase) rather than positing it as a key factor in the uptake of EVs as suggested here. Perhaps add a line like "Since 2017 however the range of EVs has increased substantially and this suggests that public charging infrastructure will be much less of a concern given that vehicles charged overnight at home can have a range of as much as 400km. It is likely that for long haul trips the provision of rapid charging options will be required but the majority of charging is likely to take place in the home or at work rather than a public charge station.	Accepted and changes made	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
4039	27	14	27	18	“reliable charging infrastructure networks are required to build confidence in the technology, and overcome the often-cited barrier of ‘range anxiety’”. -It also plays an important role in providing equitable access to low carbon transport (e.g. for those who do not have access to off-street charging)	Accepted and changes made	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
28759	27	15			I miss here a sentence clarifying that today's EVs have driving ranges that meet the average travel needs of most drivers.	Accepted and changes made	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy
56813	27	15	27	15	Stating the median light duty EV driving range among current light duty EV models would add valuable context. In the U.S. this figure was slightly over 250mi. for model year (MY) 2020: https://www.energy.gov/eere/vehicles/articles/fotw-1167-january-4-2021-median-driving-range-all-electric-vehicles-tops-250 It may also be worth noting the meaningful impacts of extreme cold weather and other environmental factors (excessive heat, wind, terrain, grades) on EV range performance.	Accepted and changes made	Government of United States of America	U.S. Department of State	United States of America

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
65029	27	23	27	23	Actually most EVs now come with easy to use charging cords that plug directly into a standard power point (either 10 or 15 amps) and special equipment is not needed, so appartment dwellers just need access to a power point… rather than policy changes...	Rejected, manufacturers and electricians recommend these mobile chargers are not used as the main charger as it can lead to safety issues with repetitive high loading on the same powerpoint. These chargers are for infrequent, mobile use.	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
47909	27	34	27	34	The share of private/public charging varies a lot, but in the US ~80% of charging is done at home: http://mydocs.epri.com/docs/PublicMeetingMaterials/ee/000000003002013754.pdf	Accepted and changes made	Matteo Muratori	NREL	United States of America
65031	27	36	27	36	This may no longer be the case with the increase in range of vehicles.	Accepted and changes made	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
43783	28	1	28	1	You could consider using a log-scale in Fig. 10.4 to enhance the small circles close to the origin of the axes.	Accepted but beyond scope of changes already made in the text.	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
28761	28	2			Figure 10.4: 2015/2016 data seems to be outdated in this rapidly evolving system.	Accepted and changes made	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy
4041	28	6	28	6	May be worth explicitly stating interoperability is key (albeit this may be covered in “accessible”?)	Accepted and changes made	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
43785	28	6	28	6	"accessible, close to amenities, safe, and affordable", what about also "fast"? Time for recharging is also an important criterion.	Accepted and changes made	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
78897	28	7	28	8	Economic analysis in Sweden, Germany and the UK suggests that highway electrification would represent a cost effective means of decarbonising long haul trucking e.g. http://www.csrf.ac.uk/2020/07/white-paper-long-haul-freight-electrification/	Accepted and changes made	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
56815	28	10	28	12	The density of charging stations and availability need to be taken into account to allow for equitable availability of EVs in urban and rural areas. This will also support long-distance travel in EVs.	Accepted and changes made	Government of United States of America	U.S. Department of State	United States of America
28561	28	17	28	24	Note that, for shipping (in particular ferries), common standard enablers of cost reductions) are still missing. See https://www.itf-oecd.org/navigating-towards-cleaner-maritime-shipping. Note also that standards are also not finalised for high power charging for road vehicles, nor for electric road systems (https://www.itf-oecd.org/regulations-and-standards-clean-trucks-and-buses).	Accepted and changes made	Pierpaolo Cazzola	International Transport Forum	France
79157	28	17	28	24	As my comment on 5:27–39 noted, the recharging-infrastructure investment including grid is significant but worthwhile, and can be spread by proper scheduling like aircraft landing slots and mitigated by demand-response, ancillary service sales, energy arbitrage, and other grid transactions. The Mobility House (Zürich), approved as a frequency-stabilization vendor to the German grid since 2918, is active in 10, launching 3, and contemplating a further 7 forms grid transaction. The firm expects €65/y operating profit from each EU operating EV in 2025, and its four-country EU vehicle/grid interaction business is already averaging €1000/EVpack-y, with 1500 EVs and 15 MW under management at 220 sites, plus 4500 spare or used EV batteries from four automakers totaling 35 MW. This is proving very advantageous for e-buses at Schiphol and Oslo Airports. I think it's worth mentioning, therefore, that recharging infrastructure is not only a cost; it also offers potential revenues from the grid. The last paragraph on p 29 hints at this but should make it more explicit.	Accepted and changes made	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
85531	28	17	28	18	The sentence refers to the cost of high-power charging infrastructure. I assumte this refers to the upfront cost which is indeed higher as the power is higher. However, the cost per kW is actually decreasing as chargers become more powerful and the cost per kWh is strongly decreasing. So the business case for high power chargers is usually better. It might be good to point that out.	Accepted and changes made	Auke Hoekstra	Eindhoven University of Technology	Netherlands
53589	28	19	28	20	Include mention of electric roads alongside other infrastructure placements	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
4043	28	22	28	24	“Policymakers have an important role to play in incentivising the uptake of charging infrastructure across the entire transport sector in order to ensure a transition can occur in a timeframe congruent with global climate targets.” -It is also worth specifically noting that fair pricing of grid connections / upgrades will be vital for heavier vehicles.	Accepted and changes made	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
53591	28	22	28	22	It is not entirely clear to me what the "timeframe congruent with global climate targets" actually is for this sector. However, I suspect that it's too late to reach the goal only by focusing on electrification. We need fossil-free hydrocarbons to lower the emissions from ICE vehicles already on the roads, which will be in used for another 15-20 years (unless we retire them early or convert them to electric drive).	Later versions clarified this.	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
11293	29	1	29	11	I suggest adding the following sentence, or similar content to this paragraph. "The most widely used form of road electrification is traditional trolleybus catenary used to operate and charge batteries on electric transit buses; this relatively mature technology is referred to as dynamic charging or In Motion Charging and powers buses in a growing number of cities" References with quotes: "Night charging and fast charging are currently the two most common systems for charging electric buses. Despite the fact that numerous trial installations were started, neither of these two systems has obtained unqualified approval of the users. The alternative is to charge vehicles in motion - dynamic charging which combines the advantages of trolleybus transport and of electric buses. One of the advantages is the reduction of risks associated with the electrification of urban transport." (Abstract) Bartłomiejczyk M., Połom M. (2020) Dynamic Charging of Electric Buses as a Way to Reduce Investment Risks of Urban Transport System Electrification. In: Gopalakrishnan K., Prentkovskis O., Jackiva I., Junevičius R. (eds) TRANSBALTICA XI: Transportation Science and Technology. TRANSBALTICA 2019. Lecture Notes in Intelligent Transportation and Infrastructure. Springer, Cham. https://doi.org/10.1007/978-3-030-38666-5_32 / https://www.researchgate.net/publication/338682809_Dynamic_Charging_of_Electric_Buses_as_a_Way_to_Reduce_Investment_Risks_of_Urban_Transport_System_Electrification "In comparison with other electric buses, the in-motion charger is the most cost-effective bus system for high capacity lines" (Abstract) Bergk, F., Biemann, K., Lambrecht, U., Pütz, R., & Landinger, H. (2016). Potential of in-motion charging buses for the electrification of urban bus lines. Journal of Earth Sciences and Geotechnical Engineering, 6(4), 347-362. www.scienpress.com/Upload/GEO/Vol%206_4_21.pdf "Overnight charging works for smaller buses that don't travel far per day. Electric buses that stop and charge at fast chargers can have a role on moderately demanding lines. But the heavy lifting is best done by battery electric trolleybuses, which are the most practical technology for large buses on the busiest and most demanding routes." Doherty E. (2019) "Trolleybuses are one of the UK's best chances to deal with the climate emergency"	Accepted and changes made	Eric Doherty	Ecopath Planning	Canada
29735	29	1	29	2	It could be argued that 3 types of "charging infrastructure" for vehicles is avaliable; plug and induction, mentioned in the text - but also battery swap solutions. This is currently mostly explored by car maker Nio in China (and in micro mobility solutions) but could become a solution for heavy duty vehicles also. Please consider reviewing the text to reflect this information.	Accepted and changes made	Government of Norway	Norwegian Environment Agency	Norway
84987	29	2	29	2	How likely is wireless charging of this type, and what impact is there on upgrading current infrastructure?	Accepted and changes made	Jameel Hayat	AECOM	United Kingdom (of Great Britain and Northern Ireland)
4045	29	6	29	6	Wireless charging has not been proven as commercially viable and this does not come across clearly enough	Accepted and changes made	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
56817	29	6	29	7	Research needed on road electrification in U.S. to reduce stationary charging station needs.	Accepted and changes made	Government of United States of America	U.S. Department of State	United States of America
43099	29	7	29	7	Electric roads systems (ERS) are not exclusively conductive. There are ERS that are recharge by wireless induction and dynamically.	Accepted and changes made	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
4047	29	8	29	11	This description on ERS is rather unbalanced, and could also mention the various drawbacks with such a scheme, for instance: oHugely expensive undertaking from capital outlay perspective oWill take a long time to roll-out across SRNs, during which time other battery chemistries (or even technologies – e.g. FCEVs) are expected to become viable oDoesn't do first and last mile, so still need a battery on vehicle oReliability is poor (owner-operated so won't be maintained to the same level as e.g. rolling stock) oVery expensive to maintain oCarbon requirements for the steelwork are considerable	Accepted and changes made	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
53593	29	9	29	9	Electric roads can also be inductive (which I am surprised to learn might actually be a cost competitive method in regions with very dense traffic, in particular for light vehicles)	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
4049	29	12	29	12	It could be made clearer that there are pretty much no vehicles available today that can charge at 350kW. It's also worth noting the huge energy / grid requirements associated with these chargers	Accepted and changes made	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
23201	29	12	29	19	For consistency with other parts of the chapter, cost data should be inserted in this paragraph.	Accepted and changes made	Government of France	Ministère de la Transition écologique et solidaire	France
85533	29	12	29	14	Unfortunately no batteries are not able to receive this speed yet and power gets reduced further as the battery becomes closer to charging. I would extend the sentence to clarify that. For example: "…for every 10 minutes of charging (although vehicle batteries usually require the charging to be slowed down considerably)."	Accepted and changes made	Auke Hoekstra	Eindhoven University of Technology	Netherlands

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
10453	29	19	29	19	After line 19, could you please add the following text?: "In Europe have been identified Europe several examples (Rothman, 2020): • Sweden is planning a pilot for about 30 KM ERS for long haul electric trucks on the way to commercial implementation on about 2,000KM1 • Germany's transportation ministry issued a call for wireless ERS demo project • Israel's energy ministry issued its plan for accelerating infrastructure projects to encourage economic growth which included 10KM of ERS in total investment of 50M ILS2 • ENBW, one of Germany's biggest energy companies signed a MOU with Electreon for the test of wireless ERS with ElectReon • Denmark - A research by a Danish university determined that the most cost effective way to electrify all transportation in Denmark and other countries is by wireless ERS • Italy is planning to deploy ERS on the A35 toll road3 • France joined an ERS research effort with Sweden and Germany and is planning two wireless ERS demo projects" Reference: Tiran Rothman. Complementary equity research reports on Electreon Wireless Ltd. 2019 Annual Update. May 25, 2020. Frost & Sullivan. 3211 Scott Blvd #203, Santa Clara, CA 95054. https://ww3.frost.com/files/3315/9058/8341/Electreon_annual19_250520_isa.pdf https://www.frostequityresearch.com/	Accepted and changes made	Aniceto Zaragoza	Oficemen	Spain
11609	29	19	29	19	After line 19, could you please add the following text?: "In Europe have been identified Europe several examples (Rothman, 2020): • Sweden is planning a pilot for about 30 KM ERS for long haul electric trucks on the way to commercial implementation on about 2,000KM1 • Germany's transportation ministry issued a call for wireless ERS demo project • Israel's energy ministry issued its plan for accelerating infrastructure projects to encourage economic growth which included 10KM of ERS in total investment of 50M ILS2 • ENBW, one of Germany's biggest energy companies signed a MOU with Electreon for the test of wireless ERS with ElectReon • Denmark - A research by a Danish university determined that the most cost effective way to electrify all transportation in Denmark and other countries is by wireless ERS • Italy is planning to deploy ERS on the A35 toll road3 • France joined an ERS research effort with Sweden and Germany and is planning two wireless ERS demo projects" Reference: Tiran Rothman. Complementary equity research reports on Electreon Wireless Ltd. 2019 Annual Update. May 25, 2020. Frost & Sullivan. 3211 Scott Blvd #203, Santa Clara, CA 95054. https://ww3.frost.com/files/3315/9058/8341/Electreon_annual19_250520_isa.pdf https://www.frostequityresearch.com/	Accepted and changes made	PEDRO MORA PERIS	UNIVERSITY	Spain
29737	29	19	29	19	Please point to the fast development in this segment. The number 4.4 MW is already been passed by the largest battery electric ferry in the world, running between Horten and Moss in norway, with a charger capable of 7.2 MW. Information are provided in Norwegian in https://www.tu.no/artikler/na-er-verdens-storste-batteriferge-i-drift/507417 and https://basto-fosen.no/nyhetsarkiv/norges-travleste-ferjesamband-blir-elektrisk-article5996-832.html.	Accepted and changes made	Government of Norway	Norwegian Environment Agency	Norway
28565	29	20	29	26	This ITF publication contains extensive information that complements and completes the overview of standards for road vehicles included in IEA, 2019a. I recommend to add it to the references: https://www.itf-oecd.org/regulations-and-standards-clean-trucks-and-buses. The same publication also discusses existing standardization gaps.	Accepted and changes made	Pierpaolo Cazzola	International Transport Forum	France
53595	29	20	29	20	Mention that lack of agreed standards is a major obstacle for introduction of electric roads, in particular across national borders.	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
69803	29	26	29	26	Another option for rapid "charging" is battery swap. It's been chosen by some Chinese manufacturers, such as NIO. In February 2021 there was 5 times more battery swap stations in China than hydrogen refuelling stations (550 vs.110). This options ensures that actual battery charging can take places at times of abundant, low-carbon, cheap electricity, and not during peak hours.	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
47911	29	27	29	27	Refs here seem pretty old (e.g., 2010, 2015, this is before AR5). The literature on smart charging is huge and very dynamic. See a recent literature review: https://doi.org/10.1088/2516-1083/abe0ad	Accepted and changes made	Matteo Muratori	NREL	United States of America
78757	29	27	30	40	V2G functionality has been found to be highly beneficial for the energy system as seasonal balancing can be reduced for the overall benefit in the energy system (https://www.mdpi.com/1996-1073/11/9/2206), while new end-use optima can be found with prosumer self-supply in the combination of residential PV - battery - BEV - V2G functionalities (https://www.sciencedirect.com/science/article/pii/S0038092X19304281). Such insights further highlight the benefits of V2G and necessity to push it further.	Accepted and changes made	Christian Breyer	LUT University	Finland
11675	29	28	29	29	Enphasis on the support also to the TSO on managing the net, that in some European countries are working to explore these opportunities with an increment of recharge points : (EAFO, https://www.eafo.eu/)	Accepted and changes made	CHIARA PUGNALINI	Altran Italy (Energy, Industry, Life Science division), European Commission	Italy
85535	29	35	29	36	I would really appreciate it if you could drop the term "controlled charging". I've been working very hard for ten years to get to that point in the Netherlands. "Controlled charging" has strong connotations of giving away control to another party and users and most politicians dislike it. It's like the term "death tax" that was succesfully introduced in the United States and helped to kill the inheretance tax. It's also not how it's going to work as the end user will probably have contracts with a so called aggregator (who creates a virtual power plan) with opt-out options (we call that "the overrule button" on your smartphone) if you need to charge right away. A quick look on wikipedia also shows that the term smart charging is usually used separate from V2G and I would love to keep it that way. So you would really do many people working on smart charging a big favour if you used that instead of Controlled charging and kept it separate from bidirectional charging aka V2G.	Accepted and changes made	Auke Hoekstra	Eindhoven University of Technology	Netherlands
52549	29	42	29	42	The proposed solutions will depend largly on the maturity and readiness of the grid system. Include this point in the report.	Accepted and changes made	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
56819	30	1	30	2	No reference provided. Suggest modifying this sentence to say: "Potential for smart charging implementation is demonstrated internationally (reference)."	Accepted and changes made	Government of United States of America	U.S. Department of State	United States of America

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
1225	30	2	30	4	There is also a challenge in preventing batteries from more rapid degradation due to a larger number of charging cycles as a result of V2G/smart charging. See for instance https://ec.europa.eu/environment/integration/research/newsalert/pdf/understanding_degradation_battery_life_key_successful_v2g_523na1_en.pdf	Accepted and changes made	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
47913	30	2	30	2	This statement should be backed by a ref (maybe IEA GEVO?)	Accepted and changes made	Matteo Muratori	NREL	United States of America
47915	30	3	30	3	and that there is a business model to compensate consumers for providing flexibility in charging	Accepted and changes made	Matteo Muratori	NREL	United States of America
52461	30	9	30	12	References are needed	Accepted and changes made	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
56821	30	9	30	10	In particular, incentives and innovative approaches are needed to address utility peak demand charges, which are a significant obstacle to EV infrastructure deployment and use.	Accepted and changes made	Government of United States of America	U.S. Department of State	United States of America
52463	30	20	30	22	Clarify the baseline scenario to which the V2G scenario has been compared.	Accepted and changes made	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
43101	30	32	30	32	The author quotes a value of £12bn from a 16 years old reference (Kempton and Tomić, 2005). Either the value of £12bn is updated to 2021 value or a more recent reference should be used, which in itself could show different value as the grid has changed a lot in this time.	Accepted and changes made	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
53597	31	1	31	3	I find this figure difficult to understand, especially the right half. It needs more discussion in the text. It's also low resolution.	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
30547	31	3	31	16	"45000h" is stated as the life span of the LED. However, this is data on catalog and differs from the actual life span including the failure probability. It would be better to describe the actual life span, taking into account the failure probability.	This is for Subash? (Editorial_Fig was deleted)	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
43103	31	8	31	9	In particular, LIB...". If this is about LIB the statement is not correct as these do not contributed to lower cost of electric vehicles. Maybe the author meant something else.	Noted. Thanks	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
23203	31	22	31	23	This sentence is a bit unclear	Noted. Thanks	Government of France	Ministère de la Transition écologique et solidaire	France
30417	32	11	40	8	10.3.2 Hydrogen Fuel Cell chaper discribes current stautus and future challlenge well. There looks no concerned explanation. I fully support this chapter.	Accepted and changes made	Hiroyuki Fukui	company	Japan
43105	32	11	32	22	This reference has a very good figure that illustrates pathways. Staffell, I., et al. (2019). "The role of hydrogen and fuel cells in the global energy system." Energy & Environmental Science. Figure 14.	To be investigated	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
81949	32	11	40	8	With the arrival of hydrogen trains, it would be helpful if technology efficiency / cost comparison for trains would be covered here as well.	To be dealt with later in the chapter	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
66201	32	12			change were to are	Accepted and changes made	Adam Weber	Lawrence Berkeley National Laboratory	United States of America
4645	32	13	32	14	delete: "Whilst not as spectacular ...nevertheless". (H2 is one very important pillar in transport emission reduction.	Rejected	Ulf Groos	Fraunhofer ISE	Germany
53599	32	13	32	13	IPPC -> IPCC	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
61151	32	13	32	13	IPCC instead of IPPC.	Accepted and changes made	Su Song	Young Crane Consulting	China
76151	32	13	32	13	IPPC --> IPCC	Accepted and changes made	Jan Fuglestvedt	CICERO	Norway
86835	32	14	32	15	With regards to the phrase" Hydrogen is seen as an important potential energy carrier for supporting the decarbonisation of the heavy vehicle sector", we suggest replacing "the decarbonisation of the heavy vehicle sector" by "a sustainable heavy vehicle sector", in line with the 2030 Agenda and its SDGs, in particular SDG 11.2 ("By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all...".	Accepted and changes made	Government of Argentina	Ministry of Environment and Sustainable development of Argentina	Argentina
4647	32	16	32	18	delete sentence. Instead: "Efficiency comparisons of hydrogen fuel cells and batteries must take into account the local and global generation of renewable energy: if RE is generated locally, the direct use in batteries is most efficent. Regarding regions, which cannot be supplied fully be local RE and which are dependent on imported RE, hydrogen might be the most efficient and cost effective energy carrier for global trade of RE. Thus, for this regions, the well to wheel efficiency of hydrogen fuel cells might be higher than reconverting hydrogen into power and recharging batteries.	Accepted and changes made	Ulf Groos	Fraunhofer ISE	Germany
53601	32	16	32	16	Double "Tokimatsu et ak., 2016"	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
43107	32	18	32	18	This section could benefit from additional content. 'While low carbon hydrogen is paramount to decarbonise suitable transport modes, different feedstocks, pathways, boundaries, and carbon intensity thresholds are currently being used in certification schemes to characterise hydrogen (e.g. low carbon for electrolytic hydrogen from nuclear, green hydrogen for electrolytic hydrogen from renewables, grey hydrogen for hydrogen produced via SMR)'. Source: Velazquez Abad, A. and P. E. Dodds (2020). "Green Hydrogen Characterisation Initiatives: Definitions, Standards, Guarantees Of Origin, and Challenges." Energy Policy 138: 111300.	Accepted and changes made	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
86667	32	19	32	21	as above, disagree with the reliance on synthetic fuels	Accepted and changes made	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
4649	32	21	32	21	delete "the only way" and insert "an approbiate way"	To be investigated	Ulf Groos	Fraunhofer ISE	Germany
56823	32	23	33	11	Section 10.3.2.1 does not include any information about the use of hydrogen fuel cell forklifts. This is significant because forklifts are the first type of transportation equipment where fuel cells have reached commercial competitiveness with diesel and Li-ion batteries. In the USA alone, there are tens of thousands of fuel cell forklifts currently in operation. This is also an important phenomenon to observe because it demonstrates a set of use cases that are likely to be difficult to electrify with batteries for which fuel cells are likely to be a good solution. Use cases that require more or less continuous operation of equipment, with no significant regular downtime where charging can occur, present substantial challenges for batteries. This is the case even when the vehicles themselves are not particularly large. The current discussion of battery and fuel cell technology suitability seems to be overlooking this nuance.	Rejected, outside scope	Government of United States of America	U.S. Department of State	United States of America

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79159	32	24	32	29	Corrrect and important price data (described as cost). How odd that electrolyzers are often assumed to cost an order of magnitude more even though in the main they're little more than PEMFCs backwards. (There are electrode and other differences, but they don't look very important.) Perhaps worth noting this presumably volume-based discrepancy when you discuss electrolytic H2. Also, importantly, how much FC, tank, and other system size and cost you need depends on your platform's tractive load. Our 0.64 kgH2/100 km midsize SUV design in 2000 ((Lovins & Cramer, "Hypercars®, hydrogen, and the automotive transition," Intl. J. Veh. Design 35(1/2):50–85, 2004, https://www.rmi.org/insight/hypercars-hydrogen-and-the-automotive-transition/), much inferior to what it'd be today, needed only a 35-klW fuel cell + 35 kW battery buffer (cheaper at the time than all-PEMFC) for normal SUV performance: its 3x lower tractive load mae its H2 tanks 3x smaller (so they packaged well with 1990s tech at 350 bar) and its PEMFC 3x smaller, so we could have paid 3x more per kW. At a standard 80% experience curve, say, you'd then need ~32x less cumulative production volume to reach a competitive pricepoint, speeding the H2 transition by a decade or two—as my NHA pepr pointed out in 1999, integrating stationary and mobile uses of H2 so each helps the other happen faster. I don't see much of that thinking nowadays.	Accepted and changes made	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
56825	32	25	32	25	FCEVs also generally demonstrate longer driving ranges than comparable EVs.	Rejected, not backed by evidence. Driving range for EVs is actually longer.	Government of United States of America	U.S. Department of State	United States of America
63091	32	25	32	27	The cost of fuel cell system (at approximately $50 per kW) is too low, please check.	Accepted and changes made	Changke WANG	National Climate Center, China Meteorological Administration	China
28763	32	26			"$50 per kW": in 2020? I also miss the reference/source of information.	Accepted and changes made	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy
45571	32	26	32	27	The 50 and 100 $/kW reported here are musch less than the 200 - 6000 $/kW numbers in Table 10.3. Or are the system boundaries different?	Accepted and changes made	Kornelis Blok	Delft University of Technology	Netherlands
66209	32	26			Should be and are and not at and also should note those costs are at projected high volume manufacturing	Accepted and changes made	Adam Weber	Lawrence Berkeley National Laboratory	United States of America
75791	32	26	32	28	All the cost numbers quoted are for a high manufacturing volume. This is fine for DoE because they focus on research and want to quantify the performance gap in research. In reality, there is an additional cost penalty today due to the low volume of fuel cell manufacturing, so the fuel cell cost for trucks is about USD 190/kW at 1000 systems per year [9] and even USD 250-290/kW for 200 systems per year [10] (slide 6). Perhaps it can be mentioned in a single sentence that there are those two major levers to reduce the cost (manufacturing capacity; research) [9] https://www.hydrogen.energy.gov/pdfs/19006_hydrogen_class8_long_haul_truck_targets.pdf [10] https://www.hydrogen.energy.gov/pdfs/review20/fc163_james_2020_o.pdf	Accepted and changes made	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
53603	32	27	32	27	kw -> kW	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
4651	32	30	32	32	around 4 kW/L, and average durability has improved to fulfill the commercial application targets (fuel cells have proven their technological readiness for cars, trucks, busses, ships, and trains)	Rejected, references included to show durability targets not yet met	Ulf Groos	Fraunhofer ISE	Germany
66205	32	31			From the table you present and DOE reports the lifetime is at least 5000 hours not 2000	To be investigated but believe 2000 is correct.	Adam Weber	Lawrence Berkeley National Laboratory	United States of America
75793	32	31	32	31	Three related comments: - Perhaps mention that durability depends on the requirements of the application. For instance, for cars, it was already above 4000 hrs a couple of years ago [11] (slide 9) and [12] (page 41) - There is a cost-durability trade-off. The fuel cell could easily be made to last 10000 hrs today. The problem is that will come at a higher PGM content and therefore higher cost - Put it in perspective and mention that the target is about 5000 hrs for cars [12] and 30000 hrs for trucks [9] [11] https://www.hydrogen.energy.gov/pdfs/review19/plenary_fuel_cell_papageorgopoulos_2019.pdf [12] https://www.fch.europa.eu/sites/default/files/MAWP%20final%20version_endorsed%20GB%2015062018%20%28ID%203712421%29.pdf	Accepted and changes made	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
4653	32	32	32	40	delete section: also batteries need purpose designed cars and one cannot just replace the engine. The section shows a tendency, but it is obvious that any new power train needs new vehicles... If one read the world-wide (also US, European, German, etc.) hydrogen rodmaps especially fuel cell trucks are very much seen as "must have" for 2030!	Rejected	Ulf Groos	Fraunhofer ISE	Germany
53605	32	34	32	35	Cost of hydrogen fuel cells is compared here only against diesel (and only in the US). It would be more informative to compare it against what is expected to be the lowest TCO technology at the time FCs reach 30,000 hours durability, i.e. battery electric. In particular as diesel is not even seen as a sustainable alternative, and taxation will (hopefully) change to make it a less attractive option.	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
28765	32	38			You may wish to check the perspectives for market development in Europe in this report from an international organisation: https://op.europa.eu/en/publication-detail/-/publication/fd62065c-7a0b-11ea-b75f-01aa75ed71a1.	Accepted and changes made	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy
30419	32	38	32	40	For long-haul truck, fuel cell truck could have a room to expand in 2050. If you read IEA ETP2020 (Figure 5.6, page 263), you will find powertrain mix of medium and heavy duty truck in 2040 and 2070. In 2040, most of them would be linternal Combustion Engine including HV, but in 2070, half of medium duty truck would be BEV whereas half of heavy duty truck would be fuel cell. So long-haul fuel cell truck has a chance to expand in 2050 timeframe.	Accepted and changes made	Hiroyuki Fukui	company	Japan
47917	32	39	32	40	This statement seems an extrapolation of the ref provided. Maybe rephrase as "The US DOE highlights the need for continuing improvements in fuel cell durability to achieve significant market adoption"?	Accepted and changes made	Matteo Muratori	NREL	United States of America
66207	32	39			The DOE Hydrogen Roadmap has earliler adoption targets that should be cited	Accepted and changes made	Adam Weber	Lawrence Berkeley National Laboratory	United States of America
4655	32	42	32	42	add Korean	To be investigated	Ulf Groos	Fraunhofer ISE	Germany
66203	32	46			I would number of vehicles that those capacities should service	To be investigated	Adam Weber	Lawrence Berkeley National Laboratory	United States of America
4657	33	1	33	1	replace "demonstration trials" by fleets (the demonstration phase is over, now commercial deployments are starting)	Rejected only trials at present.	Ulf Groos	Fraunhofer ISE	Germany
43109	33	1	33	7	There are currently hydrogen fuel cell heavy goods vehicles in Switzerland commercialised by Hyundai (Hyundai Xcient). Not as trials or demo but commercially available.	Rejected; Still a trial - not anyone can purchase.	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
4659	33	2	33	2	replace trials by implementations	Rejected	Ulf Groos	Fraunhofer ISE	Germany

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
28767	33	3		4	You may find more recent data on the stock of fuel cell HDVs at the European Alternative Fuels Observatory (EAFO)'s web: https://www.eafo.eu/vehicles-and-fleet/m2-m3.	Accepted but beyond scope of changes already made in the text.	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy
84185	33	5	33	7	China has by far the most heavy-duty fuel cell vehicles, with a fleet of over 2,000 buses and over 1,500 trucks (Deloitte China, 2020) this compares to over 1000,000 LIB buses (Bloomberg, 2020). An updated version is: "Around 6,000 heavy-duty fuel cell vehicles (buses and trucks) were on the street in China, at the end of year 2019". IPHE, "China Update", July 2020, [available at < https://1fa05528-d4e5-4e84-97c1-ab5587d4aabf.filesusr.com/ugd/45185a_b2837d07a2844db3b934c0a8278252ec.pdf >].	Accepted and changes made	Mario Valentino Romeri	Independent consultant	Italy
4661	33	6	33	6	really 1 Mio LIB busses?	Yes, see IEA ref	Ulf Groos	Fraunhofer ISE	Germany
28769	33	6			Please check LIB value and source.	Accepted	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy
53607	33	6	33	6	1000,000 -> 1,000,000	Accepted	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
66215	33	6			should be 100,000 I believe	Rejected, see IEA ref	Adam Weber	Lawrence Berkeley National Laboratory	United States of America
43111	33	11	33	11	I would add: "There is no doubt that hydrogen can play a key role for green growth in national industrial strategies and countries around the world are developing policies to this extent. " Dodds, P. E., Velazquez Abad, A., McDowall, W., Fox, G.I. (2020). Opportunities for Hydrogen and Fuel Cell Technologies to Contribute to Clean Growth in the UK. London, H2FC Supergen	Accepted and changes made	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
4663	33	13	33	13	delete sentence. Commercial deployments today show the maturity of fuel cell technologies in mobile applications. The cost aspects are still to be proven but the technology is market ready, see market deployment worldwide.	Rejected	Ulf Groos	Fraunhofer ISE	Germany
66213	33	13			How can it be immature if it is already commericalized and there are warranties that argue against reliability. The issue is that today they are overdesigned and so key is to maintain performance and durability at lower cost	To be investigated	Adam Weber	Lawrence Berkeley National Laboratory	United States of America
4051	33	18	33	18	I think it's worth explicitly stating that 'Green Hydrogen' is a particular challenge from a refuelling perspective.	Accepted and changes made	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
4665	33	19	33	22	delete paragraph: this was written by a battery enthusiastic.. Batteries in trucks and especially in aviation are (like fuel cells) demonstration and trials. Today, the arguments point towards fuel cells, but we will see.	Rejected	Ulf Groos	Fraunhofer ISE	Germany
53609	33	19	33	19	This paragraph is comparing the state of hydrogen fuel cell technology after 2030 to battery electric technology today. This comparison is unhelpful at best and risks being outright misleading. Ensure that comparisons are made under the same assumptions of timeframe, technology development rate (of common tech such as batteries and electric motors), electricity production capacity, electricity prices and diesel prices (incl. tax). Any technologically feasible improvement of ICE technology is also unlikely to be realized beyond the point in time when another technology is expected to become cheaper.	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
52465	33	22	33	22	Reference is needed to support that hydrogen-based fuels will become cost competitive after 2030	Accepted and changes made	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
4667	33	24	35	1	10.3 conctrate on technologies for mobility and delete lines AFC, PEMFC stationary, SOFC, PAFC, MCFC. PEMFC mobile 30 to 1000 kW (range extender up to ship power train), 45 US$/kW (see DOE study, which was cited before), > 10,000 hours. Replace Fuel Cell Vehicles by Light-duty Fuel cell Vehicles.	To be investigated	Ulf Groos	Fraunhofer ISE	Germany
53611	33	24	33	24	Unclear what "TanD" means	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
66211	33	24			For the table, the PEMFC mobile is for LDVs but it is modular and so HDV just has more stacks currently and those numbers do not reflect that	Accepted and changes made	Adam Weber	Lawrence Berkeley National Laboratory	United States of America
66217	33	24			There are newer DOE reports than 2010 and 2016 that can be referenced and used for the numbers including 2020	Accepted and changes made	Adam Weber	Lawrence Berkeley National Laboratory	United States of America
23205	33		33		Table 10.3 : The table is hard to read. Parts 1 and 2 share the same title. We recomand to define the acronyms somewhere	Accepted and changes made	Government of France	Ministère de la Transition écologique et solidaire	France
84187	33		35		As I said in my FOD comment, I think that we made a mistake with regard to the title of Table 10.4. The correct title is not "Table 10.4 Current performance of key technologies of H2" but "Table 10.4 Performance of key technologies of H2 at 2014, or at 'AR5 Time'". In fact all sources used for the part I and II are dated 2014 or oldest. Only one source is dated 2015! I'm very surprised of this because, as I said in my first comment, I appreciated very much all the work done in this SOD. But no problem! Table 10.4 need to be completely re-wrote for final version of SOD-Draft. New suggested and updated sources:US DOE "Program Records" [various date, accessible at < https://www.hydrogen.energy.gov/program_records.html>] among others "Hydrogen Production Cost From PEM Electrolysis – 2019" [February 3, 2020; available at <https://www.hydrogen.energy.gov/pdfs/19009_h2_production_cost_pem_electrolysis_2019.pdf>], IEA "The Future of Hydrogen Seizing today's opportunities" [June 2019; available at <https://www.iea.org/hydrogen2019/> and <https://webstore.iea.org/download/direct/2803>], IRENA "Hydrogen: A renewable energy perspective" [September 2019, available at <https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Sep/IRENA_Hydrogen_2019.pdf>], Hydrogen Council: "Path to Hydrogen Competitiveness: A Cost Perspective" [January 2020; available at <https://hydrogencouncil.com/wp-content/uploads/2020/01/Path-to-Hydrogen-Competitiveness_Full-Study-1.pdf >],Martin Tengler, BloombergNEF, 2020, "Green Hydrogen: Time to Scale Up" [available at <https://www.fch.europa.eu/sites/default/files/FCH%20Docs/M.%20Tengler_ppt%20%28ID%2010183472%29.pdf >], IRENA, "Green hydrogen cost reduction Scaling up renewables to meet the 1.5o C climate goal", December 2020, [available at <https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Dec/IRENA_Green_hydrogen_cost_2020.pdf>] and Hydrogen Council and McKinsey & Company, "Hydrogen Insights 2021: A Perspective on Hydrogen Investment, Deployment and Cost Competitiveness" [available at <https://hydrogencouncil.com/wp-content/uploads/2021/02/Hydrogen-Insights-2021.pdf>].	Accepted and changes made	Mario Valentino Romeri	Independent consultant	Italy

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
28567	35	37	39	6	This section fails to acknowledge that a lot of work needs to be developed to ensure that FCEVs can be effectively developed for trucks, as clearly show in this ITF report: https://www.itf-oecd.org/regulations-and-standards-clean-trucks-and-buses. Key areas that are still missing standardisation are refuelling nozzles suitable for heavy duty trucks and refuelling protocols. Work is being developed, but is has not been finalised. More importantly, the report flags also that standards on the Guarantee of Origin of hydrogen are still missing. Given the high relevance of the hydrogen production pathways for effective delivery of GHG emission savings, ensuring that there is greater awareness about the lack of a proper development of these instruments is a paramount piece of information that should be added to the discussion on hydrogen, especially when it comes to its use on heavy duty vehicles.	Accepted and changes made	Pierpaolo Cazzola	International Transport Forum	France
4669	36	2	36	2	add: Fleet applications like public bus transport or regional trains or ships only need a single HRS to supply the vehicles. Thus these applications do not depend on a widespread infrastructure and are the emerging market segments.	Accepted and changes made	Ulf Groos	Fraunhofer ISE	Germany
66219	36	2			Not sure what stationery is	To be investigated	Adam Weber	Lawrence Berkeley National Laboratory	United States of America
69805	36	17	36	18	If hydrogen for mobility is produced at the refuelling station via steam methane reforming, it will not be low-carbon hydrogen as most likely the CO2 emisisons will not be captured.	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
4673	36	18	36	18	… is today typically dispensed … (also 300 bar is seen for busses and liquid or crygenic is under development)	Accepted and changes made	Ulf Groos	Fraunhofer ISE	Germany
4671	36				10.6, regarding trucks, ships, airplanes onboard LH2 storages are discussed, so the last alternative should be dispensing of LH2 to the vehicle	Accepted and changes made	Ulf Groos	Fraunhofer ISE	Germany
69807	37	1	37	1	The density of liquid hydrogen is only twice as high as that of compressed hydrogen (at 70 Mpa): 2.36 vs. 1.25 kWh/l	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
69809	37	2	37	3	However, in large quantities, pipelines of compressed H2 is much more efficient than trucking liquid hydrogen.	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
69811	37	5	37	10	It is not clear while these options are distinct in the short, medium and long term. They are all in use today. They distinguish themselves by the capacity and distance. And - liquefied truck trailers for medium capacity have in fact high fixed costs, as liquefaction plants for relatively small quantities are expensive.	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
63093	37	11	37	12	The new HRS in China have been designed to refuel more than 500 kg of hydrogen per day. Please update this data.	Accepted and changes made	Changke WANG	National Climate Center, China Meteorological Administration	China
28569	37	16	38	7	There are major risks associated with the need for users for hydrogen refuelling stations, since low frequency comes with extremely high unit cost per kg of hydrogen delivered. Similar considerations exist for hydrogen transport and distribution and the importance to ensure that other end-uses can at least share (if not bear them completely, as one could expect for cases requiring large volumes of hydrogen, such as chemical plants) these costs with transport, A problem is that large scale centralized plants are generally conceived to minimize transport of hydrogen, since hydrogen is a gas that is very expensive and difficult to handle. Based on these considerations, this section sounds very optimistic, to me, and does not do justice to showing more clearly these risks and these barriers.	Accepted and changes made	Pierpaolo Cazzola	International Transport Forum	France
43787	37	16	37	24	The use of mixed currencies ($ and €) in this paragraph is a bit confusing.	Accepted and changes made	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
53613	37	16	37	16	This paragraph consists of sentences tacked together without any attempt at joining together the different claims into a coherent whole.	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
56827	37	16	37	24	Suggest adding more clarity. One estimate suggests US$2 million and another sentence suggests EUR 16 million. It is not clear if this includes cost of transporting hydrogen either through trucks or pipeline to the Hydrogen Refueling station.	Accepted and changes made	Government of United States of America	U.S. Department of State	United States of America
79161	37	16	37	24	Nice data compilation, but you should add that whether you need 350 or 700 bar depends on how efficient your vehicle is. The remarkable Toyota 2017 Mirai needed 5 kgH2 at 700 bar for a 300-mile range, but it needed 700 bar because it was 2.2-2.6x heavier and 39% less efficient than our 2000 SUV that needed 3.4 kg/H2 at 350 bar for a 330-mile range. I'm still trying to get Toyota to do a bake-off between a Mirai and their wonderful ~400-kg carbon-fiber HEV 1/X concept car shown in 2000, equipped with a small fuel cell. Guess who'd win, and who wouldn't need the very hard and costly 700 bar!	Accepted and changes made	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
1297	37	25	38	2	The cost of hydrogen is also dependent on the load factor of the factory. If it is running (close to 100%), the CAPEX per kg H2 would be much lower than if the factory is running only when there is excess electricity.This notion should be mentioned somewhere around figure 10.7. In addition, it is not clear what kind of load factor is assumend in figure 10.7.	Accepted and changes made	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
5493	37	28	37	28	replace Renewables" by "low carbon sources"	Accepted and changes made	Michel SIMON	Retraité/ Pdt d'association	France
23207	37	28	37	28	The current and foreseen mix is not realistically fully renewable electrcity; (1) hence the carbon footprint of the electricity mix should be considered in H2 scenarios; (2) electronuclear H2 generation is more and more studied (Szondy 2020 Modular nuclear reactors promise cost-competitive hydrogen production Newatlas) and could be a way forward, to be included in the scenarios	Accepted and changes made	Government of France	Ministère de la Transition écologique et solidaire	France
24685	37	28	37	28	Hydrogen produced via electrolysis: both renewable and nuclear power can be used in this process (see reference already used in the chapter: Bicer, Y., and Dincer, I. (2017). Life cycle assessment of nuclear-based hydrogen and ammonia production options: A comparative evaluation. International Journal of Hydrogen Energy, 42(33), 21559–21570. https://doi.org/https://doi.org/10.1016/j.ijhydene.2017.02.002). So we recommend replacing "as well as securing low-cost, ideally renewable electricity" with "as well as securing low-cost, ideally low-carbon electricity"	Accepted and changes made	Ann Jessica Johnson	FORATOM (European Atomic Forum)	Belgium
74233	37	28	37	28	Strike "renewable electricity" and insert "carbon free electricity" so as not to discriminate against other methods of producting green clean energy such as nuclear and hydroelectric.	Accepted and changes made	Jeffrey Merrifield	Pillsbury Law Firm	United States of America
66221	37				Should also mention the use of liquid hydrogen carriers as detailed in other sections of the report but should be mentioned and referred to here as ways to transport hydrogen over long distances	Accepted and changes made	Adam Weber	Lawrence Berkeley National Laboratory	United States of America
29739	38	1	38	1	To improve readability please consider to simplify and downsize these graphs, or remove.	Accepted and changes made	Government of Norway	Norwegian Environment Agency	Norway
53615	38	1	38	1	I think it would be very helpful for the comparison between technologies if a second Y axis can be added on the right side (same values, different unit) that converts €/kgH2 to €/kWh vehicle propulsion, after losses. This should be fairly easy to do.	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
23209	38	2	38	2	We suggest the removal of this figure 10.7, as it is less consisten with the rest of the report figures. It is also hard to compare the curves as they are not on the same graph. We also suggest to remove the cost breakdown.	To be investigated	Government of France	Ministère de la Transition écologique et solidaire	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
75795	38	4	38	7	Hydrogen Europe also has some benchmark values that might be useful [13] [13] https://hydrogeneurope.eu/sites/default/files/20200703%20Final%20Draft%20updated%20SRIA%20HE-HER.pdf	Accepted and changes made	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
79163	38	4	38	7	While I agree LIBs will generally beat H2, I think your capex model omits material income sources. As electrolyzers get cheap (already $350/kW is plausible for say green steelmaking, and less with mass production like PEMFC economcis), it'll be less important whether they run all the time, so they can shop for cheap electricity (when renewables are strongest) or even negative-cost electricity when in surplus. They can also sell demand response to the grid. These options are quite significant.	Accepted and changes made	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
66223	38	11			Should also note that the focus on HDV also circumvents some of the infrastructure issues since travel will be on known and predictable routes as well as with fleet vehicles that have central refueling	Accepted and changes made	Adam Weber	Lawrence Berkeley National Laboratory	United States of America
4675	38	12	39	6	delete paragraph: the writing is not neutral and neglects the costs of a recharging infrastructure for BEVs, which is today covered by the car buyers, which have to install and pay for their wall boxes, and the public, which pays for the fast recharging infrastructure. There are studies which show that the costs for a HRS infrastructure will be lower than for BEVs for mass markets with a single digit million cars. We should not open this discussion or if so, to be honest.	Rejected, dealt with elsewhere in 10.3	Ulf Groos	Fraunhofer ISE	Germany
43113	38	12	38	13	The statement is arguable. The costs of a recharging station with several recharging points with a power of 150 kW /each costs $millions per site (capital costs as per 2021); as several points would be required to charge vehicles simultaneously. The convenience of refuelling H2 FCEV vehicles in 5 minutes (for a full tank) vs 40 min for a BEV (charged with a 150kW charger) cannot be matched. Therefore, I don't think that is a universal truth that 'LIB vehicles using the power from the grid... be much more feasible'. H2FC could be more feasible, as soon as the heating sector adapts natural gas metalic pipelines to polyethylene ones to facilitate the transition from NG to hydrogen. At that point, transporting hydrogen to fuel stations will be simple. In the UK, BEIS is already investigating this option, and the gas grid is being upgraded already.	To be investigated	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
52467	38	12	38	13	Sentence is hard to follow	To be investigated	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
56829	38	12	39	6	This paragraph accurately describes several challenges facing hydrogen fuel cell vehicles. But it errs in overstating the case for LIB vehicles. It states that the cost of hydrogen refueling makes it "difficult to see why LIB vehicles...will not be much more feasible." This statement assumes that LIBs are capable of meeting the needs of all use cases for which FCEVs may be an option. Over the time scale discussed here, i.e., roughly the next 20 years, it is unclear that is the case. Vehicles that operate continuous duty cycles with little to no regular downtime, vehicles that are limited in the amount of additional weight or mass they can accept, and vehicles with high peak power density needs are all examples of use cases where LIB technology has not yet been shown to be adequate. It is much more than a simple "heavy" vs not heavy dichotomy. The example of Class 1 and 2 forklifts shows that even in the case of smaller vehicle types, fuel cells may be a more attractive option than batteries. The discussion of the strengths and weaknesses of LIB and fuel cell technologies currently seems to lack balance and nuance, both here in Section 10.3.2 and above in Section 10.3.1. It leads the reader to believe that perhaps batteries can do it all by mid-century. This statement is supportable for light duty vehicles, for most types of buses, and for smaller MD trucks. But for most other types of vehicle and equipment (to include larger trucks, locomotives, aircraft, marine vessels, and other nonroad equipment), there is no scientific basis to support the statement that batteries are a clear frontrunner over fuel cells. Based on the current state of technology, it seems much more likely that both batteries charged with zero carbon electricity and hydrogen fuel cells powered by zero carbon electrolysis will be essential technologies for decarbonizing transportation by mid-century. This chapter needs to take a more balanced view.	To be investigated	Government of United States of America	U.S. Department of State	United States of America
53617	38	13	38	14	"HCFVs can be viable where they are the only option as is considered possible with long haul trucking and other heavy vehicles" <-- This needs a solid source. BEV, biofuels and synthetic fuels are all far ahead of FCEV for long haulage today (though charging infrastructure is lacking for EVs moving between distant regions) and I have not found any sources that predict a path for FCEV that will make it a more cost attractive alternative than BEV before at least 2040.	Accepted and changes made	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
4677	39	6	39	6	replace "over the next decade or so" by "until 2030"	To be investigated	Ulf Groos	Fraunhofer ISE	Germany
64833	39	7	40	8	Promising way of green Hydrogen production using high temperature gas cooled reactor (HTGR) in combination with thermal-chemical hydrogen cycle shall be included into the paper. This Generation IV technology is being developed in China, where first HTGR-PM demonstration unit is being finished at Shidao Bay NPP. High potential heat can be used for green Hydrogen production in high-temperature electrolysis, thermo-chemical or hybrid thermo-chemical cycle (e.g. Westinghouse cycle). This shall be more effective than current steam reforming or electrolysis processes, opening ways to cost and environment effective Hydrogen transport applications. Instead of Hydrogen fuel cells combined with electric motors, big sized heavy trucks and railway locomotives can use compressed or liquid hydrogen tanks and turbines. The same propulsion can be used to power big transport ships. Centralized suppling of ships and locomotives with Hydrogen would be much easier than supplying milions of road cars.	Beyond scope	Radek Svoboda	Czech Nuclear Society	Czech Republic
69813	39	8	39	11	Even if competitiveness is defined, as it should, vis-à-vis competing near zero GHG emission options (and not vis-à-vis fossil fuels), the statement that FCV vehicle would become competitive vs. LIBs and electricity for long-haul trucks, vs. Ammonia in modified marine ICEs, and vs. e-kerosene in existing aircrafts, could be challenged. Fuel cells lack enough power density for ships and planes, hydrogen storage on ships is costly and on aircrafts a safety and weight challenge.	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France
28575	39	9	39	39	I recommend using information from the IEA to give some background on volumes of biofuels being produced and their location. See https://www.iea.org/reports/transport-biofuels and https://www.iea.org/reports/renewables-2020/transport-biofuels#abstract.	Accepted and changes made	Pierpaolo Cazzola	International Transport Forum	France
29379	39	10	0	0	There is a dot before the bracked of the citations	Accepted and changes made	Maria Pregnolato	University of Bristol	United Kingdom (of Great Britain and Northern Ireland)
28571	39	12	39	14	These lines are misleading, Cost parity does not only depend on fuel cell and hydrogen costs, but also on costs and frequency of use of stations, as well as the nature and volume of hydrogen transport and distribution. On transport an distribution aspects, see this great paper: https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.366.3345&rep=rep1&type=pdf	Accepted and changes made	Pierpaolo Cazzola	International Transport Forum	France
69815	39	12	39	14	FCV may become competitive with internal combustion vehicles provided green hydrogen is at a very low cost - but this would suppose vey low cost for green electricity as well, making electric vehicles, which will always consume three times less electricity, still very challenging cost-wise.	Accepted and changes made	Cédric PHILIBERT	Institut Français des Relations Internationales	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
75797	39	12	39	21	Perhaps mention there are at least two factors: technology improvement (e.g. the Pt reduction mentioned in the text but some other aspects are mentioned in page 35 of [14]) and the cost reduction by economies of scale in manufacturing (see for instance page 36 of [14] for FCEV but the document also has medium- and heavy-duty trucks) [14] https://www.energy.gov/sites/prod/files/2019/12/f70/fcto-sa-2018-transportation-fuel-cell-cost-analysis.pdf	Accepted and changes made	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
65035	39	22	39	22	Perhaps provide evidence that H2 will be used in buildings as it seems very unlikely.	Accepted and changes made	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
43789	39	26	39	27	Later in this Chapter (e.g., Sect. 10.4.4), currency values are specified together with their respective reference year (e.g., USD_2015). I think this notation should be used consistently when comparing costs in different years.	Accepted and changes made	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
75799	39	26	39	27	Perhaps make cross-reference to another section of this report (if any) where that is discussed (the supply side, with the capacity of electrolyzers deployed and the production cost of hydrogen	Accepted and changes made	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
4679	39	27	39	27	add: Pipeline transport of GH2 over 500 km might be as cost effective as 0.1 USD/kg. (Hydrogen Insights Report 2021, Hydrogen Council, Mc Kinsey and Company)	To be investigated	Ulf Groos	Fraunhofer ISE	Germany
4681	39	33	39	33	delete "... requiring international collaboration at a level not yet seen for hydrogen." Hydrogen for transport was much earlier standardized than battery recharging, so there are already international standards established for 700 bar refilling and hydrogen gas quality.	To be investigated	Ulf Groos	Fraunhofer ISE	Germany
66225	39	33			Need to look at various roadmaps in the last year as there has been a lot more international cooperation and vision than this statement seems to suggest	Accepted and changes made	Adam Weber	Lawrence Berkeley National Laboratory	United States of America
4683	39	34	39	41	delete paragraph: these questions are not widely discussed. Politics and public already decided for green H2 in the long-term and decided for zero-emission hydrogen in the near future. The only discussion is about the question if blue or turquoise H2 is feasible for the short and medium term. I recommend not to open the chapter for social impact (or it would have to be widely discussed in each chapter): of course market and technology development should always take into account the needs of the local societies, economies and environment. The need for water for electrolysis leads to production sites typically near sea water and this will in opposite lead to large scale drinking water production out of sea water and there will be (even for economic reasons) a growing supply also for the local inhabitants.	Rejected	Ulf Groos	Fraunhofer ISE	Germany
29381	39	34	0	0	the reference Galassi has also the name Cristina	Accepted and changes made	Maria Pregnolato	University of Bristol	United Kingdom (of Great Britain and Northern Ireland)
45573	39	35	39	35	Van Biert et al. is not listed in the reference list.	Accepted and changes made	Kornelis Blok	Delft University of Technology	Netherlands
1223	39	38	39	38	"that" should be removed	Accepted and changes made	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
1299	39	38	39	40	CCS is mentioned here, but the key tecnicals issues that are written (fuel cell operating conditions, hydrogen on-board storage options and safety issues) are also applicable for hydrogen produced with hydrolysis wherefore CCS is not needed (and even not an option). I think the part "with carbon capture and storage (CCS) technology" can be removed.	Accepted and changes made	Marlinde Knoope	KIM Netherlands Institute for Transport Policy Analysis	Netherlands
43791	39	41	39	41	Could you please elaborate a bit more on what is meant by "context-dependent"?	Accepted and changes made	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
66227	39	41			Need to compare to traditional oil refining since the water requirements are perhaps even lower for hydrogen and this is misleading here.	Accepted and changes made	Adam Weber	Lawrence Berkeley National Laboratory	United States of America
4685	39	42	40	4	delete paragraph: large-scale H2 production is intented at places with tremendous availabilities of RE (wind and sun) like North Africa, MENA, Australia, Chile. RE are for this regions as cheap as 2 ct/kWh or below. H2 in transport will generate the highes economic impact as cost for fuels are significantly higher than costs for household or industry power or coal in industry, etc. So it is economical likely, that H2 will be used for transport. Water scarcity: see above. No one intends to build electrolysis plants in deserts. Efficiency aspects always have to be discussed on a global level. Of course H2 fuel is less efficient than BEV when looking on a local level, but if one takes into account that RE have to be and will be traded on a global level (like oil and coal today) H2 will be the energy carrier and not copper power lines over several thousands of kms down in the ocean. For this global trade electricity is not the solution and so (if H2 is really used in transport) it would be more efficient to directly use H2 in fuel cell power trains than to convert H2 back into electricity and recharge a BEV. LCA show that production of a FCEV is more environmentally friendly than production of a BEV and both have more climate emissions in production and end of life than ICE. Pt use is in the area of todays ICE exhaust catalytic systems and carbon fibre impact is lower than Li, Co, etc. for battery. Difference are over operation. Alternative would be to discuss all this topics widely and neutral (and not so reluctant against fuel cell technology as it is at the moment).	Rejected	Ulf Groos	Fraunhofer ISE	Germany
52469	39	42	40	4	Sentence is too long and hard to follow	Accepted and changes made	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
60473	39	42	40	4	One alternative to overcome some of the challenges related to the direct use of H2 is the use of CCU technologies. CO2-based fuels can find a role in sectors that are harder to decarbonize, such as aviation, shipping and energy intensive industries since hydrocarbons have volumetric energy densities that are orders of magnitude above those of hydrogen and present-day batteries (e.g. Dimitriou et al., 2015, Schmidt et al., 2017, Hepburn et al., 2019, DENA-Powerfuels in Aviation, 2019). The long-term use of carbon based energy carriers in a net zero emissions economy relies upon their production with renewable energy, and upon low-cost, scalable, clean hydrogen production, e.g. via the electrolysis of water. The estimated potential for the scale of CO2 utilization in fuels varies widely, from 1 to 4.2 Gt CO2 yr−1, reflecting uncertainties in potential market penetration. The high end represents a future in which CO2-based fuels have sizeable market shares, due to cost reductions and policy drivers (Hepburn et al., 2019). In the near-term (2030), the CO2 used to produced alternative fuel will mainly come from point sources (e.g. Farfan et al.,2019), while in the mid-term (2040), it will come from direct air capture (DAC) (RAM et al., 2020, Breyer et al., 2019, Drechsler and Agar, 2021). Life-cycle analysis demonstrate that both point source and DAC to fuel pathways can provide climate benefit over conventional diesel fuel if a low carbon source of electricity is used (e.g.Daggash et al., 2018, CONCAWE, 2019, Liu et al., 2020,). The chances for these CO2-based fuels to succeed will strongly depend on their compatibility with existing technology and infrastructure, with the growth and price of renewable energy and with the development of appropriate policy and market incentives (Grim et al., 2020). Despite these challenges, most of the boundary conditions (fuel composition, price, feedstock) for near- and medium-term deployment of CO2-based fuels are clear; now, it is a matter of finding the most economical route towards the synthesis of these fuels (Ramirez et al., 2020). In term of technologies, recent advances in the CCU field offer untapped potential for the realization of CO2 conversion to fuels. Today, a large palet of technologies exist, some are close to commercialization, others are at the benchtop/pilot scale, and some have yet to be scientifically proven. Thermochemical and bioelectrochemical routes offer the most technically feasible near-term opportunities for CO2-based fuels, representing immediately deployable pathways to high-value and relatively high-volume products. These pathways are the closest to commercialization and are ready to be upscaled in near-term (5-10 years) while other routes such as the direct electrochemical pathways are promising on the long-term but will take several decades to overcome the current technical barriers (Diaz et al., 2018, Messias et al. 2019, Edwards et al., 2019, Bushuyev et al., 2020, Masel et al., 2021). Close to 50 high Technology Readiness Level (TRL) projects on CO2 to fuel exist in Europe and many of them will reach commercialisation in the near-term (before 2030). Please find a few examples below with the forecasted production of CO2-based fuel in near-term (within 5 years):	To be investigated	Célia Sapart	Université Libre de Bruxelles / CO2 Value Europe	Belgium
74235	39	42	40	4	This paragraph should be revised so that it is not renewables centric. Green hydrogen produced by carbon free nuclear is exactly the same as hydrogen produced by renewables. The point is to manufacture hydrogen using carbon free energy. Additionally, due to its energy density, nuclear can produce significantly more hydrogen with a smaller geographical footprint.	Accepted and changes made	Jeffrey Merrifield	Pillsbury Law Firm	United States of America
76333	39	42	40	4	One alternative to overcome some of the challenges related to the direct use of H2 is the use of CCU technologies. CO2-based fuels can find a role in sectors that are harder to decarbonize, such as aviation, shipping and energy intensive industries since hydrocarbons have volumetric energy densities that are orders of magnitude above those of hydrogen and present-day batteries (e.g. Dimitriou et al., 2015, Schmidt et al., 2017, Hepburn et al., 2019, DENA-Powerfuels in Aviation, 2019). The long-term use of carbon based energy carriers in a net zero emissions economy relies upon their production with renewable energy, and upon low-cost, scalable, clean hydrogen production, e.g. via the electrolysis of water. The estimated potential for the scale of CO2 utilization in fuels varies widely, from 1 to 4.2 Gt CO2 yr−1, reflecting uncertainties in potential market penetration. The high end represents a future in which CO2-based fuels have sizeable market shares, due to cost reductions and policy drivers (Hepburn et al., 2019). In the near-term (2030), the CO2 used to produced alternative fuel will mainly come from point sources (e.g. Farfan et al.,2019), while in the mid-term (2040), it will come from direct air capture (DAC) (RAM et al., 2020, Breyer et al., 2019, Drechsler and Agar, 2021). Life-cycle analysis demonstrate that both point source and DAC to fuel pathways can provide climate benefit over conventional diesel fuel if a low carbon source of electricity is used (e.g.Daggash et al., 2018, CONCAWE, 2019, Liu et al., 2020,). The chances for these CO2-based fuels to succeed will strongly depend on their compatibility with existing technology and infrastructure, with the growth and price of renewable energy and with the development of appropriate policy and market incentives (Grim et al., 2020). Despite these challenges, most of the boundary conditions (fuel composition, price, feedstock) for near- and medium-term deployment of CO2-based fuels are clear; now, it is a matter of finding the most economical route towards the synthesis of these fuels (Ramirez et al., 2020). In term of technologies, recent advances in the CCU field offer untapped potential for the realization of CO2 conversion to fuels. Today, a large palet of technologies exist, some are close to commercialization, others are at the benchtop/pilot scale, and some have yet to be scientifically proven. Thermochemical and bioelectrochemical routes offer the most technically feasible near-term opportunities for CO2-based fuels, representing immediately deployable pathways to high-value and relatively high-volume products. These pathways are the closest to commercialization and are ready to be upscaled in near-term (5-10 years) while other routes such as the direct electrochemical pathways are promising on the long-term but will take several decades to overcome the current technical barriers (Diaz et al., 2018, Messias et al. 2019, Edwards et al., 2019, Bushuyev et al., 2020, Masel et al., 2021). Close to 50 high Technology Readiness Level (TRL) projects on CO2 to fuel exist in Europe and many of them will reach commercialisation in the near-term (before 2030). Please find a few examples below with the forecasted production of CO2-based fuel in near-term (within 5 years):	To be investigated	Deepak PANT	Flemish Institute for Technological Research (VITO)	Belgium
78821	39	42	40	4	the use of CCU technologies is one alternative to overcome some of the challenges related to the direct use of H2. Indeed, CO2-based fuels can find a role in sectors that are harder to decarbonize, such as aviation, shipping and energy intensive industries since hydrocarbons have volumetric energy densities that are orders of magnitude above those of hydrogen and present-day batteries (e.g. Dimitriou et al., 2015, Schmidt et al., 2017, Hepburn et al., 2019, DENA-Powerfuels in Aviation, 2019). Dimitrou et al., 2015, Energy Environ. Sci, 8, 1775-1789.• Hepburn et al., 2019, Nature, 575, 87-97.• Schmidt et al., 2017, Chem. Ing. Tech. 2018, 90, o. 1–2, 127–140.• DENA, 2019, Powerfuels in Aviation, German Energy Agency	To be investigated	Sylvain Nizou	CEA	France
79165	39	42	40	4	Sorry I can't look up the refs right now, but the water is a non-issue (see my industry-standard 2003 white paper "Twenty Hydrogen Myths," peer-reviewed but I hadn't time to get it properly published, at https://rmi.org/insight/twenty-hydrogen-myths/), and the Pt, having been reduced >10x decades ago at LANL, is less than in the displaced ICEs' catalytic converters, as well as fully recyclable. Remote delivery also seems pretty silly when we already have an electric grid to do that; transport costs far more than the present value of buying costlier small electrolyzers before their volume makes them cheap like PEMFCs.	Rejected	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
83717	39	42	40	4	One alternative to overcome some of the challenges related to the direct use of H2 is the use of CCU technologies. CO2-based fuels can find a role in sectors that are harder to decarbonize, such as aviation, shipping and energy intensive industries since hydrocarbons have volumetric energy densities that are orders of magnitude above those of hydrogen and present-day batteries (e.g. Dimitriou et al., 2015, Schmidt et al., 2017, Hepburn et al., 2019, DENA-Powerfuels in Aviation, 2019). The long-term use of carbon based energy carriers in a net zero emissions economy relies upon their production with renewable energy, and upon low-cost, scalable, clean hydrogen production, e.g. via the electrolysis of water. The estimated potential for the scale of CO2 utilization in fuels varies widely, from 1 to 4.2 Gt CO2 yr−1, reflecting uncertainties in potential market penetration. The high end represents a future in which CO2-based fuels have sizeable market shares, due to cost reductions and policy drivers (Hepburn et al., 2019). In the near-term (2030), the CO2 used to produced alternative fuel will mainly come from point sources (e.g. Farfan et al.,2019), while in the mid-term (2040), it will come from direct air capture (DAC) (RAM et al., 2020, Breyer et al., 2019, Drechsler and Agar, 2021). Life-cycle analysis demonstrate that both point source and DAC to fuel pathways can provide climate benefit over conventional diesel fuel if a low carbon source of electricity is used (e.g.Daggash et al., 2018, CONCAWE, 2019, Liu et al., 2020,). The chances for these CO2-based fuels to succeed will strongly depend on their compatibility with existing technology and infrastructure, with the growth and price of renewable energy and with the development of appropriate policy and market incentives (Grim et al., 2020). Despite these challenges, most of the boundary conditions (fuel composition, price, feedstock) for near- and medium-term deployment of CO2-based fuels are clear; now, it is a matter of finding the most economical route towards the synthesis of these fuels (Ramirez et al., 2020). In term of technologies, recent advances in the CCU field offer untapped potential for the realization of CO2 conversion to fuels. Today, a large palet of technologies exist, some are close to commercialization, others are at the benchtop/pilot scale, and some have yet to be scientifically proven. Thermochemical and bioelectrochemical routes offer the most technically feasible near-term opportunities for CO2-based fuels, representing immediately deployable pathways to high-value and relatively high-volume products. These pathways are the closest to commercialization and are ready to be upscaled in near-term (5-10 years) while other routes such as the direct electrochemical pathways are promising on the long-term but will take several decades to overcome the current technical barriers (Diaz et al., 2018, Messias et al. 2019, Edwards et al., 2019, Bushuyev et al., 2020, Masel et al., 2021). Close to 50 high Technology Readiness Level (TRL) projects on CO2 to fuel exist in Europe and many of them will reach commercialisation in the near-term (before 2030). Please find a few examples below with the forecasted production of CO2-based fuel in near-term (within 5 years):	To be investigated	Christian Breyer	LUT University	Finland
5495	39	43	39	43	replace Renewables" by "low carbon sources"	Accepted and changes made	Michel SIMON	Retraité/ Pdt d'association	France
5497	39	45	39	45	replace Renewables" by "low carbon sources"	Accepted and changes made	Michel SIMON	Retraité/ Pdt d'association	France
4687	40	6	40	8	I would recommend to delete this paragraph: if politics decide to spread funds as largely as it does todays for BEVs FCEV would be cost competitive by 2030. As there are huge industrial investments today regarding fuel cell trucks I would nevertheless see cost parity by 2030 - 2035. So, my recommendation is to delete the paragraph or start a larger discussion.	Rejected	Ulf Groos	Fraunhofer ISE	Germany
20109	40	9	42	29	Section 10.3.3 on biofuels does not sufficiently reflect the fact that many biofuels used today result in an increase in GHG emissions compared to fossil fuel, when taking into account full LCA (direct and indirect emissions, including ILUC). This is especially the case for most biodiesel, as was shown in this paper : https://www.transportenvironment.org/sites/te/files/publications/2016_04_TE_Globiom_paper_FINAL_0.pdf Biofuels are a quite sensitive issue also in link with human rights, land grabbing, food sovereignty, biodiversity and they have been criticized as an unsustainable policy by UN Special Rapporteur on the Right to Food : http://www.srfood.org/images/stories/pdf/otherdocuments/20130423_biofuelsstatement_en.pdf This needs to be reflected in the section.	Related to Chapter 7. These issues have been addressed there.	Noé Lecocq	Inter-Environnement Wallonie	Belgium
48053	40	9	42	29	Biofuels can significantly reduce atmospheric emissions by replacing fossil fuels. Significant literature is available and has not been quoted throughout Section 10.3.3. As this mitigation option may also significantly help to avoid thousands of deaths per year, and improve the life quality of millions of people, a specific topic “Effects of replacing fossil fuels by biofuels in health and life quality” must be included in this section. The following literature can easily be accessed by the authors of Chapter 10: M. de F. Andrade et al., “Air quality in the megacity of São Paulo: Evolution over the last 30 years and future perspectives,” Atmos. Environ., vol. 159, no. March, pp. 66–82, 2017, doi: 10.1016/j.atmosenv.2017.03.051. Renewable Fuels Association, “Environment. Ethanol, the Low Carbon Solution,” 2020. https://ethanolrfa.org/environment/. J. Yang et al., “Emissions from a flex fuel GDI vehicle operating on ethanol fuels show marked contrasts in chemical, physical and toxicological characteristics as a function of ethanol content,” Sci. Total Environ., vol. 683, pp. 749–761, 2019, doi: 10.1016/j.scitotenv.2019.05.279. E. M. P. A. Vormittag, C. G. Rodrigues, P. A. de André, and P. H. N. Saldiva, “Assessment and valuation of public health impacts from gradual biodiesel implementation in the transport energy matrix in Brazil,” Aerosol Air Qual. Res., vol. 18, no. 9, pp. 2375–2382, 2018, doi: 10.4209/aaqr.2017.11.0449. S. Mueller and O. H. Sciences, “Health Impact of Blending Ethanol into Gasoline in 5 Global Cities,” pp. 1–2, 2019. S. Mueller, “Avoided Mortalities from the substitution of ethanol for aromatics in gasoline with a focus on secondary particulate formation”. 2019. Energy Resources Center. S. Mueller, “Cancer Reductions from the use of high-octane ethanol-blended gasoline with a focus on toxic air compounds”. 2019. Energy Resources Center. X. Liang et al., “Air quality and health impacts from using ethanol blended gasoline fuels in China,” Atmos. Environ., vol. 228, no. March, 2020, doi: 10.1016/j.atmosenv.2020.117396. D. Jin, K. Choi, C. L. Myung, Y. Lim, J. Lee, and S. Park, “The impact of various ethanol-gasoline blends on particulates and unregulated gaseous emissions characteristics from a spark ignition direct injection (SIDI) passenger vehicle,” Fuel, vol. 209, no. January, pp. 702–712, 2017, doi: 10.1016/j.fuel.2017.08.063. K. Von Stackelberg, J. Buonocore, P. V. Bhave, and J. A. Schwartz, “Public health impacts of secondary particulate formation from aromatic hydrocarbons in gasoline,” Environ. Heal. A Glob. Access Sci. Source, vol. 12, no. 1, 2013, doi: 10.1186/1476-069X-12-19. M. Muñoz et al., “Bioethanol Blending Reduces Nanoparticle, PAH, and Alkyl- and Nitro-PAH Emissions and the Genotoxic Potential of Exhaust from a Gasoline Direct Injection Flex-Fuel Vehicle,” Environ. Sci. Technol., vol. 50, no. 21, pp. 11853–11861,	Implemented. It is now mentioned in the text and we added some fo the references.	Marcelo moreira	UNICAMP - Agroicone	Brazil

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
50973	40	9	42	29	Biofuels can significantly reduce atmospheric emissions by replacing fossil fuels. Significant literature is available and has not been quoted throughout Section 10.3.3. As this mitigation option may also significantly help to avoid thousands of deaths per year, and improve the life quality of millions of people, a specific topic “Effects of replacing fossil fuels by biofuels in health and life quality” must be included in this section. The following literature can easily be accessed by the authors of Chapter 10: M. de F. Andrade et al., “Air quality in the megacity of São Paulo: Evolution over the last 30 years and future perspectives,” Atmos. Environ., vol. 159, no. March, pp. 66–82, 2017, doi: 10.1016/j.atmosenv.2017.03.051. Renewable Fuels Association, “Environment. Ethanol, the Low Carbon Solution,” 2020. https://ethanolrfa.org/environment/. J. Yang et al., “Emissions from a flex fuel GDI vehicle operating on ethanol fuels show marked contrasts in chemical, physical and toxicological characteristics as a function of ethanol content,” Sci. Total Environ., vol. 683, pp. 749–761, 2019, doi: 10.1016/j.scitotenv.2019.05.279. E. M. P. A. Vormittag, C. G. Rodrigues, P. A. de André, and P. H. N. Saldiva, “Assessment and valuation of public health impacts from gradual biodiesel implementation in the transport energy matrix in Brazil,” Aerosol Air Qual. Res., vol. 18, no. 9, pp. 2375–2382, 2018, doi: 10.4209/aaqr.2017.11.0449. S. Mueller and O. H. Sciences, “Health Impact of Blending Ethanol into Gasoline in 5 Global Cities,” pp. 1–2, 2019. S. Mueller, “Avoided Mortalities from the substitution of ethanol for aromatics in gasoline with a focus on secondary particulate formation”. 2019. Energy Resources Center. S. Mueller, “Cancer Reductions from the use of high-octane ethanol-blended gasoline with a focus on toxic air compounds”. 2019. Energy Resources Center. X. Liang et al., “Air quality and health impacts from using ethanol blended gasoline fuels in China,” Atmos. Environ., vol. 228, no. March, 2020, doi: 10.1016/j.atmosenv.2020.117396. D. Jin, K. Choi, C. L. Myung, Y. Lim, J. Lee, and S. Park, “The impact of various ethanol-gasoline blends on particulates and unregulated gaseous emissions characteristics from a spark ignition direct injection (SIDI) passenger vehicle,” Fuel, vol. 209, no. January, pp. 702–712, 2017, doi: 10.1016/j.fuel.2017.08.063. K. Von Stackelberg, J. Buonocore, P. V. Bhave, and J. A. Schwartz, “Public health impacts of secondary particulate formation from aromatic hydrocarbons in gasoline,” Environ. Heal. A Glob. Access Sci. Source, vol. 12, no. 1, 2013, doi: 10.1186/1476-069X-12-19. M. Muñoz et al., “Bioethanol Blending Reduces Nanoparticle, PAH, and Alkyl- and Nitro-PAH Emissions and the Genotoxic Potential of Exhaust from a Gasoline Direct Injection Flex-Fuel Vehicle,” Environ. Sci. Technol., vol. 50, no. 21, pp. 11853–11861,	Implemented. It is now mentioned in the text and we added some fo the references.	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
56831	40	9	40	46	This section makes brief reference to the current feedstock supply challenges facing lignocellulosic biofuels. However, it does not address how these challenges might be overcome. Elsewhere in Section 10.3.3, biofuels are spoken of as perhaps the leading emissions reduction option for the aviation and marine sectors. However, the levels of biofuel consumption described for these sectors would require dramatic increases in total global biofuel production, to say nothing of lignocellulosic fuel production. If these quantities of fuels cannot be produced, then biofuels cease to become a realistic option. The section needs to address this issue head on. If the best available science supports the conclusion that these quantities of lignocellulosic biofuels are feasible to produce by mid-century, that science needs to be cited here. If the science does not support that conclusion, then the lack of support needs to be clearly described.	Noted. We reformulated the text in some parts and we believe most of these aspects are now metioned in the text.	Government of United States of America	U.S. Department of State	United States of America
81947	40	9	41	8	Biofules should be differentiated as "biofuels from agricultural products" and "from waste" (or first, second, third generation?). The text states that impacts are addressed in the AFOLU Chapter. I would still suggest that some of the effects are mentioned here, as biofuel promotion policies have shown desastrous consequences not only in terms of GHG from AFOLU but also food security, water scarcity, land ownership, loss of biodiversity, smallscale farmers in developing countries etc. First generation biofuels have not prooved to be a sustainable transport decarb approach.	Noted. Some of the eapsects are mentioned in the text. Details of the mentioned aspects are discussed in Chapter 7	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
82077	40	9	42	21	I think the section should also mention the advantages and opportunities of drop-in fuels in shipping. It should probably also mention in more detail why it is difficult to regulate the shipping sector and emphasize not only that it is an international sector and infrastructural changes would be necessary, but also look into factors as for example, how would stricter regulations in shipping would affect trade (e.g. barriers for fresh products). The section could also mention that although the IMO addresses the problem of sustainability in the shipping sector, its measures focus on sulphur levels (and ship design and efficiency) rather than CO2 emissions. Finally, the quality of drop in fuels should be good enough and that is indeed one of the characteristics that define drop-in fuels and that make them an attractive option for greening shipping.	Noted. Partially Implemented suggestions in the text. These are addressed in the Shipping section of Ch10.	Sofia Rosero Abad	University	Netherlands
20115	40	10	40	39	Section 10.3.3.1 relies heavyly on IEA 2017 bioenergy roadmap. This roadmap by IEA does not consider full LCA GHG emissions, as ILUC emissions are not included. This is not a comprehensive scientific approach. Message about the fact that biofuels will provide very large part of aviation fuel in the future are subject to strong critics both from the science and the NGO community. See https://www.transportenvironment.org/sites/te/files/publications/2016_06_Aviation_biofuels_briefing_FINAL.pdf The IPCC report should really reflect the state of the debate on biofuels in aviation, and not just take for granted some optimistic scenarios from energy agencies.	Related to Ch 7. It has been addressed there.	Noé Lecocq	Inter-Environnement Wallonie	Belgium
20117	40	10	40	39	Section 10.3.3.1 should better reflect the great uncertainties about future bioenergy availability at large scale. IEA 2017 bioenergy roadmap does not developp this much, but still points out that : "For the longer term, inevitable concerns are apparent about the availability of sufficient land to provide enough food to feed the growing global population and also to contribute to energy production, given the many factors and the long timescales involved. The land available for energy production will be influenced by a number of factors, which are difficult to forecast or influence".	Implemented. It is now mentioned in the text.	Noé Lecocq	Inter-Environnement Wallonie	Belgium
47919	40	10	40	10	I was surprised to not see discussion around BECCS here (and perhaps a pointer to Section 6.4). Daioglou et al is cited widely from EMF-33, and another paper from EMF-33 showed a major nexus between bioenery and CCS: https://link.springer.com/article/10.1007/s10584-020-02784-5	Implemeted. We added the suggested reference. BECCS is specifically treated alsewehere in a specific Box	Matteo Muratori	NREL	United States of America
53619	40	10	42	21	It would be helpful to clarify somewhere in this section that the main use of fossil free hydrocarbons / drop-in fuels is to reduce emissions from the already rolling fleet of ICE vehicles (of all types). These fuels are not likely to become cheaper than fossil fuels, but they are likely a cheaper alternative than early scrapping of ICE vehicles, and may be cheaper than fossil fuels if the social cost of carbon is accounted for. Biofuels/efuels are not really a competitor to electrification (they are more expensive for almost all road vehicles yet to be built), but a complement to be used when electrification is not an option.	Implemented	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
64827	40	10	40	39	There is a lack of complex environmental a socio-economic evaluation of biofuels production and usage. Industrial-size growing of plants for biofuels production leads in practice to deforrestation, extensive land usage, replacement of foodstuff production, growing energy demand connected with field works (oil fuel) and production of farming chemicals (industrial fertilizers, insecticides etc.). This leads to higher food prices and loss of social stability in affected countries. Forced usage of higher shares of biofuels in conventional engines also leads to shortening of car lifetime and higher demand for new cars with negative environmental impact. This environmental, social and economical impacts shall be taken into account during evaluation of the biofuels GHG reduction potential.	Related to Chapter 7. These issues have been addressed there.	Radek Svoboda	Czech Nuclear Society	Czech Republic
65037	40	10	40	10	Perhaps in future reviews the role of seaweed based biofuel can be explored as it is a carbon neutral option with multiple benefits to coastal management.	Accepted. We added onesentence about this.	Karlson Hargroves	Curtin University Sustainability Policy Institute, Curtin University	Australia
75803	40	10	40	39	Some key numbers missing in this section: biofuels use in transport today; range of biofuels use in the future; link with bioenergy potential and section where this is further discussed in th report	Partially implemented	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
20113	40	11	40	12	This sentence should be completed as follows : "Under strict conditions regarding land use and agricultural yields, biofuels may represent an important climate mitigation option for the transport sector (Daioglou et al. 2019; Staples et al. 2017)." Indeed, the source article by Diaoglou clearly states that : "Such a supply of bioenergy can only be achieved without extreme levels land use change if agricultural yields improve significantly and effective land zoning is implemented"	Partially implemented	Noé Lecocq	Inter-Environnement Wallonie	Belgium
64309	40	11	40	39	Biofuel is a promising option, but there may be limits to its supply capacity. In other chapters, biodiversity constraints are introduced, and the same explanation is given for BECCS, which is emphasized as a long-term negative emission technology. It would be better to explain how much is used for transportations among biomass feed stock supply	Noted. It has been addressed in Ch7.	Takashi Hongo	Mitsui & Co. Global Strategic Studies Institute	Japan
48049	40	12	40	13	Although it is true that significant advancements have been observed in electromobility, the message that biofuels are less important is misleading. Biofuels and electromobility (with electricity from renewable sources) should, together, tackle challenge of reducing fossil fuels consumption int the transport sector. At least in the short- to mid-term, biofuels for light vehicles will still be needed (IEA, 2020) IEA Bioenergy TCP & IEA Advanced Motor Fuels TCP, 2020). In terms of emissions reductions, IEA's projection on a well-to-wheel basis from transport vehicle electrification in the (ambitious) EV30@30 Scenario amounts to a mere 535.6 Mt CO2eq, out of total projected transport sector emissions of 8.9 Gt CO2 eq ((IEA Global EV Outlook 2019). Further, EV fleet will represent at maximum 50% of new sales in the IRENA optimistic zero decarbonization scenario in 2050 (IRENA, 2020). Early action requires biofuels to be deployed immediately. Biofuels have a major role in developing countries in Latin America and Africa (Trindade, 2019; IRENA, 2020; chapter 4 of this report). It follows that there would be a large need for biofuels for several decades to come (IRENA, 2020). IPCC should not put excessive or exclusive focus on actions expected to deliver significant results only in the very long run (after 2050). In fact, it should be noted that different excerpts of Chapter 6 already hint on the need to evaluate the role of alternative fuels – especially, of biofuels – in more nuance in such scenarios: "Many studies focus on electrification as an end use decarbonisation strategy and do not consider significant contributions from biofuels or other renewable fuels (Bauer et al. 2018a). These studies typically assume a constrained set of available technologies to demonstrate the technical feasibility of very high renewable systems and are not optimising to find least-cost, technology neutral decarbonisation pathways (Jenkins et al. 2018b)." (p. 86, l. 8-12). In other regions, however, that may not necessarily be the case, and a comparatively lower use of electricity may coexist of higher levels of biofuels penetration, as it is correctly summarized in the following passage: "Regions endowed with cheap and plentiful low carbon electricity resources (wind, solar, hydropower) will favor electrification, while those with substantial bioenergy production or availability of other liquid fuels might put less emphasis on electrification, particularly in hard-to electrify end-uses (medium confidence). For example, among a group of Latin American countries, relative assumptions about liquid fuels and electricity result in an electrification range of 28% to 82% for achieving a net10 zero energy system (Bataille et al. 2020). Similarly, the level of penetration of biofuels that can substitute for electrification will depend on regional circumstances such as land-use constraints, competition with food, and sustainability of biomass production (see Section 6.6.4)." (Chapter 6, p. 87, l. 5-12). In the same vein: "Many scenarios indicate that Latin America will reach net-zero energy system emissions more quickly than other regions due to	Partially implemented. The general idea of the comment is now introduced in the text and some of the references were also added	Marcelo moreira	UNICAMP - Agroicone	Brazil

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
50969	40	12	40	13	Although it is true that significant advancements have been observed in electromobility, the message that biofuels are less important is misleading. Biofuels and electromobility (with electricity from renewable sources) should, together, tackle challenge of reducing fossil fuels consumption int the transport sector. At least in the short- to mid-term, biofuels for light vehicles will still be needed (IEA, 2020) IEA Bioenergy TCP & IEA Advanced Motor Fuels TCP, 2020). In terms of emissions reductions, IEA's projection on a well-to-wheel basis from transport vehicle electrification in the (ambitious) EV30@30 Scenario amounts to a mere 535.6 Mt CO2eq, out of total projected transport sector emissions of 8.9 Gt CO2 eq ((IEA Global EV Outlook 2019). Further, EV fleet will represent at maximum 50% of new sales in the IRENA optimistic zero decarbonization scenario in 2050 (IRENA, 2020). Early action requires biofuels to be deployed immediately. Biofuels have a major role in developing countries in Latin America and Africa (Trindade, 2019; IRENA, 2020; chapter 4 of this report). It follows that there would be a large need for biofuels for several decades to come (IRENA, 2020). IPCC should not put excessive or exclusive focus on actions expected to deliver significant results only in the very long run (after 2050). In fact, it should be noted that different excerpts of Chapter 6 already hint on the need to evaluate the role of alternative fuels – especially, of biofuels – in more nuance in such scenarios: "Many studies focus on electrification as an end use decarbonisation strategy and do not consider significant contributions from biofuels or other renewable fuels (Bauer et al. 2018a). These studies typically assume a constrained set of available technologies to demonstrate the technical feasibility of very high renewable systems and are not optimising to find least-cost, technology neutral decarbonisation pathways (Jenkins et al. 2018b)." (p. 86, l. 8-12). In other regions, however, that may not necessarily be the case, and a comparatively lower use of electricity may coexist of higher levels of biofuels penetration, as it is correctly summarized in the following passage: "Regions endowed with cheap and plentiful low carbon electricity resources (wind, solar, hydropower) will favor electrification, while those with substantial bioenergy production or availability of other liquid fuels might put less emphasis on electrification, particularly in hard-to electrify end-uses (medium confidence). For example, among a group of Latin American countries, relative assumptions about liquid fuels and electricity result in an electrification range of 28% to 82% for achieving a net10 zero energy system (Bataille et al. 2020). Similarly, the level of penetration of biofuels that can substitute for electrification will depend on regional circumstances such as land-use constraints, competition with food, and sustainability of biomass production (see Section 6.6.4)." (Chapter 6, p. 87, l. 5-12). In the same vein: "Many scenarios indicate that Latin America will reach net-zero energy system emissions more quickly than other regions due to	Partially implemented. The general idea of the comment is now introduced in the text and some of the references were also added	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
75801	40	15	40	24	Message is roughly the same but perhaps it is better to use the latest ETP [15] [15] https://www.iea.org/reports/energy-technology-perspectives-2020	Implemented	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
79167	40	15	40	19	Worth saying that the 2017 IEA biofuels conclusion has been overtaken by events in the market around both efficiency and electrification, per my comments above on heavy transport and aviation: 4L18–19, 5:27–39, 7:13–20, etc. Even the van Vuuren 2017 finding about aviation (40:31–32) now seems dated: please see my comments on 5:40–6:5 and 7:13–20. Of course, IAMs won't start to catch up on those technological and design shifts for years.	Noted	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
47635	40	20	40	20	better to refrain from absolute statements such as "Biofuels will complement…". Better to say "Biofuels may complement…"	Implemented	Vassilis Daioglou	Utrecht University	Netherlands
86669	40	22	40	23	I assume the following statement refers to the IEA scenarios earlier in the paragraph: "Biofuels are projected to provide about 40% of aviation 23 transport fuel in 2060, and 30% of fuel for shipping". Given the very low level of biofuel produced at present, this is a HEROIC assumption and there really should be scenarios around this. See for example a report by Ricardo and E4Tech on Advanced Biofuels for Aviation, https://ee.ricardo.com/downloads/transport/targeted-aviation-advanced-biofuels-demonstration-competition-%E2%80%93-feasibility-study, which discusses the early stage of technology readiness and significant challenges of commercialisation. A lik needs to be made to the role of ICAO- if ICAO does not have a mandate consistent with Paris temperature goals, the instutional framework to deliver Sustainable Aviation Fuels is unlikely to be developed. The UK Committee on Climate Change in its recommendations on the 6th UK Carbon Budget suggests that until commercialisation and uptake of Sustainable Aviation FUel can be demonstrated, capacity growth should be constrained. See https://www.theccc.org.uk/wp-content/uploads/2020/12/Sector-summary-Aviation.pdf at p.12.	Partially implemented. Text was reformulated to include this comment.	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
47637	40	28	40	30	There is a paper ucrrently under review (second round), part of the EMF-33 project, which focuses on biofuels in the transport sector as projected by IAMS: Leblanc, F., et al. (under review) The contribution of bioenergy to the decarbonization of transport: a multi-model assessment, Climatic change	Noted	Vassilis Daioglou	Utrecht University	Netherlands
53621	40	28	40	34	There are claims here that biofuels are expected to be the dominant fuel for heavy road vechiels (over some unspecified timeframe and in some unspecified region). This claim does not agree with the rest of the chapter, nor does it give a nuanced picture of reality. Biofuels are unlikely to 1) become available at anywhere near the volumes we consume truck diesel today, 2) be cost competitive vs. both fossil fuels (excluding social cost of carbon) and electrification (gradually reaching TCO parity with diesel in more and more markets during the 2020s). Their use is as a cheaper alternative than early scrapping of already manufactured ICE vehicles.	Implemented. Text was revised.	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
85509	40	28	40	34	I think IAMs have been rightly critizised for heavily underestimating electric vehicles and heavily overestimating biofuels. For me this means that using IAM publications as support for biofuels (especially publications from 2017) to make the point that biofuels are needed for heavy road transport is the wrong way around. A better way to make this point is by looking at recent papers that look specifically at heavy trucks and to what extend biofuels are inevitable for most trips. I want to point to my remark of chapter 10 page 4 line 18 to page 5 line 31 that directs to the 2021 journal paper of Nykvist in Joule that shows that especially very heavy trucks are ideal candidates for electrification through batteries. I think a consensus is forming that precious biofuels are best reserved for really hard problems like long haul aviation and shipping.	Noted. Partially imlemented. It is also adressed in the section about Shipping in Ch10.	Auke Hoekstra	Eindhoven University of Technology	Netherlands
69817	40	31	40	32	Biofuels may be among the most important fuel options, but electricity for heavy road and e-kerosene for aviation are as much important or more.	Noted	Cédric PHILIBERT	Institut Français des Relations Internationales	France
28577	40	40	42	29	I recommend a revistiation of this section reorganising it based on oleochemical, biochemical and termochemical pathways, as suggested in https://www.ieabioenergy.com/blog/publications/new-publication-drop-in-biofuels-the-key-role-that-co-processing-will-play-in-its-production/ and as picked up (witha focus on shipping) in https://www.itf-oecd.org/navigating-towards-cleaner-maritime-shipping. This can also generate opportunities to include infromation on the integration of low-carbon hydrigen and carbon of biogenic origing for the production of fuels.	Noted. Out of tthe current scope of our chapter	Pierpaolo Cazzola	International Transport Forum	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
29383	40	42	0	0	the bracket should go before "e.g."	Implemented	Maria Pregnolato	University of Bristol	United Kingdom (of Great Britain and Northern Ireland)
56833	40	45	40	46	There is an increasing interest in renewable natural gas (RNG) or biomethane for light, medium, and heavy duty transport fleets, particularly in California.	Implemented. It is now mentioned in the text.	Government of United States of America	U.S. Department of State	United States of America
48051	41	0	41	0	This table should also include “dedicated crops”, “second crops” and “cover crops”, which are production practices that can deliver negative emissions even without CCS. There is a growing body of literature assessing the potential of such mitigation options, which the authors are invited to take into account in this reevaluation: Liu, X., Kwon, H., Northrup, D., & Wang, M. (2020). Shifting agricultural practices to produce sustainable, low carbon intensity feedstocks for biofuel production. Environmental Research Letters, 15(8), 084014. Moreira, M. M., Seabra, J. E., Lynd, L. R., Arantes, S. M., Cunha, M. P., & Guilhoto, J. J. (2020). Socio-environmental and land-use impacts of double-cropped maize ethanol in Brazil. Nature Sustainability, 3(3), 209-216. Pavlenko, N., & Searle, S. (2018). A comparison of induced land use change emissions estimates from energy crops. International Council on Clean Transportation (ICCT): Washington, DC, USA.	Related to Chapter 7. These issues have been addressed there.	Marcelo moreira	UNICAMP - Agroicone	Brazil
50971	41	0	41	0	This table should also include “dedicated crops”, “second crops” and “cover crops”, which are production practices that can deliver negative emissions even without CCS. There is a growing body of literature assessing the potential of such mitigation options, which the authors are invited to take into account in this reevaluation: Liu, X., Kwon, H., Northrup, D., & Wang, M. (2020). Shifting agricultural practices to produce sustainable, low carbon intensity feedstocks for biofuel production. Environmental Research Letters, 15(8), 084014. Moreira, M. M., Seabra, J. E., Lynd, L. R., Arantes, S. M., Cunha, M. P., & Guilhoto, J. J. (2020). Socio-environmental and land-use impacts of double-cropped maize ethanol in Brazil. Nature Sustainability, 3(3), 209-216. Pavlenko, N., & Searle, S. (2018). A comparison of induced land use change emissions estimates from energy crops. International Council on Clean Transportation (ICCT): Washington, DC, USA.	Related to Chapter 7. These issues have been addressed there.	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
1301	41	1	41	8	Unclear what the levels 1-3 of relative cost of conversion process stands for. Better to use low, medium and high costs.	Implemented	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
20111	41	1	41	3	Table 10.5 should include complete life cycle GHG emissions the biofuels considered (direct and indirect emissions, including ILUC). This table is useless and not relevant for policy-makers if it shows only a partial information on a very limited part of climate impact of biofuels. Such table and comprehensive GHG emissions values are not given either in the AFOLU chapter, where the reader is re-directed by note b of table 10.5. This note b does not redirect to precise information. The reader of IPCC report should recieved clear and comprehensive information about climate impacts of policy choices. He should not be required to make sums by its own from various chapters to get an idea of the climate impact. Table 2 of this paper gives full GHG/MJ estimates for several biofuels : https://www.transportenvironment.org/sites/te/files/publications/2016_04_TE_Globiom_paper_FINAL_0.pdf	Noted. These aspects come together insections 10.4 and 10.6.	Noé Lecocq	Inter-Environnement Wallonie	Belgium
43117	41	1	41	3	FAME of HVO from used cooking oil could be added, as it has very low carbon intensity.	Implemented	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
56835	41	1	41	3	A column indicating the biofuel products associated with each row would add clarity to Table 10.5.	Not implemented. It can vary depending on the upgrade and intended application	Government of United States of America	U.S. Department of State	United States of America
56837	41	1	41	3	In Table 10.5, "Gasification and Fischer-Tropsch synthesis", suggest identifying "renewable diesel" and/or hydrotreated vegetable oil (HVO) as a product here.	Not implemented. It can vary depending on the upgrade and intended application	Government of United States of America	U.S. Department of State	United States of America
56839	41	1	41	3	In Table 10.5, "Biomethane from residues", suggest also identifying as "renewable natural gas (RNG)". Biomethane is also commonly produced from agricultural wastes and landfills.	Not implemented. It can vary depending on the upgrade and intended application	Government of United States of America	U.S. Department of State	United States of America
75633	41	1	41	3	When it comes to biofuels, it is always crucial to remember they are in competition – considering the finite nature of fertile soil surface - with the usage of soil for food production and nature reservation, nature regeneration even. This is typically referred to as emissions from indirect land use change (ILUC), which has no definite, clear-cut size as research shows (see, for example: https://doi.org/10.1002/bbb.2124 and https://doi.org/10.1016/j.jclepro.2020.120716). Even though they are often ignored, they could go towards a 231g/MJ (DOI:10.1016/j.rser.2020.110398) – overshadowing the numbers mentioned in the table and cancelling out the positive impact of biofuels. It would be highly appreciated if a discussion on the consequences of ILUC – including the most updated data sources mentioned in this piece – would be provided, especially since most research on biofuels with the inclusion of ILUC come to the conclusion that no CO2 is saved.	Related to Chapter 7. These issues have been addressed there.	Amira El-Feiaz	Technische Universiteit Eindhoven	Netherlands
85497	41	1	41	3	The most basic problem with biofuels is generally considered to be the competition with food and nature on a planet that has a finite amount of fertile soil surface. That is usually expressed as emissions from indirect land use change (ILUC). New research shows that the size of ILUC is not clear (https://doi.org/10.1002/bbb.2124) and usually underestimated (10.1016/j.jclepro.2020.120716). They are usually ignored but it could be up to 231 g/MJ (DOI:10.1016/j.rser.2020.110398) which dwarfs the values mentioned in this table and negates any positive impact of biofuels. I propose not ignoring this issue but including a discussion on the impacts on ILUC (e.g. using the very recent sources provided) and warning people that most studies that include ILUC conclude biofuels don't save CO2.	Related to Chapter 7. These issues have been addressed there.	Auke Hoekstra	Eindhoven University of Technology	Netherlands
69821	41	4	41	21	Maritime stakeholders fear that the cost of biofuels and/or sythetic hydrocarbons will be high due limited feedstock availability (itself due to sustainability concerns), and strong competition from the aviation sector. See, e.g. Korean Register, 2020, Forecasting the Alternative Marine Fuel - Ammonia, Busan, KR. They put their hopes now in green ammonia production. The two largest manufacturers of marine engines, MAN ES and Wärtsilä, have undertaken to develop the building or refurbishment of their engines to make them able to combust ammonia, together with a pilot fuel such as dihydrogen, which could be extracted on-board from ammonia. See, e.g. MAN ES, 2019, Engineering the future two-stroke green-ammonia engine, Copenhagen; and various announces in https://www.wartsila.com/media/news-releases.	Noted. It is addressed in the section about Shipping in Ch10.	Cédric PHILIBERT	Institut Français des Relations Internationales	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
69819	41	9	42	3	Optimism? No one in the sector believes jet fuels produced from biomass can represent a significant share of aviation fuels if trafic returns to pre-Covid levels, even less so if the doubling of the trafic by 2037 anticipated in 2018 by the International Air Transport Association was to materialise. Biofuels represented less than 0.01% of all jet fuels in 2018, with 15 million litres. The IEA "accelerated case" see production growing to 2800 million l by 2024, while 4500 million L would be needed to achieve 1% of the expected demand by 2024 (before the Covid 19 pandemic) (IEA 2019, Renewables 2019; see also IEA 2018 Renewables 2018 for a more focused analysis of sustainable aviation fuels from biomass). Most support to the aviation sector in the context of the pandemic is not conditional on environmental or climate action, "neglecting an opportunity to scale up sustainable aviation fuel use" (IEA 2020, Renewables_2020.) While biofuels can contribute to carbon-neutral aviation, in the longer term their contribution will likely be limited by feedstock, and synthetic kerosene from renewable-based hydrogen and carbon recycled from the atmosphere will most likely be indispensable to get closer to net carbon neutrality, unless all emissions are compensated with CDR. It is not so much an issue of price - there is no cheap solution, and air travellers will have to pay more to fly in the future - but an issue of feedstocks limits.	Implemented. Also addressed in section 10.5	Cédric PHILIBERT	Institut Français des Relations Internationales	France
75807	41	9	42	3	Perhaps mention that there are 8 approved ASTM pathways and that all of those are with biofuels [16] (Table 22). Also, that the blending level is up to 50% and today, flights with 100% biofuels are not yet possible [16] https://www.destination2050.eu/wp-content/uploads/2021/02/Destination2050_Report.pdf	Implemented	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
85383	41	9	41	9	Proposed change: Within the aviation sector there is optimism that jet fuels produced from biomass resources could offer a viable means to reduce emissions under the right policy circumstances. Despite the growing interest in aviation biofuels, both demand and production volumes remain negligible compared to conventional fossil aviation fuels. To date, only one facility is regularly producing sustainable aviation fuels, based on waste feedstocks (World Energy, in Los Angeles). Although many technology routes for these biofuels are consolidated, the potential to scale-up of aviation biofuel volumes is restricted by the lack of low cost and sustainable feedstocks (see Chapter 7). Additionally, competition with ground transportation is hindering their further use of SAF in aviation. However, analysis done by ICAO shows that feedstock and land availability would not be a constraint to sustainable aviation fuels production, and by 2050 it would be physically possible to meet 100% of international aviation jet fuel demand with sustainable aviation fuels, corresponding to a 63% reduction in emissions. However, this level of fuel production could only be achieved with extremely large capital investments in sustainable aviation fuel production infrastructure, and substantial policy support. The effort required to reach these production volumes would have to significantly exceed historical precedent for other fuels, such as ethanol and biodiesel for road transportation. (ICAO, 2018 - (Sustainable Aviation Fuels Guide). (ICAO, 2019 A40-WP/54).	Partially implemented	Neil Dickson	ICAO	Canada
56841	41	11	41	12	For context, it may be useful to cite total world annual aviation fuel demand (pre-COVID) and global annual RJF production volume, to give a sense of current market share and scale-up needed. For instance, pre-pandemic, U.S. airlines consumed approxmately 18B gallons of fuel/year (including all domestic and international flights), where total U.S. RJF production ranged in the hundreds of millions gallons.	Noted. Not fully implemented, but the main point of the comment is now refleted in the text.	Government of United States of America	U.S. Department of State	United States of America
61181	41	15	41	17	Assumptions around the sustainable production of feedstock is significant. The range of feedstock used today creates uncertainty in the lifecycle emmissions reduction potential. Given the high sensitivity of expected of expected emmission reductions to the sustainability of feedstock, it would be recommended to add a sentence or a note aknowledging that for biofuels to be sustainable, the feedstock must be produced sustainably. Page 63 lines 11-17 discuss this. However, this should be included in this section.	Implemented	Andrea Cristina Ruiz	Abdul Latif Jameel Poverty Action Lab and Member of Committee on Extreme Weather and Climate Change Adaptation Transportation Review Board-National Academy of Science	United States of America
23211	41	16	41	16	What does RJF stands for?	Corrected	Government of France	Ministère de la Transition écologique et solidaire	France
45611	41	16	41	16	Acronym use without explanation - RJF	Corrected	Annika Bose Styczynski	O.P. Jindal Global University	India
56843	41	16	41	16	"SAF" or sustainable aviation fuel is a more commonly agreed term for use in the aviation sector than is "RJF".	Implemented	Government of United States of America	U.S. Department of State	United States of America
10005	41				Table 10.5 The right column "Relative Cost of Conversion Process (1-3)" did not have any references for the valuation mark of 1, 2, and 3, as an example: 1 indicated high, etc.	Implemented	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
56845	42	1	42	1	"SAF" or sustainable aviation fuel is a more commonly agreed term for use in the aviation sector than is "RJF".	Implemented	Government of United States of America	U.S. Department of State	United States of America
45613	42	2	42	2	Acronym use without explanation - TRL. This clarifies itself only later when looking at the table.	Corrected	Annika Bose Styczynski	O.P. Jindal Global University	India
43793	42	5	42	7	The measurements by Petzold et al. (2010) on this topic could also be cited: https://pubs.acs.org/doi/10.1021/es2021439.	Outdated for AR6	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
56847	42	13	42	14	Specifically, marine sector biofuels offer a significant advantage in meeting aggressive sulfur emission reduction targets set by The International Maritime Organization.	Implemented	Government of United States of America	U.S. Department of State	United States of America
56849	42	20	42	20	Regarding "supply chains", biofuel production and distribution supply chains involve notable transport and logistical challenges. This aspect appears missed here, whereas T&D issues are extensively discussed in the Hydrogen Fuel Cells section (10.3.2).	Implemented	Government of United States of America	U.S. Department of State	United States of America
56851	42	21	42	21	Regarding "may open the market for ethanol fuels", the number of automaker vehicle models that are capable of burning mid and high-blend ethanol (flex fuel vehicles / FFVs) continue to decline annually.	Noted	Government of United States of America	U.S. Department of State	United States of America
18461	42	22	42	26	Figure 10.8 would benefit from more explanation. What do the 'technology readiness' numbers mean? Why would a technology straddle several of these categories?	Noted. We provide references for the TRL meaning.	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
75805	42	24	42	24	It would be great if there is a 1:1 match between Figure 10.8 and Table 10.5. Otherwise it leaves the question open in Table 10.5 of how advanced each pathway is. The other component missing is potential, to give a sense that some options (e.g. biomethane from residues) might be attractive from a cost, technology and GHG reduction perspective but the limitation is elsewhere (i.e. potential, scale)	Partially implemented. Potentials are shortly discussed in the text.	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
48055	43	1	44	8	Section 10.3.4 as a whole brings no guidance at all regarding what can be done in the short and medium terms to reduce GHG emissions of internal combustion engines (ICE). Yet, substitution of fossil fuel by biofuels can reduce GHG emissions by more than 50% in most cases and this can be done immediately. The section should include at least one paragraph on biofuels availability. The paragraph should also mention different time scales (short- , mid- and long-term) and national and regional circumstances, since this will affect the assessment of the issue. IEA (Global EV Outlook 2019) presents a more nuanced evaluation of the progressive penetration of EVs in the light vehicles flee and corresponding mitigation potential. Similarly, IRENA (2020, Global Renewables Outlook: Energy Transformation 2050) and IEA (Global EV Outlook 2019), which also highlights EVs coexistence with biofuels in the coming decades: “Transport will become much more electrified, but not everywhere, not in all sectors and not all at once. It follows that there would be a large need for biofuels for several decades to come. While EVs will come to dominate light vehicle fleets and will be powered increasingly by renewable electricity, they can only enter markets with well-developed power grids and charging infrastructure. Moreover, fleets take two decades to turn over. Heavy long-distance freight trucks, marine ships and airplanes are unlikely to be fully electrified due to the higher energy density they require. Hence, all forms of biofuels must be deployed more widely as the immediate climate solution (IRENA, 2020b). While technical and institutional challenges remain in scaling up the deployment of advanced biofuels, conventional biofuels (for example, sugarcane ethanol) have huge potential for increasing production capacity in Africa (IRENA, 2019l).” (IRENA, 2020, Global Renewables Outlook).	Take into account_Reorganised write up on alternative fuels to cover ammonia, drop in fuels, transition fuels and biofuels	Marcelo moreira	UNICAMP - Agroicone	Brazil
50975	43	1	44	8	Section 10.3.4 as a whole brings no guidance at all regarding what can be done in the short and medium terms to reduce GHG emissions of internal combustion engines (ICE). Yet, substitution of fossil fuel by biofuels can reduce GHG emissions by more than 50% in most cases and this can be done immediately. The section should include at least one paragraph on biofuels availability. The paragraph should also mention different time scales (short- , mid- and long-term) and national and regional circumstances, since this will affect the assessment of the issue. IEA (Global EV Outlook 2019) presents a more nuanced evaluation of the progressive penetration of EVs in the light vehicles flee and corresponding mitigation potential. Similarly, IRENA (2020, Global Renewables Outlook: Energy Transformation 2050) and IEA (Global EV Outlook 2019), which also highlights EVs coexistence with biofuels in the coming decades: “Transport will become much more electrified, but not everywhere, not in all sectors and not all at once. It follows that there would be a large need for biofuels for several decades to come. While EVs will come to dominate light vehicle fleets and will be powered increasingly by renewable electricity, they can only enter markets with well-developed power grids and charging infrastructure. Moreover, fleets take two decades to turn over. Heavy long-distance freight trucks, marine ships and airplanes are unlikely to be fully electrified due to the higher energy density they require. Hence, all forms of biofuels must be deployed more widely as the immediate climate solution (IRENA, 2020b). While technical and institutional challenges remain in scaling up the deployment of advanced biofuels, conventional biofuels (for example, sugarcane ethanol) have huge potential for increasing production capacity in Africa (IRENA, 2019l).” (IRENA, 2020, Global Renewables Outlook).	Take into account_Reorganised write up on alternative fuels to cover ammonia, drop in fuels, transition fuels and biofuels	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
29741	43	2	43	2	The text states that there is a "rapid adoption" of fuel-cell electric vehicles. We don't know if this is the case, other than maybe in the bus segment in some densely populated cities? Please consider modifying the text or elaborate more to reflect this.	Noted_See Chapter 10.3.2 for Fuel cell vehicls	Government of Norway	Norwegian Environment Agency	Norway
53623	43	2	43	5	Clarify that ICE will play a role for a long time simply because vehicles have a 15-25 year lifespan. There is a long time lag between the composition of new vehicle sales and the composition of the total fleet in operation.	Take into account_reflected in the text	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
85537	43	2	43	8	This is a strange argument. In essence: without regulation, internal combustion engines will be with us for a long time so we need to regulate synthetic fuels into existence (which are much more energy and CO2 intensive and costly). In the light of the strong internal combustion engine lobby it might be important that the IPCC avoids the impression that is uses less than straightforward logic to defend internal combustion engines so as to avoid an impression of bias. This is also implicitly acknowledged on the same page in line 31-32 by the way. And it might be important to remind people that efuels require about 4x more input energy than battery electric vehicles and 2x more input energy than hydrogen electric which makes them use large amounts of renewable energy that we don't have enough from in the forseeable future which increases their CO2 emissions considerably if one looks at the issue holistically. See for example the graph on page 29 of this well known report: https://www.transportenvironment.org/sites/te/files/publications/2020_12_Briefing_feasibility_study_renewables_decarbonisation.pdf	Take into account_Reorganised write up on alternative fuels to cover ammonia, drop in fuels, transition fuels and biofuels	Auke Hoekstra	Eindhoven University of Technology	Netherlands
84989	43	3	43	5	This underlines the importance of policy to promote EVs etc and scrap older more polluting vehicles. Legislation or measures on air quality may provide a mechanism to help make progress on this.	Noted	Jameel Hayat	AECOM	United Kingdom (of Great Britain and Northern Ireland)
43115	43	5	43	5	Several European countries have already decided to phase out the sale of new ICE vehicles. The UK will phase these from 2030, and hybrids from 2035.	Accepted_Mentioned in the text	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
47921	43	5	43	5	Some recent electrification scenarios paint a different picture with very rapid and significant EV adoption for on-road transportation (especially passenger cars). I think this should be mentioned, different studies provide different projections, see for example: https://doi.org/10.2172/1459351	Take into account_reflected in the text	Matteo Muratori	NREL	United States of America
43795	43	8	43	8	I would add "…and their climate impact".	noted	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
15511	43	9	43	10	Should note that adoption of regulations varies significantly between countries. Some changes to testing protocols have shown anomalies rather than specifically leading to improvements?	Noted	Ryan Falconer	Auckland Council, New Zealand	Australia
28579	43	9	43	14	It would be a pity here not to cite this report, which is the source of a lot of the information reported in this section: https://www.iea.org/reports/fuel-economy-in-major-car-markets. And updates available here: https://www.iea.org/reports/fuel-consumption-of-cars-and-vans	Noted_GFEI data is the basis for IEA reports	Pierpaolo Cazzola	International Transport Forum	France
1303	43	11	43	12	Unclear to what period the 0,7% improvement refers to. Compared to 2016 levels?	Editorial_Corrected in the text	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
43119	43	11	43	11	The EU has implemented GHG emissions standards that will see reductions of 30% by 2030 among heavy duty vehicles; hence, in the EU, improvements will speed up.	Noted	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
10785	43	12	43	14	This remark suggests again that sufficiency would be an useful concept for transport as well as for buildings. However this word appears nowhere in chapter 10. Why?	Unknown comment	Philippe Waldteufel	CNRS	France
17135	43	12	43	14	It would be good if more information about the SUV trends could be provided. Recent IEA reports include figures for the share of SUVs on vehicle sales, both at the global level and for world regions.	Noted	Giulio Mattioli	TU Dortmund University	Germany
23213	43	12	43	14	Are these figures for sales or for the total fleet?	Editorial_Deleted the figure	Government of France	Ministère de la Transition écologique et solidaire	France
85539	43	12	43	12	I would leave out the number of 7.2 because it is based on lab tests while we know that real world performance is at least 14% worse. E.g. see the publications by the ICCT. https://theicct.org/publications/way-real-world-co2-values-european-passenger-car-market-its-first-year-after and chapter 10 page 48 line 1-5.	Noted	Auke Hoekstra	Eindhoven University of Technology	Netherlands
47923	43	15	43	24	Co-optimization of engines and fuels is another element that should be mentioned: https://www.nrel.gov/docs/fy19osti/73282.pdf	Take into account_Reorganised the section and focused more on fuels	Matteo Muratori	NREL	United States of America
28581	43	17	43	19	This sentence is wrong and very misleading. It should be corrected radically. The paper cited is about the combine use of a Miller cycle and water injection. What is capable to improve efficiency is the Miller cycle (for a review of how this can happen, see https://www.sciencedirect.com/topics/engineering/miller-cycle), certainly not the water injection (which uses energy available in the fuel to vaporize water). The paper attributes merits for knock reduction to the water injection, and not for efficiency improvement. Keeping the sentence here as it is would really be a major problem, capable to discredit a lot if the remaining analysis. Let me add also that I am not familiar with the RCCI technology cited below, but a 57% improvement in efficiency sounds like something that the auto industry would have picked up already, if it was really available. Based on how wrong are the lines citing Neumann, I recommend a thorough check of the information reported in the rest of this paragraph.	Take into account_Deleted the details of the technology under development	Pierpaolo Cazzola	International Transport Forum	France
56853	43	17	43	24	Not sure of the water to fuel ratio mentioned here and the efficiency improvement resulting from that mix. Suggest taking this sentence out or verifying with other data or literature.	Take into account_Deleted the details of the technology under development	Government of United States of America	U.S. Department of State	United States of America
29743	43	19	43	24	The paragraph this sentence belongs to refers to technologies in development. However, this speicific sentence seem to refer to a known potential new technology that is yet to be materialized in the market. We therefore question the relevance of mentioning this, and ask you to consider deleting or review the wording and/or placing of this text.	Take into account_Deleted the details of the technology under development	Government of Norway	Norwegian Environment Agency	Norway
23215	43	22	43	22	In the statement "RCCI offers improved fuel efficiency of 57%", we recommand to clarify what 57% is respect to. It seems to be inconsistent with Table 10.6	Take into account_Deleted the details of the technology under development	Government of France	Ministère de la Transition écologique et solidaire	France
28475	43	25	43	32	The origin of the carbon used for e-fuels must be included. This is appropriately addressed in Chapter 11. Synthetic fuels can only be carbon neutral if the carbon that is used is atmospheric in origin. Using fossil carbon to make synthetic fuels cannot be carbon neutral because upon combustion, fossil carbon is dumped into the atmosphere.	Take into account_Reorganised the section and focused more on fuels. Show also chapter 6 for fuel production	Mark Preston Aragones	Bellona Europa	Belgium
28583	43	25	43	32	This sentence depicts a rosy world failing to inform the reader about the massive requirements in terms of energy inputs and the stringent need for very low-carbon energy sources that would be required to ensure that synfuels (e-fuels) are actually delivering GHG emission reductions on a life-cycle basis. Cost assessments are also available in far greater detail than this. For example in https://www.iea.org/reports/the-future-of-hydrogen (doenload report, pages 60-62). The same section talk about the environmental impact of hydrogen-based synthetic hydrocarbon fuels. The same subject is covered in pages 36-37 here (with a focus on shipping): https://www.itf-oecd.org/sites/default/files/docs/navigating-cleaner-maritime-shipping.pdf. See also sources cited in this section.	Take into account_Reorganised the section and focused more on fuels. See also chapter 6 for fuel production	Pierpaolo Cazzola	International Transport Forum	France
53625	43	25	43	26	Clarify that it's promising for reducing emissions from existing ICE vehicles, but unliekly to be a cost competitive solution for future vehicles (the much greater efficiency means that direct electrification will most often be cheaper).	Take into account_Mentiond in chapter 10.2	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
69823	43	25	43	39	Synthetic fuels in ICEs have an overall efficiiency electricity to mobility of ~15%, vs 70% for BEVs. It has been argued that the economics can be improved if the synthetic fuels are produced in areas with excellent resources, roughly doubling or even tripling the output for same solar and wind capacities (Perner, J. and T. Steinfort, 2020, The concept of efficiency in the German climate policy debate on road transport, Frontier Economics), this does not suffice to close the gap. This efficiency gap would justify limiting the use of synfuels in ICEs to cases where electrification is actually impossible.	Take into account_Mentiond in chapter 10.2	Cédric PHILIBERT	Institut Français des Relations Internationales	France
81955	43	25	43	32	This paragraph seems to suggest that syn fuels for road vehicles are an option if it was not for the high cost. It should be mentioned though that the low energy efficiency from REN electricity to syn fuels in combination with much more efficient options for road vehicles plus the danger of maintaining ICE fleets longer than necessary should keep use of synfuels in road transport limited in volume and time.	take into account_Issues of synthetic fuel are described in the text	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
1305	43	26	43	28	If the CO2 is captured from the air, it will help in closing the carbon cycle. If the CO2 is captured from a coal or natural gas power plant, you can argue whether it helps in closing the carbon cycle. You have to be very careful to avoid double counting, either the electricity is close to carbon neutral or the fuel is carbon neutral. If the synthethic fuel is burned, than the CO2 comes in the atmosphere.	Noted	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
23217	43	29	43	29	We suggest to develop when this price is decrease supposed to happen	Take into account_Issues of synthetic fuel are described in the text	Government of France	Ministère de la Transition écologique et solidaire	France
1307	43	31	43	32	The production can be expanded.... So why is the "limited amount of production" a problem? I suggest to remove this part of the phrase or explain why it is limited (in terms of feedstock etc.).	take into account_Issues of synthetic fuel are described in the text	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
60471	43	31	43	32	This sentence is incomplete. Could be rephrased as follows: "Due to the high cost, the limited amount of production and the existing alternatives to decarbonise light mobility though electrification of hydrogen, the adoption of synthetic fuels is expected to be used more in aviation and shipping sector where alternatives to fuels are lesser" also it is important to note that: The high cost of CCU technologies is often considered as a drawback for the upscaling of these technologies. However, De Luna et al, 2019 have shown that when electricity costs fall below 4 cents/kWh and energy efficiency is at least 60%, all products generated from CO2 electrolysis will become competitive with current market prices for these products derived from fossil fuel sources. •De Luna et al., 2019, Science, 364, 6438.	take into account_Issues of synthetic fuel are described and added the Ref in the text	Célia Sapart	Université Libre de Bruxelles / CO2 Value Europe	Belgium
76331	43	31	43	32	This sentence is incomplete. Could be rephrased as follows: "Due to the high cost, the limited amount of production and the existing alternatives to decarbonise light mobility though electrification of hydrogen, the adoption of synthetic fuels is expected to be used more in aviation and shipping sector where alternatives to fuels are lesser" also it is important to note that: The high cost of CCU technologies is often considered as a drawback for the upscaling of these technologies. However, De Luna et al, 2019 have shown that when electricity costs fall below 4 cents/kWh and energy efficiency is at least 60%, all products generated from CO2 electrolysis will become competitive with current market prices for these products derived from fossil fuel sources. •De Luna et al., 2019, Science, 364, 6438.	Take into account_reflected in the text	Deepak PANT	Flemish Institute for Technological Research (VITO)	Belgium

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
78819	43	31	43	32	complements in the following sentence to explain that cost and amount of production are not the only reason to suggest that synthetic fuels are not prioritary for light duty vehicules : "Due to the high cost, the limited amount of production and the existing alternatives to decarbonise light mobility though electrification of hydrogen, the adoption of synthetic fuels is expected to be used more in aviation and shipping sector where alternatives to fuels are lesser." The high cost of CCU technologies is often considered as a drawback for the upscaling of these technologies. However, De Luna et al, 2019 have shown that when electricity costs fall below 4 cents/kWh and energy efficiency is at least 60%, all products generated from CO2 electrolysis will become competitive with current market prices for these products derived from fossil fuel sources. • De Luna et al., 2019, Science, 364, 6438.	Take into account_reflected in the text	Sylvain Nizou	CEA	France
83715	43	31	43	32	This sentence is incomplete. Could be rephrased as follows: "Due to the high cost, the limited amount of production and the existing alternatives to decarbonise light mobility though electrification of hydrogen, the adoption of synthetic fuels is expected to be used more in aviation and shipping sector where alternatives to fuels are lesser" also it is important to note that: The high cost of CCU technologies is often considered as a drawback for the upscaling of these technologies. However, De Luna et al, 2019 have shown that when electricity costs fall below 4 cents/kWh and energy efficiency is at least 60%, all products generated from CO2 electrolysis will become competitive with current market prices for these products derived from fossil fuel sources. •De Luna et al., 2019, Science, 364, 6438.	take into account_Issues of synthetic fuel are described and added the Ref in the text	Christian Breyer	LUT University	Finland
83953	43	31	43	32	A recent study showed that when electricity costs fall below 4 cents/kWh and energy efficiency is at least 60%, all products generated from CO2 electrolysis will become competitive with current market prices for these products derived from fossil fuel sources (P. (De Luna et al, Science 364 (2019) 6438) Examples of projects that will reach commercialization in the near term show that synthetic fuels will be used in many other sectors: - Carbon Recycling International => 4000 tons of methanol/year - Jupiter 1000 (CO2 flue gas to CH4) : 25Nm3/h of methane - North CCUhub (CO2 to methanol)=> 44000 tons of methanol/year - Mo-Industrial e-fuel (CO2 to methanol)=> 80 000 tons of methanol/year - C2Fuel (CO2 to formic acid) => 2.4 Million tons of formic acid/year - Audi e-gas plant (CO2 to methane => 1000 tons of methane/year	Noted	Ana Machado	Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa	Portugal
28585	43	33	43	39	DME can be produced from many primary sources, not only renewable energy. I would also question the use to he work "promising synthetic fuels" for DME, since it has been on the table for decades, but never really picked up much interest.	Noted	Pierpaolo Cazzola	International Transport Forum	France
48057	43	33	43	39	Section 10.3.4 as a whole brings no guidance at all regarding what can be done in the short and medium terms to reduce GHG emissions of internal combustion engines (ICE). Yet, substitution of fossil fuel by biofuels can reduce GHG emissions by more than 50% in most cases and this can be done immediately. The section should include at least one paragraph on biofuels availability. The paragraph should also mention different time scales (short- , mid- and long-term) and national and regional circumstances, since this will affect the assessment of the issue. The authors of Chapter 10 are invited to carefully revise these issues. In fact, as mentioned in other comments to specific sections of Chapter 10, a recent joint-assessment of the joint role of biofuels and electromobility in decarbonizing land transportation is presented by IEA Bioenergy TCP and IEA Advanced Motor Fuels TCP in the recent report The Role of Renewable Transport Fuels in Decarbonizing Road Transport (2020), which presents relevant estimates for several countries, including: "Our assessment shows that biofuels contribute most to decarbonization now and up to 2030, 2040, or even 2050, depending on the country. In Germany and in the USA, efficiency gains become the main contributor after 2030, and in Finland and Sweden the impact of biofuels remains largest until around 2040 when the use of electric vehicles takes over. In Brazil, biofuels remain the largest contributor until 2050." In the MORE EV scenarios, which assumed 100% of passenger car sales in 2050 to be various sort of electric vehicles (i.e. not necessarily BEVs), the report estimates that "the share of EVs in the passenger car fleet reaches between 1.3% (Brazil) and 21% (Finland) in 2030, and between 19.4% (Brazil) and 77% (Sweden) by 2050". Additional key conclusions from the same report: - In the Current Policies scenario, biofuels already provide the largest contribution to the reduction of TTW CO2 emissions now and up to 2030, 2040, or even 2050, depending on the country. Electric vehicles only catch up with biofuels by 2040. - Even if electric vehicles are introduced at a higher rate, biofuels remain the largest contributor to decarbonization in the short to medium term. - Depending on the fuel qualities available in a region, maximizing the use of biofuels, and in particular of drop-in biofuels, can reduce TTW CO2 emissions to almost zero by 2050. IRENA (2020, Global Renewables Outlook: Energy Transformation 2050) also present a more nuanced evaluation on the progressive penetration of EVs in the light vehicles fleet, as well as of its coexistence with biofuels in the coming decades: “Transport will become much more electrified, but not everywhere, not in all sectors and not all at once. It follows that there would be a large need for biofuels for several decades to come. While EVs will come to dominate light vehicle fleets and will be	Take into account_Reorganised write up on alternative fuels to cover ammonia, drop in fuels, transition fuels and biofuels. See also chapter 10.3.2.	Marcelo moreira	UNICAMP - Agroicone	Brazil

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
50977	43	33	43	39	Section 10.3.4 as a whole brings no guidance at all regarding what can be done in the short and medium terms to reduce GHG emissions of internal combustion engines (ICE). Yet, substitution of fossil fuel by biofuels can reduce GHG emissions by more than 50% in most cases and this can be done immediately. The section should include at least one paragraph on biofuels availability. The paragraph should also mention different time scales (short- , mid- and long-term) and national and regional circumstances, since this will affect the assessment of the issue. The authors of Chapter 10 are invited to carefully revise these issues. In fact, as mentioned in other comments to specific sections of Chapter 10, a recent joint-assessment of the joint role of biofuels and electromobility in decarbonizing land transportation is presented by IEA Bioenergy TCP and IEA Advanced Motor Fuels TCP in the recent report The Role of Renewable Transport Fuels in Decarbonizing Road Transport (2020), which presents relevant estimates for several countries, including: "Our assessment shows that biofuels contribute most to decarbonization now and up to 2030, 2040, or even 2050, depending on the country. In Germany and in the USA, efficiency gains become the main contributor after 2030, and in Finland and Sweden the impact of biofuels remains largest until around 2040 when the use of electric vehicles takes over. In Brazil, biofuels remain the largest contributor until 2050." In the MORE EV scenarios, which assumed 100% of passenger car sales in 2050 to be various sort of electric vehicles (i.e. not necessarily BEVs), the report estimates that "the share of EVs in the passenger car fleet reaches between 1.3% (Brazil) and 21% (Finland) in 2030, and between 19.4% (Brazil) and 77% (Sweden) by 2050". Additional key conclusions from the same report: - In the Current Policies scenario, biofuels already provide the largest contribution to the reduction of TTW CO2 emissions now and up to 2030, 2040, or even 2050, depending on the country. Electric vehicles only catch up with biofuels by 2040. - Even if electric vehicles are introduced at a higher rate, biofuels remain the largest contributor to decarbonization in the short to medium term. - Depending on the fuel qualities available in a region, maximizing the use of biofuels, and in particular of drop-in biofuels, can reduce TTW CO2 emissions to almost zero by 2050. IRENA (2020, Global Renewables Outlook: Energy Transformation 2050) also present a more nuanced evaluation on the progressive penetration of EVs in the light vehicles fleet, as well as of its coexistence with biofuels in the coming decades: “Transport will become much more electrified, but not everywhere, not in all sectors and not all at once. It follows that there would be a large need for biofuels for several decades to come. While EVs will come to dominate light vehicle fleets and will be	Take into account_Reorganised write up on alternative fuels to cover ammonia, drop in fuels, transition fuels and biofuels. See also chapter 10.3.2	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
5499	43	36	43	36	after Renewable, add : or low carbon sources	Editorial_Corrected in the text	Michel SIMON	Retraité/ Pdt d'association	France
29385	44	0	0	0	Fig. 10.9 is quite poor in quality, it seems also distorted	Later versions clarified this.	Maria Pregnolato	University of Bristol	United Kingdom (of Great Britain and Northern Ireland)
47639	44	1	44	2	Is it possible to dissagregate this graph across regions. Showing global averages is good enough to show the general trends, but regional disparities would be very interesting, especially since it some cases the trand may be upwards (?)	Later versions clarified this.	Vassilis Daioglou	Utrecht University	Netherlands
85541	44	2	44	2	This is based on laboratory measurements (GFEI 2020) and it might be good to reflect that in the description of the figure. E.g. by adding "(based on type approval data and not real world driving measurements)". Real world numbers are about 14% worse (it was around 39% for the NEDC and the WLTP is better but still far from perfect). https://theicct.org/publications/way-real-world-co2-values-european-passenger-car-market-its-first-year-after For comparison sake this is fine and I fully understand that using real world driving data is politically a bridge to far for now but I think the scientific community should stay vigilant and use real world data. See also https://doi.org/10.1016/j.trpro.2017.05.333 for a reference that is bit more dated and less precise but peer reviewed and gives a 10-15% range that is already used on chapter 10 page 48 line 1-5.	Later versions clarified this.	Auke Hoekstra	Eindhoven University of Technology	Netherlands
8323	45	1	59	25	The sub-section on LCA is interesting and hellpful. Yet, I think it breaks the logical flow, as it seems to be a sub-topic of road transport. Hence, I would like to suggest to include it in Section 10.3. and ensure better integration with the analysis presented there. Maybe it could even be advisable to split 10.4. and move the different parts to their counterparts in 10.4. (e.g. move the LCA analysis of batteries in 10.4. to the discussion of battery technologies in 10.3.)	We have reorganized sections 10.3 and 10.4 to addess this concern and improve the flow of the chapter	Michael Jakob	MCC Berlin	Germany
79169	45	1	51	14	Important to note that this entire analysis is sensitive to assumed vehicle efficiency. My comments at 5:21–25 and 22:22–24 give a 2020 SAE and a 2004 IJVD citation showing advantageous 2–3x reductions in LDV tractive load, since extended to 4x by two startups entering the market in 2021, as my comments describe; those vehicles are so superefficient (0.7–0.9 Lequiv/100 km) that they need little or no recharging for normal driving because their topside PV capture suffices. The academic literature hasn't caught up yet, but BMW did in 2013 with great commercial success (see SAE paper at doi:10.4271/13-01-01-0004). If you showed, as you should, the L/100 km assumptions behind Fig. 10.11, I suspect they wouldn't reflect this range of vehicle efficiency; if they did, the error bars would become meaninglessly wide. So I think you need to normalize to a nominal vehicle, state its efficiency, and explain in the caption that other options 2–4x more efficient or ?X less efficient are also available and would scale the fuel-cycle impacts correspondingly.	We have relied on efficiency ranges from the literature. We include all the values embedded in the section figures in the Annex for the chapter	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
43121	45	12	45	14	Freight Transport / Road -> Light duty (vans) are missing.	They are part of the LDV fleet	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
1315	45	25	51	14	In section 10.4.1 H2 is discussed as fuel for FCEV. H2 emits water vapor, which is also a GHG. But it seems to be that this is not taken into account (see line 16-18 on page 49). In section 10.5.3.2, about H2 as fuel for airplanes, an emission index of water vapour of 2.6 is mentioned. Is this also of relevance for cars, or is it not an issue because the water vapor is emitted at ground level instead of at higher altittudes? Nevertheless good to make this clear. Also are NOX emissions (from ICE's) included in section 10.4.1?	We have added some text about water vapor and we are consulting with aviation authors about the issue	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
45579	45	25	51	14	The analysis in this section is very valuable, but is in the end static. It suggests that in certain power system contexts the application of EV is not a good idea. But it doesn't acknowledge the dynamics. Even if the power system is largely based on coal, it may be a good idea to start the EV transition (in the end building up charging infrastructure etc. takes time) and at the same time decarbonize the power system (which many countries are doing anyway).	We will add a sentence refering to other sections of the chapter that cover the infrastructure issues	Kornelis Blok	Delft University of Technology	Netherlands
47057	45	25	49	15	The treatment of PHEVs in this section contains many errors, inaccurate characterizations, inconsistencies, including Fig 10-11. These will be described individually.	We can't respond to these assertions without detailed information	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
1245	46	1	47	11	A split up of the life-cycle emissions in a couple of phases (for instance 1. battery manufacturing, 2. rest of vehicle manufacturing, 3. vehicle use (tailpipe, TTW), 4. fuel cycle (WTT) and 5. end-of-life vehicle recycling) would make the information in this paragraph more comparable to other studies about life-cycle emissions of vehicles. See for instance ICCT (2018), Effects of battery manufacturing on electric vehicle life-cycle GHG emissions.	We have a section discussing battery issues in section 3.	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
1241	46	4	46	4	"particularly for alternative powertrain technologies." ... , including the batteries for BEVs, PHEVs en FCEVs. Especially the production of a battery adds a large amount of CO2 emissions in the phase of manufacturing, in the order of 100 kg CO2 per kWh charging capacity (for example: 10 tonnes of CO2 for a 100 kWh battery).	This issues is included in the discussion about battery technologies in section 10.3	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
1243	46	5	46	14	Which bandwidth is taken for the CO2 emissions of the manufacturing of batteries? The overview study of Emilsson and Dahllöf give a bandwidth of 61-146 kg CO2/kWh battery capacity. Emilsson, E. en Dahllöf, L. (2019). Lithium-Ion Vehicle Battery Production. Status 2019 on Energy Use, CO2 Emissions, Use of Metal Products Environmental Footprint, and Recycling. Stockholm: IVL Swedish Environmental Research Institute.	We used a range of studies and attempted to harmoniza assumptions.	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
45615	46	5	46	14	You might want to consider the LCA findings of a comparative analysis by Bloomberg: https://about.bnef.com/blog/the-lifecycle-emissions-of-electric-vehicles/?utm_source=Email&utm_campaign=BNEF&utm_medium=Newsletter&utm_content=BNEFMonthInReview&tactic=432660	Done	Annika Bose Styczynski	O.P. Jindal Global University	India
47059	46	5	46	14	[1 of 2] We have reviewed all of the 30 listed references. Our review is summarized in Review Visual 1 in https://bit.ly/ipcc_review_wg3_figs. Twelve of the articles explicitly assesses PHEVs and their greenhouse gas (GHG) performance. Of those 12 articles, zero of them state or suggest that a PHEV performs worse in GHG than an ICE. In fact, zero of them state or suggest that the PHEV performs worse in GHG than a HEV. Whatever methodology was used to summarize these 30 articles into Fig 10.11 (it is not explained), it entirely reverses the the findings of each article that directly compairs GHG performance of PHEVs to HEV and ICE vehicles. This section will need significant revision. [Continued]	We are working on an update of the PHEV numbers. We now include LC impacts of a PHEVs when running on charge depleting mode, with electricity produced from either NG or low-carbon, and also the impacts when running the PHEV on charge sustaining mode	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47061	46	5	46	14	[2 of 2] We also found zero studies describing performance of a PHEV using coal power, and yet there are at least 11 points on Fig 10.11 associated with this scenario. It is unclear how those figure values were created/calculated.	Several studies on the LCA of PHEV include charging with coal-based electricity. We thus included this source of electricity in the harmonization effort for described in the appendix for the chapter	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47955	46	5	46	14	While LCA is important part of this analysis, it is fundamentally not easy to compare various LCA analyses since assumptions and boundary are hugely different research by research. In that sense, IEA 2020 (Gloval EV outlook 2020 p 191 Figure 4.2 is providing very useful insight as this analysis compares all type of powertrain based on uniform unbiased assumption, such as global average power supply GHG intensity. So please also include this comparison in this reference and use it as a kind of base analysis. In a world of LCA, as assumptions differe wildly research by research, median and mode of many papers are not providing unbiased insights. Some very biased anlyses make average figure distorted.	We addressed this concern by performing a harmonization effort using the data from the studies.	Takao AIBA	Toyota	Japan
63229	46	5	49	30	Figure 10.11 uses g CO2E/passenger-km as the unit to assess the life cycle emission intensity for all types of LDV technologies, while the text discussion uses g CO2e/vkm: the unit should be consistent.	The figure uses both gCO2e/passenger-km (secondary x-axis) and gCO2e/vehicle-km(primary x-axis)	Government of Canada	Environment and Climate Change Canada	Canada
28771	46	23			It would be helpful to provide more details on PHEV's UFs (beyond what you say also on p. 48).	The section is being restructured but we have space constraints.	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy
47073	46	23	46	24	I would like to see a citation for the lowerbound of utility factor of 8%. This seems to be an error, as there have been no credible reports of PHEVs with such low utility factors. Please either provide here a citation for the 8% claim, or change the text.	In the new figure we are presenting the life cycle impacts in charge sustaining and charge depleting mode, therefore disregarding the UF. We are aware of the large span of UFs available in the literature and we decided to not present any as the UF is dependent upon several factors.	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47113	46	23	46	24	[1 of 3] The report text in this section implies that the authors relied on their own data (or contributed data that the authors analyzed themselves) in order to infer the utility factor range of 8% to 71% stated in line 24 of page 10-46. Relying on only one data collection effort however, especially one that is not available to the general public, nor are there much details about what, how and where the data was collected, is generally not good practice. [Continued]	We relied on data from publicly available reports/paper to do the harmonization effort. We did not use a single data source for any of the numbers. The annex to the chapter includes a detailed description of the data collected and used.	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47115	46	23	46	24	[2 of 3] One way to improve the confidence in the utility factor values derived by the authors' own work is to cite and show agreement with peer-reviewed published work. One recent and very relevant paper that ought to be cited for this is (Raghavan and Tal 2020), whose full citation is: SS Raghavan, G Tal (2020) Plug-in hybrid electric vehicle observed utility factor: Why the observed electrification performance differ from expectations, International Journal of Sustainable Transportation, DOI: 10.1080/15568318.2020.1849469 [Continued]	We did not derive any values from our own work. We relied on the values in the literature.	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47117	46	23	46	24	[3 of 3] It is well known that utility factor depends not only on how vehicle owners use their car (driving distances and frequency of connecting to chargers), but also on the design vehicle itself in terms of the electric driving range. In (Raghavan and Tal 2020 – Table 4), the median values for observed real-world utility factors were: 14%, 36%, 68% and 70% for PHEVs with US-EPA rated electric ranges of 10, 20, 40 and 53 miles (16, 32, 64 and 85 km), respectively. While the high end of utility factors in (Raghavan and Tal 2020) seems to agree with the high end in the authors' data, the lower end involves a high level of disagreement. The bounds here should coincide with a specific reference.	The bounds we chose aim to represent the whole range of values reported in the literature. As stated in the response above, we decided to present the LC impacts on CD and CS modes.	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
56855	46	24	46	38	The transport of feedstock and biofuel products are another significant factor in determining the LCA emissions of biofuels. Depending on the mode of transport, the additional emissions can be significant and the potential for decarbonization of the transport of biofuels may be limited (e.g., for heavy-duty trucks).	We relied on the emissions data from the biofuels chapter for our harmonization effort.	Government of United States of America	U.S. Department of State	United States of America
56857	46	24	46	38	The discussion of biofuel emissions intensity does not make any distinctions between types of biofuel feedstocks. The ranges of intensities presented seem to encompass all types of feedstocks, and in this context the range seems appropriate. However, that is far to simplistic a representation of the current state of science. The literature has generally found that commodity crop-based fuels have the highest carbon intensity, followed by lignocellulosic crop-based fuels, with non-crop-based fuels having the lowest emissions intensity. This important distinction should be clarified here.	These issues are covered in the biofuels discussions througout the report. For our section, we provide a range of all the values available	Government of United States of America	U.S. Department of State	United States of America
47641	46	27	46	27	The Daioglou 2020 reference is wrong. I suspect you are refer to Daioglou 2017. https://www.nature.com/articles/s41558-017-0006-8	Will correct	Vassilis Daioglou	Utrecht University	Netherlands
47643	46	29	46	31	There reference for the partial models is incorrect. The correct referenes are: https://www.nature.com/articles/s41558-017-0006-8 and https://iopscience.iop.org/article/10.1088/1748-9326/ab6c2e	Will correct	Vassilis Daioglou	Utrecht University	Netherlands
45575	46	30	46	30	What are "partial models"? And can anything be said about the validity of the results of both approaches? Now the reader is left a bit in the dark.	We added clarification of the source of the data for EF of biofuels, which came from another chapter	Kornelis Blok	Delft University of Technology	Netherlands
47121	46	32	46	36	[1 of 3] It is unclear what statement the authors are trying make with the reference to Bio-Fuels Partial models, and what is intended message from the respective scenarios generated in Figure 10.11. It also bears to note that not one of the ~30 cited references for Figure 10.11 (see Review Visual 1, available at bit.ly/ipcc_review_wg3_figs) has considered any cases of bio-fuel partial models in the way the authors of this report did. [Continued]	As noted before, the biofules EF came from the data from another chapter	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
47123	46	32	46	36	[2 of 3] Referring to chapter 7 (Agriculture, Forestry, and Other Land Uses), the brief explanation of partial model bio-fuels is that certain bio-mass resources (e.g. growing forests) are already very effective carbon sinks that harvesting them as bio-mass to create bio-fuels would be worse (in terms of net global warming potential) than using fossil fuels. To most readers, this simply infers a message along the lines of “Only the appropriate bio-mass sources should be used for bio-fuels” [Continued]	That is probably the right message to get across, byt again the issues related to biofules are discussed in detail in chapter 7 and chapter 10 is constrained on the amount of space we can dedicate to it.	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47125	46	32	46	36	[3 of 3] Since fossil-fuel Gasoline and Diesel are already abundantly in use, it wouldn’t make much sense to expect a new fuel pathway that has worse global warming potential (whatever that fuel pathway might be) to gain future market share. As such, if the intent of figure 10.11 is to showcase the best and worst possible scenarios of various powertrains, the practical worst case scenario for ICEVs, HEVs and PHEVs should be no worse than simply using 100% fossil fuel Gasoline or Diesel. We suggest that the Figure 10.11 remove the "Bio-Fuels Partial models" sections to keep the focus on relative powertrain performance.	We include all pathways available in the literature. Some of them might be worse than the status quo, but that is information we need to include	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47645	46	32	46	36	Not clear where the LUC emissions come from. They do not coincide with Box 7.10 Figure 1.	We have confirmed that our biofuels data is consistent with what is reported in chapter 7.	Vassilis Daioglou	Utrecht University	Netherlands
48059	46	32	46	36	This conclusion does not consider important findings, such as negative LUC emissions due to bioenergy expansion. Estimates (including in Chapter 7 – for which specific comments were also presented) should be updated taking into account the following references: Strapasson, Alexandre, Jeremy Woods, Helena Chum, Nicole Kalas, Nilay Shah and Frank Rosillo-Calle. “On the Global Limits of Bioenergy and Land Use for Climate Change Mitigation.” , (May 2017) . Staples, M. D., Malina, R., & Barrett, S. R. (2017). The limits of bioenergy for mitigating global life-cycle greenhouse gas emissions from fossil fuels. Nature Energy, 2(2), 1-8.	We are working on updating the biofules numbers based on changes done in chapter 7. We will look atht citation provided	Marcelo moreira	UNICAMP - Agroicone	Brazil
50979	46	32	46	36	As we have commented for Chapter 7, Box 7.10, the discussion about calculating climate change mitigation values of bioenergy and BECCS correctly points out the wildly contrasting conclusions based on different assumptions and methodologies, but then goes on to give more weight and relevance in the text and in the Figure to some of the more extreme and biased methodologies, particularly the so-called “partial models” that incorporate unrealistic and uneconomical “foregone sequestration” assumptions about counterfactual “natural regrowth”. Scarce literature is cited to support the numbers in the “partial models” curves (supposedly they come from a single paper, Daioglou et. al 2020?). This highlights an unproven, recent methodology with disputed assumptions while discarding a host of recent developments and precision building in LCA and ILUC literature, that has benefited from more precise modeling of national and regional level conditions. It is concerning because emissions at this level is extremely rare in specialized LCA literature, which has been omitted from the review and from the figure (we present some literature below, but strongly recommend to increase the list and invite specialized scientists). We specially missed publications from Wallace Tyner (lead bioenergy scientist from Purdue University) who has contributed for decades in this topic (including by developing values currently used in the LCFS and CORSIA) and not a single citation found in chapter 7 or 10 (please see Melissa et al 2021 for a non-comprehensive list of Tyner's work). Here we provide a short list of available literature, but we strongly recommend authors of chapter 10 to contact experts on the field, including the authors of the below mentioned literature. Finally, this conclusion does not consider important findings, such as negative LUC emissions due to bioenergy expansion. Estimates (including in Chapter 7 – for which specific comments were also presented) should be updated taking into account the following references: Strapasson, Alexandre, Jeremy Woods, Helena Chum, Nicole Kalas, Nilay Shah and Frank Rosillo-Calle. “On the Global Limits of Bioenergy and Land Use for Climate Change Mitigation.” , (May 2017) . Staples, M. D., Malina, R., & Barrett, S. R. (2017). The limits of bioenergy for mitigating global life-cycle greenhouse gas emissions from fossil fuels. Nature Energy, 2(2), 1-8. Liu, B., & Rajagopal, D. (2019). Life-cycle energy and climate benefits of energy recovery from wastes and biomass residues in the United States. Nature Energy, 4(8), 700-708. Kang, Y., Yang, Q., Bartocci, P., Wei, H., Liu, S. S., Wu, Z., ... & Chen, H. (2020). Bioenergy in China: Evaluation of domestic	This comment should be addressed by chapter 7, since we are relying on their values for our LCA harmonization process	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
47649	46	34	46	34	Rose et al 2020 reference missing from reference list. I suspect this is the paper: https://link.springer.com/article/10.1007/s10584-020-02945-6	Will correct	Vassilis Daioglou	Utrecht University	Netherlands
47647	46	36	46	36	Again, the Daioglou reference is incorrect. I assume these numbers come from Box 7.10 Figure 1.	Will correct	Vassilis Daioglou	Utrecht University	Netherlands

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
48061	47	0	47	0	Figure 10.11 is flawed, particularly regarding the estimated GHG emissions results of biofuels with partial models. The Supplementary Material to Figure 10.11 (Chapter 10, pp. 160-161, Table A.10.4.1) indicates that values for biofuels in partial models calculation departs from 133 g CO2e/MJ, and that this value is based on data from Chapter 7. However, no reference to the specific section or sub-chapter of Chapter 17 is made, so it is not possible to double check and review those unusual figures. This is a matter of great concern, since emissions levels that high are extremely rare in specialized LCA literature concerning biofuels emissions factors. This specialized literature seems to have been neglected in the assessment that resulted in the figures presented in Table A.10.A.1 and Figure 10.11. Therefore, a non-exhaustive list of additional references to specialized literature is presented below: Staples, M. D., Malina, R., & Barrett, S. R. (2017). The limits of bioenergy for mitigating global life-cycle greenhouse gas emissions from fossil fuels. Nature Energy, 2(2), 1-8. Liu, B., & Rajagopal, D. (2019). Life-cycle energy and climate benefits of energy recovery from wastes and biomass residues in the United States. Nature Energy, 4(8), 700-708. Kang, Y., Yang, Q., Bartocci, P., Wei, H., Liu, S. S., Wu, Z., ... & Chen, H. (2020). Bioenergy in China: Evaluation of domestic biomass resources and the associated greenhouse gas mitigation potentials. Renewable and Sustainable Energy Reviews, 127, 109842. Liu, X., Kwon, H., Northrup, D., & Wang, M. (2020). Shifting agricultural practices to produce sustainable, low carbon intensity feedstocks for biofuel production. Environmental Research Letters, 15(8), 084014. Moreira, M. M., Seabra, J. E., Lynd, L. R., Arantes, S. M., Cunha, M. P., & Guilhoto, J. J. (2020). Socio-environmental and land-use impacts of double-cropped maize ethanol in Brazil. Nature Sustainability, 3(3), 209-216. Melissa J. Scully et al 2021 Environ. Res. Lett. in press https://doi.org/10.1088/1748-9326/abde08 HERNANDES, THAYSE APARECIDA DOURADO ; SCARPARE, FABIO VALE ; SEABRA, JOAQUIM EUGÊNIO ABEL . Assessment of the recent land use change dynamics related to sugarcane expansion and the associated effects on water resources availability.	We are updating the bioful values based on changes we are receiving from Chapter 7. We are also reviewing the papers provided by the reviewer	Marcelo moreira	UNICAMP - Agroicone	Brazil
50981	47	0	47	0	Figure 10.11 is flawed, particularly regarding the estimated GHG emissions results of biofuels with partial models. The Supplementary Material to Figure 10.11 (Chapter 10, pp. 160-161, Table A.10.4.1) indicates that values for biofuels in partial models calculation departs from 133 g CO2e/MJ, and that this value is based on data from Chapter 7. However, no reference to the specific section or sub-chapter of Chapter 17 is made, so it is not possible to double check and review those unusual figures. Please see comment above for page 46, on why the numbers for the methodology used in the so-called "partial models" using counterfactual "natural regrowth" assumptions of foregone sequestration should not be highlighted in this figure, as it is a marginal, extreme methodology running counter to a large body of established literature on LCA of bioenergy. This is a matter of great concern, since emissions levels that high are extremely rare in specialized LCA literature concerning biofuels emissions factors. This specialized literature seems to have been neglected in the assessment that resulted in the figures presented in Table A.10.A.1 and Figure 10.11. Therefore, a non-exhaustive list of additional references to specialized literature is presented at the end of this comment. This is a non-exhaustive list, and we strongly recommend the authors to make a careful, comprehensive reassessment of the list, expanding the literature review and/or even considering the possibility of preparing a new invitation and request for LCA data among LCA experts. Publications from the late Dr. Wallace Tyner (1945-2019) were specially missed, since this lead bioenergy scientist from Purdue University contributed for decades with high quality research on this topic, including in the development of LCA values for biofuels in California's LCFS and, more recently, CORSIA sustainable aviation fuels. Not a single citation of this author was found in Chapter 10. It should be noted that even if the value of 133 gCO2/MJ were correct (which would mean that a significant body of peer reviewed literature incorrect), it goes without saying that programs and policies that promote biofuels as a mitigation option throughout the world by definition only incentivize biofuels with an average lower GHG emissions level (i.e. lower than 80 gCO2/MJ). Staples, M. D., Malina, R., & Barrett, S. R. (2017). The limits of bioenergy for mitigating global life-cycle greenhouse gas emissions from fossil fuels. Nature Energy, 2(2), 1-8. Liu, B., & Rajagopal, D. (2019). Life-cycle energy and climate benefits of energy recovery from wastes and biomass residues in	We are updating the bioful values based on changes we are receiving from Chapter 7. We are also reviewing the papers provided by the reviewer	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
1227	47	1	47	5	The discrepancy between NEDC and real world emissions can even be larger than the bandwidth of 15-38%. The fewer the type approval emissions the larger the difference with the real world emissions. See for instance figure SE1 in TNO report 2018 R10371 "Real-world fuel consumption of passenger cars based on monitoring of Dutch fuel pass data 2017" https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiXh9GtvrzuAhULHewKHeJkB2IQFjAAegQIAxAC&url=https%3A%2F%2Fpublications.tno.nl%2Fpublication%2F34626700%2FcEr4Yt%2FTNO-2018-R10371.pdf&usg=AOvVaw2HCSNQOEvimigZV1f52PNY. For type approval emissions of 80 g/km the real world emissions are around 130 g/km.	Will include this citation	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
1237	47	1	47	11	Fig 10.11 is very difficult or even impossible to interpret. For instance what is the meaning of the colours: coal seems to be blue, biofuels green and a mixture of coal&biofuels purple. Is that correct? Other difficulties: What is the meaning of the dots, what are the unities for the left Y-axis, why do the written numbers representing the medians (at the right Y-axis not) correspond with the median lines inside the boxplots?	We are updating the figure and will address this concern	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
1239	47	1	47	11	Fig 10.11: Option "biofuels, EMF33" appears to be the best option for all drive trains. At the same time, all information regarding this specific type of biofuel, like worldwide availability, price compared to other biofuels, etc, is lacking, which makes it impossible to assess the viability of this option. With regard to EMF33 the reader is referred to chapter 7 (see Table A.10.4.1 on page 160/161), but it is preferable that more information is given in figure 10.11 and the surrounding text as well.	We are space-constrainted so we have to refrain from repeating too much material covered in other chapter. However, we have updated the biofuels box for chapter 10.	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
47957	47	1	50	31	Figure 10.11 gives us very biased view especially about PHEV. In the Figure 4.2 of IEA 2020 Gloval EV Outlook, PHEV has the 2nd lowest lifecycle CO2 emissions among various powertrain. In this figure 10.11 seems to be skiewed by using very biased studies. Especially, 100% coal fiered electricity grid is very rare in the world . Almost no chance to use such a dirty electricity. However, in this exhibit shows coal electricity is occupying 50% of the global electricity generation. So based on IEA 2020, more objective view should be shown using global average electricity CO2 emission.	We are updating the figure for PHEVs and we aim to revise the electricity sources	Takao AIBA	Toyota	Japan
79331	47	1	47	9	This graph is confusing. It may be better to divide it into multiple, simpler graphs. The key conclusion is that even the best alternative fuels produce 20-40% of the lifecycle emissions of a conventional gasoline vehicle, so it is inaccurate to call them "zero emission vehicles," they are "elsewhere emitting vehicles", and their benefits can be partly offset if their low operating costs induce additional vehicle travel, a rebound effect. This indicates that alternative fuel and autonomous vehicles should be implemented with TDM incentives to prevent rebound effects. This should be discussed. See: Jihye Byun, Sungjin Park and Kitae Jang (2017), “Rebound Effect or Induced Demand? Analyzing the Compound Dual Effects on VMT,” Sustainability, (www.mdpi.com/2071-1050/9/2/219/pdf). Saeed Moshiri and Kamil Aliyev (2017), “Rebound Effect of Efficiency Improvement in Passenger Cars on Gasoline Consumption,” Ecological Economics, Vo. 131, pp. 330-341 (https://doi.org/10.1016/j.ecolecon.2016.09.018). Morteza Taiebat, Samuel Stolper and Ming Xu (2019), “Forecasting the Impact of Connected and Automated Vehicles on Energy Use: A Microeconomic Study of Induced Travel and Energy Rebound,” Applied Energy, Vol. 247, pp 297-308 (https://doi.org/10.1016/j.apenergy.2019.03.174).	Addressed in the section about systemic changes	TODD LITMAN	Victoria Transport Policy Institute	Canada
85513	47	1	47	1	I think it's important to add "Biofuels with CCS" to the captions now simply called "Biofuels, EMF33" because most people won't know that this includes BECCS. Also you should specify if "Biofuels, partial models" include ILUC and if so based on what study since this basically determines the major part of biofuels emissions.	Clarify in text EMF33, etc.	Auke Hoekstra	Eindhoven University of Technology	Netherlands
85543	47	1	47	1	Can I ask how the BEV emissions where established? Assuming a BEV uses 0.2 kWh/km and 1.5 passengers this gives us 0.2/1.5=0.13 kWh/km. Assuming 1 kg per kWh for pure coal this results in 130 g/km, not 192 g/km. Similar for natural gas at 420 g/kWh => 55 g/km, not 106. Of course you have to include the battery but that should only add around 16 g/km. (Please check that your sources do not rely on the now outdated IVL Romare 2017 study that was corrected in 2019 with emissions halved.) If you find your sources use values of more than 100 kg CO2eq please don't use them or correct them because they are outdated or use self defined processes that are not in line with how large factories operate. doi.org/10.3390/en13102638 might be the best source, as it is a recent review with figure 3 showing very clearly that emissions go down as publications become more recent (now often below 50 kg/kWh) and explains accurately why this is.	This comment seems to originate from a confusion between WTW vs full LCA values (the difference being the inclusion of the vehicle cycle). Clarified in text/caption/figure.	Auke Hoekstra	Eindhoven University of Technology	Netherlands
85545	47	1	47	1	Can you explain how values as low as 13 and 9 can be reached when manufacturing emissions from a car excluding batteries easily exceeding 30g/person-km when assuming 180k km? (180k km is often taken in the literature but 250k is closer to the average in Europe and the US.)	Misunderstanding WTW vs full LCA values. Clarified in text/caption/figure.	Auke Hoekstra	Eindhoven University of Technology	Netherlands
43797	47	4	47	8	The caption is not very clear: I guess the length of box represents the interquantile range (as stated), but what do the whiskers represent? Is that the full range or another quantile? Please clarify.	Clarified in text	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
10011	47				Figure 10.11 What refers to low-carbon electricity? Is it driven from only wind and solar PV?	Clarified in text	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
30421	47		47		Order of median Well to Wheel emission value among ICEV, HEV and PHEV is very strange. As BEV by "low-carbon electricity" is 9g/km and HEV by "gasoline" is 139g/km, combination of BEV and HEV, such as PHEV emission would be in between the two. However, median emission of PHEV (185g/km) is much higher than HEV (139g/km) and still higher than ICEV (180g/km). I don't know how to calculate this number. It needs to review the calculation. For your reference, you can see PHEV emission is in between HEV and BEV by "Andersson et al, The greenhouse gas emission of an electrified vehicle combined with renewable fuels: Life cycle assessment and policy implication, Applied Energy, 289, 116621, 2021"	This comment seems to originate from a confusion between WTW vs full LCA values (the difference being the inclusion of the vehicle cycle). Clarifiedin text/caption/figure. Clarified the method we used -- i.e., we are at the whims of the reviewed literatue and did not perform an original analysis Double checked PHEV methods/text/data	Hiroyuki Fukui	company	Japan
30423	47		47		Fuel efficiency and electric efficiency of PHEV in TableA.10.4.2 looks mode fuel efficiency. As lower fuel efficiency of PHV (0.45MJ/v-km) is much lower than HEV's (1.22MJ/v-km), this lower number would come from fewer gasoline consumption which is saved by electric drive, This indicates mode fuel efficiency is included utility factor. As lower electric efficiency of PHV (0.005kWh/v-km) which is much lower than BEV's (0.12kWh/v-km) is same situation such as too much ICEV drive makes electric efficiency lower. Considering hybrid and electric drive ratio to calculate PHEV efficiency, combination of lower fuel efficiency and higher electric efficiency, or higher fuel efficiency and lower electric efficiency is reasonable. Based on this idea, PHEV emission (biofuel, partical, coal electricity) would be from 241g/km to 290g/km, This is much lower than median 386g/kn in the figure, This is not inconsistent.	We have updated the discussion about utility factors	Hiroyuki Fukui	company	Japan
30425	47		47		It looks strange why whisker of BEV by coal electricity is not covered higher side (around 530g/km). This makes BEV box shift smaller side. As long as power source is same, WtW emission among BEV and PHEV would be similar, but this whisker treatment makes reader mislead the relation of two powertrain. In general, BEV emission is higher than PHEV, but this figure doesn't look so. This also appears for BEV by natural gas electricity.	explicitly clarified that the box and whisker shapes are representative of the fuel efficiency data for a given powertrain (i.e., proportions will be the same for the same powertrain);	Hiroyuki Fukui	company	Japan
30427	47		47		Based on Table A.10.4.1 (fuel emission) and TableA.10.4.2 (electric efficiency), WtW emission of BEV (coal electricity) would range between 115 and 453g/km, However, it seems this figure does not plot those number properly.	This comment seems to originate from a confusion between WTW vs full LCA values (the difference being the inclusion of the vehicle cycle). Clarified in text/caption/figure.	Hiroyuki Fukui	company	Japan
30429	47		47		Compare with this Figure 10.11 of LDV emission and Figure 10.14 of freight vehicle emission, relative PHEV emission value is different. As Figure 10.14 describes, PHEV emission by coal electricity is much lower than BEV's.However, this order is different for Figure 10.11. It would be difficult to explain why this order is defferent. Based on existing paper, emission order is basically ICEV>HEV>PHEV, not PHEV>ICEV>HEV. I have never seen the order which is described in Fig 10.11. Please check the calculation of Figure 10.11.	Noted. Thanks	Hiroyuki Fukui	company	Japan

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
47063	47		47		[1 of 3] There is inadequate explanation on how this Figure was created. For example, the right side indicates the median emissions. For ICE-gasoline, it is 180. For HEV-gasoline, 139. For PHEV with gasoline with low-carbon electricity, it is 185. This makes no sense, unless, for PHEVs, low-carbon electricity is more carbon intensive than gasoline. It is also inconsistent with the BEV with low-carbon electricity (in the same figure), which shows much lower GHG/vkm than any ICE, HEV, or PHEV. Further, it is inconsistent with the text on p 48, lines 17-20. [Continued]	We are revising the PHEVs section and this issue will be solved	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47065	47		47		[2 of 3] The box plots and points therein are not clearly described. Page 46 explains that the figure is based on the 29-30 references, all of which we read and organized in review visual 1, available at https://bit.ly/ipcc_review_wg3_figs. However, the mapping from the literature to this figure is not clear. Again, for the PHEVs, we find 11-14 dots in their respective figure for each fuel (notwithstanding that we find only 12 references examining PHEVs). How are those calculated? And why do these dots suggest GHG performance of PHEVs are much worse than ICE's and HEVs, when the papers they come from state the opposite? [Continued]	We are revising the PHEVs section and this issue will be solved	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47067	47		47		[3 of 3]A person reading this section should expect that the associated Fig 10.11 would broadly provide relative performance of each powertrain under similar fuel and vehicle size assumptions. Regarding PHEVs, this point is well stated on p 48, lines 17-20. However, this is not what Fig 10.11 shows. While it is true that PHEVs GHG performance is likely highly-dependant on charging and driving behavior, there are no credible studies suggesting that PHEVs are generally worse than ICE or HEV (under equal fueling and vehicle-size assumptions). This is not reflected in Figure 10.11, where the PHEV is shown as the worst performer in most/all scenarios. It appears that this figure needs either to be removed, or a new methodology needs to be proposed in order to more accurately summarize the literature.	We are revising the PHEVs section and this issue will be solved	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47119	47		47		There seems to be an inconsistency of the coloring scheme for the box-plots involving bio-fuels in Figure 10.11. Box plots for ICEVs and HEVs have orange-colored hue except for the bio-fuel cases, the color is green. Whereas for PHEVs all the box plots (including bio-fuel cases) have the same color scheme with a purple hue. Is there an implied message here (e.g. that bio-fuels somehow behave differently when employed in different powertrains)? Or is this simply an oversight? Suggestion to authors is to maintain consistency. Either each powertrain has same color hue across all use cases, or bio-fuels having different color across all the powertrains where they are used.	The colour coding of the figures did not have a logic. We are working on this to avoid confusion.	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
85547	48	1	48	5	Thank you for including this remark. However it would be good to also make this clear in figure 10.9. One could consider including the more precise and recent source https://theicct.org/publications/way-real-world-co2-values-european-passenger-car-market-its-first-year-after. Did you check real world emissions where used in figure 10.11 on page 47?	added text clarifying that most fuel efficiencies were test cycle values Added citation to real-world vs test cycle section	Auke Hoekstra	Eindhoven University of Technology	Netherlands
70337	48	3			It would be very appropriate to cite ICCT 2019: From lab to road. https://theicct.org/publications/laboratory-road-2018-update . The gap between test cycle and real world emissions was about 39% in 2017	added citation	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
56859	48	6	48	11	When comparing diesel vs gasoline ICEV, should indicate that diesel produces more PM that have local air quality impacts, subsequent health impacts, and act as a SLCF.	added relevant text	Government of United States of America	U.S. Department of State	United States of America
85549	48	9	48	9	Could you please refer to your calculation here. This seems too low. Assuming 10t production CO2eq production emissions (page 48 line 37) over 180k km (fig 10.11) gives 56 g/vkm for production. Taking 7.2 l/100km (fig 10.9) and adding 14% (page 48 line 1-5 and see my comment for even more precise source) adds 7.2*1.14=8.2l/100km. I haven't seen any sources for emissions of diesel and gasoline yet but I assume it's close to my calculations (page 22 of https://www.avere.org/wp-content/uploads/2020/09/englisch_Studie-EAuto-versus-Verbrenner_CO2.pdf). My calculations indicate that including production we emit around 3140g/l for gasoline and 3310g/l for diesel. Multiplying 8.2l/100km with 3140g/l yields 257g/vkm. This is slightly more than your value *without production emissions*. Please clarify this discrepancy or improve the calculation.	Clarified in text/caption/figure. The value calculates to be 257 g/vkm, we report to be 240 g/vkm…an approximate 7% difference.	Auke Hoekstra	Eindhoven University of Technology	Netherlands
47961	48	12	48	22	HEV charge its battery with power not only through regenrative braking but also by internal combustion engine. HEV can reduce more than 30% comparing to ICE counterpart. Accoridng to the table 1 of "https://www.osti.gov/servlets/purl/1376462,"Fuel consumption sensitivity of conventional and hybrid electric light duty gasoline vehicles to drive style," Hev improves more than 50% in some cases. According to the current catalogue fuel economy figures of some Toyota vehicle, it would be about 40 % improvement in some cases (https://www.toyota.com/camryhybrid/). So HEV is more effective and important than present description of this sentence. Especially in order to reduce stock of CO2 in the atmosphere from transport sector HEV is taking quite important role, as HEV has and will much wider market share than ZEVs in the near future.	- adjust "mainly rely on regen braking" - cited Thomas et al	Takao AIBA	Toyota	Japan
47069	48	13	48	13	This claim is misleading. HEV also charge its battery with power from the engine. "...the battery is charged through regenerative braking and by the internal combustion engine" [emphasis added, from https://afdc.energy.gov/vehicles/how-do-hybrid-electric-cars-work] Also see: bit.ly/ipcc_review_wg3_figs Review Visual 2, or https://afdc.energy.gov/fueleconomy/animations/hybrids/hybrid/hybridcruising.html The text here should be updated to reflect this fact.	- adjust "mainly rely on regen braking" - cited Thomas et al	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47071	48	13	48	14	This claim is misleading. While the traction battery of a PHEV can be charged both by regenerative braking and charging from the grid, it is also charged from the engine, even when not in "battery charging by gas" mode of operation. "PHEV batteries can be charged using a wall outlet or charging equipment, by the ICE, or through regenerative braking. " [emphasis added, https://afdc.energy.gov/vehicles/how-do-plug-in-hybrid-electric-cars-work] The text here should be updated to reflect this fact.	- adjust "mainly rely on regen braking" - cited Thomas et al	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47091	48	13	48	13	As addressed in the critique of Fig 10.11, these bounds of 107-455 g/vkm are gravely misleading. Once the analysis is corrected, these values will need to be updated.	revised PHEV section and results; check we use an 'averaged' fuel efficiency (I think we do - we couldn't harmonize the utility factors…)	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47089	48	18	48	18	[1 of 2] Replace 'ICEV' with 'HEV'. When a PHEV is in charge sustaining mode, it is operating as a hybrid, with at least some energy recaptured by the battery and used later. This is Hybrid operation. If the author wishes to bound PHEV GHG perfromance by two powertrains, it should be bounded by HEV using the same fuel and BEV using the same source of electricity. If the author thinks that the current wording is correct, then a credible reference is needed showing a PHEV running purely in ICEV (not HEV) while in charge sustaining mode.	Ref added	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47127	48	18	48	18	[2 of 2] In fact, as a good rule-of-thumb, if the utility factor (UF) of the PHEV is provided, or can be inferred using SAE J2841 Fleet Utility Factor or similar, then PHEV_CO2 is approximately equal to UF * BEV_CO2 + (1 – UF) * HEV_CO2. For example, see Fig 3 in [Wu et al., 2019], after subtracting out the production GHG, shown clearly for the California, Massachusetts, and Texas cases. I say approximately because, when comparing a PHEV to its approximately equivalent BEV and HEV, care must be chosen in identifying "appxoimately equivalent" BEVs and HEVs. For example, even if one manufacturer sells a PHEV and BEV version under the same model name, those vehicles often do not have identical power, nor identical weight, where the only difference is the powertrain. In fact, sometimes the BEV is noteably heavier than the PHEV, and under some circumstances, the PHEV can have a lower GHG/km than its related BEV. The author should carefully consider this when checking the updated results of this section's analysis, as well as Figure 10.11.	revised PHEV section and results	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
85511	48	21	48	21	Most people will not know EMF-33 uses BECCS to achieve these low values. In order to inform people properly it might be good to add that. For example by saying: "…varying between 90 (biofuels with BECCS, EMF-33) and 250 (biofuels, partial models). I would personally appreciate a link to the exact sources used here since I'm still wondering what the ILUC calculation sources of the 'partial models' are.	Clarify in text EMF33, etc.	Auke Hoekstra	Eindhoven University of Technology	Netherlands
47075	48	23	48	24	While this range of 107-455 gCO2eq/vkm are consistent with Figure 10.11, this range, as compared to the ICE and HEV range given on this page, suggests that PHEVs are higher GHG than both the ICE and HEV. However, the cited literature never reaches this conclusion [See comment for page 10.46, lines 5-14]. If anything, when correctly compared (same size, same fuel sources) the literature suggests that PHEVs have lower GHG/vkm than HEVs and ICEs. I recommend a major change in methodology that properly places the PHEV's performance as compared to ICE and HEV.	revised PHEV section and results	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
45577	48	27	48	29	HEVs always yield a moderate mitigation potential compared to gasoline or diesel cars. This doesn't depend on the carbon intensity of the power system!	reformulate "HEVs yields a moderate mitigation potential"	Kornelis Blok	Delft University of Technology	Netherlands
5501	48	32	48	32	replace Renewables" by "low carbon sources"	Noted. Thanks	Michel SIMON	Retraité/ Pdt d'association	France
47077	48	34	48	35	[1 of 6] [Transport and Environment, 2020] remains a study without peer review, and has a few problems. First, for the three PHEVs under study, T&E highlights a mismatch between laboratory tested results and on-road results, and implies this is an issue unique to PHEVs. However, their own report also shows that the all-electric PHEV driving tested 31%, 62%, and 87% worse than the officially (WLTP) expected GHG/km. As these all-electric km of PHEV driving should approximate the energy efficiency of a similarly operated BEV, it begs the question of by how much BEVs on-road performance would miss their official GHG numbers. This question is not considered in the study. Therefore, a reader could easily be mislead to believe that differences from lab testing to on-road performance is an issue unique to PHEVs. [Continued]	Clarified "PHEVs may have higher emissions than similarly sized ICEVs" Edited citation to T&E report 2020	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47079	48	34	48	35	[2 of 6] Second, their study of the "battery charging" mode is problematic. Burning enough gasoline to simultaneously i) move the car and ii) charge the battery, will increase the used fuel per vkm during operation in this "gas charging" mode. However, their study fails to consider the subsequent zero-additional-GHG e-driving that is enabled by charging the battery during the "battery chargine" mode. Ignoring this impact to the over-all energy efficiency makes their analysis flawed. [Continued]	Clarified "PHEVs may have higher emissions than similarly sized ICEVs" Edited citation to T&E report 2020	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47081	48	34	48	35	[3 of 6] Please see Review Visual 3 at https://bit.ly/ipcc_review_wg3_figs To demonstrate, consider two scenarios, Scenarios 1 and 2. In both scenarios, we will consider what happens right after the PHEV switches from charge depletion to charge sustaining mode. In the first scenario, after the PHEV enters charge sustaining mode, the driver simply drives the remaining A+B km in hybrid, or charge sustaining mode, after which the trip concludes. During the earlier A km, the PHEV uses G_A liters of gas. During the later B km, the PHEV uses G_B liters of gas. [Continued]	Clarified "PHEVs may have higher emissions than similarly sized ICEVs" Edited citation to T&E report 2020	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47083	48	34	48	35	[4 of 6] Please see Review Visual 3 at https://bit.ly/ipcc_review_wg3_figs. In the second scenario, after entering into charge sustaining mode, the PHEV driver chooses to put the PHEV in "battery charging" mode. The PHEV then drives A km in battery chargine mode. After A km, the driver sees that B km of range has accrued in the traction battery, exactly the distance needed to complete the trip. So, the driver disengages battery charge mode. The PHEV, seeing that the traction battery now has greater-than-zero range, switches to electric drive, until it is again at the lower limit of SOC. This electric driving generates zero additional CO2. The trip continues to draw down the B km of electric range in its traction battery, after which the trip concludes. In the second scenario, while driving the first A km in battery charging mode, the car will burn the gasoline needed to move the vehicle A km, plus additionally, extra gas to convert the energy, stored in the traction battery, to drive the final B km of the trip in Electric mode. [Continued]	Clarified "PHEVs may have higher emissions than similarly sized ICEVs" Edited citation to T&E report 2020	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47085	48	34	48	35	[5 of 6] Please see Review Visual 3 at https://bit.ly/ipcc_review_wg3_figs. It is clear that the amount of gas needed to move the vehicle the first A km should be the same in both scenarios. It should also be clear that the amount of energy needed to drive the PHEV's final B km is nearly the same in both scenarios. As such, in Scenario 2, the extra gas burned in Battery Charging Mode is nearly equal to G_B. The reason I say "nearly" is due to the fact that the energy of the of gas will experience some loss from the round trip into and out of the traction battery. Also, the operating point, and thus the efficiency of the engine, may be slightly different in the two scenarios. [Continued]	Clarified "PHEVs may have higher emissions than similarly sized ICEVs" Edited citation to T&E report 2020	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47087	48	34	48	35	[6 of 6] Please see Review Visual 3 at https://bit.ly/ipcc_review_wg3_figs. Regardless of the efficiency of the vehicle's engine converting gas energy (or lack thereof), this penalty is only paid once in both scenarios. In Scenario 1, the penalty is paid in driving the final B km in hybrid mode. In scenario 2, the penalty is paid while driving the earlier A km. As such, the total amoung of gas burned in both scenarios should be similar, and certainly less than would take for an ICE to travel the A+B km. [T&E 2020] only measures the G_A+G_B liters burned during the first A km, but ignores what happens in the subsequent B km, when zero-additionally-created GHG is used. This analysis is flawed, and should not be cited by the IPCC, and the statement at the indicated point in the text should be removed or altered.	Clarified "PHEVs may have higher emissions than similarly sized ICEVs" Edited citation to T&E report 2020	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
47959	48	35	48	35	Reference (Transport and Environment, 2020) is not peer reviewed scientific literature and should not be used in the IPCC report.	Removed reference to T&E report	Takao AIBA	Toyota	Japan
56861	48	37	48	40	Either remove this sentence or provide reference and quality with any assumptions.	Added references	Government of United States of America	U.S. Department of State	United States of America
28773	48	38			For what battery capacity? I guess these values are from the sources listed on p. 46 (perhaps mention the specific source(s) also here).	Added sources/values for median battery size	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy
47093	48	40	48	42	This appears to be wishful thinking without real justification. A great deal of batteries today are manufactured in China, which currently has very high carbon intensity grid. While China has set some impressive goals, the proof won't come until those goals are met. It seems that battery manufactering will likely go to the parts of the globe where manufacturing is least expensive.	Clarified	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
56863	48	45	48	48	No literature citations are provided for the BEV lifecycle emissions impact range presented here. Literature on this topic is abundant and it should not be difficult to find a high quality citation for the range of lifecycle emissions associated with BEVs.	Clarified in text saying that the values stated come from the harmonization	Government of United States of America	U.S. Department of State	United States of America
56865	48	46	49	5	BEV charged with carbon intensive energy sources may increase local air pollution, increase the production of SLCF, and result in additional health impacts.	Noted	Government of United States of America	U.S. Department of State	United States of America

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
11227	49	1	49	15	Regarding BEVs, their imprt on CO2 depend not only on the electricity miw that provides the charging but also on how the charging occurs (more or less flexible - it can be incentivized to only occur in low-demand periods in order to no sollicitate fossil fuelled power plants. An extensive study on the integration of electric vehicles in France has been conducted by De Lauretis et al, 2020, and quantifies the emissions reductions according to different levels of penetration of electric vehicles and different levels of flexibility of the battery charging. https://na-admin.eventscloud.com/eselectv3/v3/events/474828/submission/files/download?fileID=3fae1ac294d1cbe811f187a40e0f2459-MjAyMC0wOCM1ZjI0NDAyNzY3NDNi	Noted	Bianka SHOAI-TEHRANI	RTE Réseau de Transport d'Electricité, CentraleSupelec Paris Saclay University	France
70217	49	1	49	2	Could add this more recent reference: Wolfram et al. (2020, DOI: 10.1111/jiec.13067) find 35 g CO2e/km (normalized over 180,000km) for a compact size BEV passenger car, manufactured and charged with low-carbon electricity (60 g CO2e/kWh), which can be further reduced to 31 g CO2e/km when recycled materials are used, and 33 g CO2e/km when vehicle components are reused.	This is probably already in the data collected, but it's been harmonized	Paul Wolfram	Yale University	United States of America
75809	49	1	49	15	It would be great to see a waterfall chart for BEV from 90 gCO2-eq/vkm to as low as it can get. The relevance of this is the reliance on BEV to reach net zero emissions but the 90 gCO2-eq/vkm shows that much more needs to be done in the manufacturing step. Using renewable electricity in manufacturing can already cut it to 33 gCO2-eq/vkm but the steps for reaching zero are missing (or alternatively, the quantification of the aspects mentioned in the paragraph)	Production of Evs cannot realistically reach 0. Furthermore, this work is focusing on the current life cycle impacts and not prospective impacts.	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
85551	49	1	49	2	I don't have a better source handy but Elingsen et al uses highly outdated energy intensive factory processes for battery production that are not representative for modern factory production. That's not their fault: for lithium ion batteries, factories from 2014 (and the underlying source is even from 2010 if I'm not mistaken) are practically from the stone age. Also, I don't think they assume mining and steel production is done with low carbon energy. We should not look away from resource problems but windfarms produced with windfarms producing cars could come to extremely low carbon footprints. Basically it is an assymptote approaching zero when once you start producing low carbon sources with low carbon sources with low carbon sources.	Ref added. We are not only using Ellingsen but a handful of sources for the production of LIBs. Furthermore, we are not investigating the prospective impacts of producing vehicles	Auke Hoekstra	Eindhoven University of Technology	Netherlands
43799	49	3	49	5	It should be mentioned, however, that non-exhaust emissions (tire and break wear) could still represent a significant contribution to PM emissions even for BEV, also because (as mentioned on page 50, line 26) BEV are on average heavier. See, e.g.: Denier van der Gon, H. A.; Gerlofs-Nijland, M. E.; Gehrig, R.; Gustafsson, M.; Janssen, N.; Harrison, R. M.; Hulskotte, J.; Johansson, C.; Jozwicka, M.; Keuken, M.; Krijgsheld, K.; Ntziachristos, L.; Riediker, M. & Cassee, F. R. The Policy Relevance of Wear Emissions from Road Transport, Now and in the Future--An International Workshop Report and Consensus Statement J. Air Waste Manage. Assoc., Informa UK Limited, 2013, 63, 136-149.	Good point we are addressing	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
23219	49	6	49	6	The claim that "since COVID-19 has been discovered as being carried on diesel particulates" appears to be unsubstantiated given the references (the problematic term being "diesel"). The citation (Newman 2020) does refer to diesel, but by invoking references which do not mention diesel. Please add references or change the wording	We have removed this sentence	Government of France	Ministère de la Transition écologique et solidaire	France
47095	49	9	49	15	As this section of vehicle electrification wraps up, it is fine to express an encouraging outlook. However, this is firstly a scientific work. I see three forward looking statements in which 'may' or 'might' are the strongest assurances we can give at this point. Consider adding some language, such as 'Future battery chemeistries may, or may not, achieve lower costs, ...' Or some other language that admits that it is possible that not all three of those outcomes go as planned, in which case we will need to consider new solutions and pathways.	This is a good point. Noted	Kenneth Laberteaux	Toyota Motor North America-R&D	United States of America
28775	49	13			It would be helpful to mention in the Chapter more details on battery durability and to state whether a battery replacement over the vehicle's lifetime might be needed.	Noted	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy
56867	49	16	49	30	The carbon intensity of FCEVs should be presented as a range here, as is done for BEVs in the previous paragraph. The current draft notes the existence of electrolysis-based hydrogen, but does not provide estimated emissions in this discussion. Only emissions estimates for SMR-based H2 are presented in-text.	Good point. Noted. Thanks	Government of United States of America	U.S. Department of State	United States of America
69825	49	16	49	16	Maybe it would be clearer to write "higher manufacturing emissions" than "higher production emissions".	Good point. Noted. Thanks	Cédric PHILIBERT	Institut Français des Relations Internationales	France
75811	49	16	49	17	Perhaps the 15 tCO2-eq can be: 1. Expressed in gCO2-eq/vkm (to compare with ICE); 2. What fraction of this number is the electricity input during manufacturing. Even better, what is the breakdown for the 15 tCO2-eq and what are the main levers to reduce that number	Noted	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
52547	49	22	49	22	The discussion does not cover carbon capture technologies which are important in order to give decision makers all possible options.	Noted	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
85553	49	22	49	22	On the previous page you included production in the emissions of the BEV (page 49 line 46). It seems fair to include production emissions for hydrogen too. Assuming 15t (line 17) and 180k vkm (figure 10.11) this adds 83 grams and brings it to 215 g/vkm.	Good point. Thanks.	Auke Hoekstra	Eindhoven University of Technology	Netherlands
5503	49	26	49	26	replace Renewables" by "low carbon sources"	Noted	Michel SIMON	Retraité/ Pdt d'association	France
69827	49	26	49	28	Electrolysis of water with low-carbon electricity has been commercial since 1926 in Norway and other places, based on hydropower. The sole novelty would be the use of variable renewable electricity flows from solar PV or windpower.	Noted	Cédric PHILIBERT	Institut Français des Relations Internationales	France
69829	49	26	49	30	What seems missing here is a direct comparison of LCA GHG emissions of FCEVs vs BEVs, taking full account of the electric-to-mobility efficiencies of both modes.	Noted. This could be potentially done if we had enough data points on FCEVs and enough space	Cédric PHILIBERT	Institut Français des Relations Internationales	France
1309	49	31	49	32	A two-wheeler that is upcoming in many cities in the developed world is the e-scooter. In addition, (electric) bicycles are not mentioned in this section. These are a very interesting option to reduce GHG emissions.	Covered elsewhere in the chapter	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
79765	49	31	49	41	It looks like these 10 lines are the only part of this chapter covering (electric) two-wheelers, and three-wheelers are absent altogether (sorry if I missed it), even though a key part of the global mobility system, including for freight. Please including a proper section (with section number) on two wheeler and one on three-wheelers. There is a lot of literature, including on electrification of these vehicles.	No data collected.	Stefan Bakker	KiM Netherlands Institute for Transport Policy Assessment	Netherlands
79761	49	33	49	36	This statement is too weak and general. IEA ETP 2014 already showed that electric two-wheelers have over 60% lower operating emissions even when powered by 100% coal-based power. See also Kerdlap & Gheewala (2016 https://onlinelibrary.wiley.com/doi/abs/10.1111/jiec.12406). Or as I stated in my FOD comments: " (see for example IEA EV Outlook 2018). Indeed, over 80% of the 29 million tonnes of CO2 savings in 2017 by all types of electric vehicles globally are due to e-bikes in China. "	Noted. Revised	Stefan Bakker	KiM Netherlands Institute for Transport Policy Assessment	Netherlands

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79763	49	36	49	41	"Life cycle emissions intensity for two-wheelers is also generally lower than LDVs on a vehicle-kilometre basis, however, generally have less carrying capabilities than LDVs. A fully occupied passenger vehicle may therefore still have lower emissions than a fully occupied two- wheeler on a passenger-kilometre basis. However, today, most passenger vehicles have relatively low occupancy, with correspondingly high emissions intensity on a passenger-km basis. This points to the importance of utilisation of passenger vehicles" Please delete this entire part, as it is confusing and does not add any value. The only important thing is that on a passenger-km basis, two-wheelers are much more efficient than LDVs (as shown in IPCC reports and many other publications). If the authors really wish to push this argument, please include a quantificaiton, i.e. average occupancy for two-wheelers, and average occupancy for LDVs, so the reader can understand which messages is being conveyed.	This is a fair point. Revisited	Stefan Bakker	KiM Netherlands Institute for Transport Policy Assessment	Netherlands
70219	49	41	49	41	Add: Increasing the occupancy of a vehicle from the current average of 1.5 to 2.0 could reduce life-cycle emissions of individual passenger vehicles by 3.9-11.7 t CO2e, depending on vehicle size and powertrain (DOI: 10.1111/jiec.13067).	Noted. Revisited	Paul Wolfram	Yale University	United States of America
43801	50	1	50	1	Isn't this fuel intensity rather than fuel efficiency? Higher values in Fig. 10.12 refer to less efficient vehicles, so to call this quantity an efficiency is a bit counterintuitive.	Good point. Noted. Thanks	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
85555	50	1	50	31	This is not the place to go into detail on shared autonomomous electric vehicles (SAEVs) but maybe it is worth a short mention here. Fact is they do require over ten times less vehicles which reduces production emissions by 90% and could be on average 3-5x lighter if the SAEV fleet is fit for purpose which takes you to over 95% less production emissions, without lightweighting or using low carbon energy in the production process. On the other hand, you also mention this in the summary/conclusions (page 59 line 20-25).	Noted	Auke Hoekstra	Eindhoven University of Technology	Netherlands
79171	50	11	50	23	Glad you got around to lightweighting, but I suggest reassessing this discussion in light of “Reframing Automotive Efficiency,” SAE Int. J. Sust. Trans., Energy, Env., & Policy 1(1):59–84 (2020), 5 May 2020, doi:10.4271/13-01-01-0004. It's possible to create the problems you describe, but it's not necessary. And of course while tractive load is dominated by mass (~2/3 in USA, ~90% in India where one drives more slowly), aero drag and rolling resistance matter too, as well as accessory loads whose largest term, air conditioning, could now be probably eliminated (as I'm now writing up for PNAS, mentioned in 29:57 comment).	Noted	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
1311	51	1	51	3	What is the shaded area in figure 10.12 indicating?	Confidence intervals	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
12565	51	1	51	1	Please cite source of figure. I think this is GFEI 2019.	Original figure.	Matteo Craglia	International Transport Forum	France
47651	51	1	51	3	Y-axis label "Fuel Efficiency" is not approprite. "Fuel Consumption" makes more sense (if the inverse unit were displayed, efficiency would make sense).	Good point. Noted. Thanks	Vassilis Daioglou	Utrecht University	Netherlands
9713	51	4	51	6	Why advanced ICEV, HEV, and PHEV have limited mitigation potentials compared to biofuels? Please cite the relevant literature. How hybridization and fuel efficiency improvements in ICE fare with respect to other forms of transport, e.g. for freight transport.	Later versions clarified this.	Mustafa Babiker	Saudi Aramco	Saudi Arabia
56869	51	8	51	11	This sentence overplays the uncertainty in BEV emissions intensity and understates the likelihood of benefits relative to ICE technologies. It is true that BEVs fueled using electricity from a 100% coal-based grid would not have emissions savings compared to an ICEV. However, such a grid is not very common, and is becoming even less common. As shown in Figure 10.11, even using 100% natural gas electricity, BEVs achieve ~40% emissions savings relative to an ICE vehicle (106 g/pkm vs 180 g/pkm on average). In practice, even a 100% natural gas grid would be on the carbon-intensive side of the global average. The current statement, that "BEVs and FCEVs have no or low climate mitigation effects when carbon intensive energy is used" is therefore not true. While not sufficient to prevent the worst impacts of climate change, BEVs fueled by even a relatively pessimistic 100% natural gas electricity grid are still substantially less carbon-intensive than an ICE vehicle. It would be more accurate to state that BEVs achieve emissions savings unless the grid itself is very coal/oil intensive, though the magnitude of these savings is greater to the extent that more electricity is generated from natural gas and, especially, from non-emitting electricity sources like nuclear and renewables.	Rephrased "limited mitigation potential, not enough to deeply decarbonize passenger LDVs...."	Government of United States of America	U.S. Department of State	United States of America
28587	51	10	51	14	This section talks about BEV and FCEV as if they were exposed to the same requirements in terms of low-carbon energy stringency to deliver net reductions in emissions, However, wide differences in energy efficiency between the two technologies and fuel/energy production, transport an distribution pathways strongly favour BEVs over FCEVs in terms of capacity to reduce life cycle emissions. In other words, the same level of carbon per unit energy contained in the electricity and/or the hydrogen leads to significantly lower life cycle emissions for a BEV than for a FCEV, due to the fact that the energy efficiency of the BEVs and its energy supply chain is far better (especially with renewable electricity) than for a FCEV. This should be clearly emerging from this discussion, and it is not.	Revisited. Revised	Pierpaolo Cazzola	International Transport Forum	France
56871	51	10	51	11	BEV charged with carbon intensive energy sources may increase local air pollution, increase the production of SLCF, and result in additional health impacts.	Noted. Revisited	Government of United States of America	U.S. Department of State	United States of America
75813	51	10	51	11	Is that really the case? A few pages before it was mentioned that BEV have 33 gCO2-eq/vkm when renewable electricity is used in both steps, which is still far from zero and the equivalent number for FCEV was not mentioned	Far from zero but much better. We have updated the discussion	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
28589	51	15	53	13	The discussion developed here (and in particular the section on DAC) would benefit a lot from the integration of information on the energy requirements needed for different options. DAC is very energy inefficient, across the board. And this is clearly pointing to a major challenge, in terms of scale, since it also requires very low carbon pathways for the provision of this energy to be meaningful.	Fuel production issues should be covered in the Energy chapter, but we can add a line about the issue	Pierpaolo Cazzola	International Transport Forum	France
79333	51	16	51	16	The statement, "Buses provide urban and peri-urban transport services to millions of people around the world" does not properly frame the issue. Public transit operates in urban areas where there are many human ears and lungs, and public transit improvements, including service expansions and transit-oriented develoment, are key emission reduciton strategies. As a result, it is important to ensure that transit vehicles minimize noise and air pollution, and have maximum comfort. Alternative fuels, particularly electrification, can make transit urban-friendly.	Noted	TODD LITMAN	Victoria Transport Policy Institute	Canada

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
11295	51	18	51	21	Re “Alternative technologies to conventional diesel-powered buses include diesel hybrid-electric buses; buses powered with compressed natural gas (CNG), liquified natural gas (LNG), and biodiesel; battery electric buses; and hydrogen fuel cell electric buses” I suggest adding trolleybuses to this list, and differentiating between battery electric buses with static and dynamic charging. For example “trolleybuses; battery electric buses with static or dynamic charging” Full sentence could read: “Alternative technologies to conventional diesel-powered buses include diesel hybrid-electric buses; buses powered with compressed natural gas (CNG), liquified natural gas (LNG), and biodiesel; trolleybuses; battery electric buses with static or dynamic charging; and hydrogen fuel cell electric buses” Sources that use the term ‘dynamic charging’ tend to be recent and include: Bartłomiejczyk M., Połom M. (2020) Dynamic Charging of Electric Buses as a Way to Reduce Investment Risks of Urban Transport System Electrification. In: Gopalakrishnan K., Prentkovskis O., Jackiva I., Junevičius R. (eds) TRANSBALTICA XI: Transportation Science and Technology. TRANSBALTICA 2019. Lecture Notes in Intelligent Transportation and Infrastructure. Springer, Cham. https://doi.org/10.1007/978-3-030-38666-5_32 / https://www.researchgate.net/publication/338682809_Dynamic_Charging_of_Electric_Buses_as_a_Way_to_Reduce_Investment_Risks_of_Urban_Transport_System_Electrification And Doherty E. (2020) “Best electric-bus charging system is already overhead in Vancouver” www.straight.com/news/eric-doherty-best-electric-bus-charging-system-is-already-overhead-in-vancouver	Good point, revised.	Eric Doherty	Ecopath Planning	Canada
10787	51	27	51	28	What about hydrogen for long distance trains?	We have included hydrogen for freight rail	Philippe Waldteufel	CNRS	France
56873	52	11	52	17	Very good point that infrastructure emissions (construction and maintenance of roads and/or rail) are not included. Should repeat this point earlier in Section 10.4 to clarify that they are not included in the LCA for most of the subsections.	Revised. Thanks	Government of United States of America	U.S. Department of State	United States of America
56875	52	18	52	22	Although BEV buses may not offer emissions reductions depending on carbon intensive energy sources, they may still have significant near road AQ benefits and subsequent health benefits.	Similar to comment 79333. Probably makes senset to add short paragraph at beginning of section mentioning other benefits (like AQ) that are beyond scope. Could move the line about air quality for NG vehicles to this new paragraph.	Government of United States of America	U.S. Department of State	United States of America
1251	52	30	52	30	Liu et al., 2020 is missing in list of references	Reference list rechecked.	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
69831	52	31	52	31	Liu et al 2020 is quoted several times but does not figure in the reference list. I assume it's A life cycle assessment of greenhouse gas emissions from direct air cpture and Fischer-Tropsch fuel production, Sust. Energy Fuels, 6:	Reference list rechecked.	Cédric PHILIBERT	Institut Français des Relations Internationales	France
85557	52	33	52	34	Since renewable energy is a "scarce resource" for the forseeable future (we would be on a path to 1.5C if we made them abundant before say 2060) it seems prudent to mention that DAC-FT requires at least four times as much energy as electric vehicles. One might even add a scenario with DAC-FT as they are currently made (with electricity from natural gas and hydrogen from steam reforming) because now this graph is going to be used extensively by DAC FT proponents to prove that the IPCC agrees with them they are better than BEV.	Same as 28589	Auke Hoekstra	Eindhoven University of Technology	Netherlands
56877	52	40	53	2	Appreciate the point about occupancy of buses when comparing BEV buses/passenger rail vs BEV cars. Authors could further emphasize the point that higher occupancy means that ICEV buses/passenger rail may even be more beneficial than BEV cars -- increasing the importance of soft strategies and policies that help to incentivize transit over single occupancy vehicles.	Good point. Revisited	Government of United States of America	U.S. Department of State	United States of America
84991	52	42	52	43	Is there a reference for this?	"As shown in Figures 10.13 and 10.11" We will update figure numbers as appropriate	Jameel Hayat	AECOM	United Kingdom (of Great Britain and Northern Ireland)
1253	53	1	53	13	Fig 10.13: the same comment as for figure 10.11 on page 47. Option "biofuels, EMF33" appears to be a very good option (together with DAC FT-diesel). At the same time, information about EMF33's (and DAC FT-diesel's) worldwide availability, price compared to other fuels, etc, is lacking. Therefore it is impossible to assess the viability of this option. It may be a very expensive option with only a very limited availability.... With regard to EMF33 the reader is referred to chapter 7 (see Table A.10.4.1 on page 160/161), but it is preferable that more information is given in figure 10.13 and the surrounding text as well.	Address this comment related to biofuels after similar comments in our section have been addressed. Added a sentence about the viability of DAC (it is new, not proven, not commercially available yet)	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
53635	53	1	56	1	It would be extremely informative and much more transparent if these bars were split on manufacturing, fuel and decommisioning.	We've basically already done this to the extent possible in the space allotted. We don't include decommisioning emissions	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53637	53	1	56	1	What is "conventional" and "low" hydrogen? If electricity is involved at all in the "conventional" case, it should be at least 2.5 times worse than the corresponding BEV case.	Updated figure label to be consistent with LDVs. The conventional case includes hydrogen from gas reforming (so does not include electricity)	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53639	53	1	56	1	Do emissions for "Diesel (>2030)" decrease due to something like Euro 7, or something inherent with the fuel? Diesel trucks are used all over the world and most are fairly old. It's dangerous to suggest that all old trucks globally magically begin adhering to new efficiency standards after a certain year. (same for rail and medium-duty trucks)	Clarified in text and in figure label to say "New diesel (2030+). Also clarified where these assumptions come from in the submitted studies	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53641	53	1	56	1	It is VERY important to align estimates of total cost of ownership (the chapter often talks about what is cheapest) with estimates of emissions trajectories for ICE vehicles. Further efficiency improvements in ICEs are theoretically possible, but will come at high cost (R&D, complexity, manufacturing and maintenance). When taking these additional costs into account, along with a shrinking demand for ICE vehicles, future ICE is not cost competitive vs. future BEV (which is plummeting in cost). This means ICE development will stagnate very soon. It is dangerous to suggest that low-emission diesel is an option.	We are completely revamping the LCC discussin	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53643	53	1	56	1	Just make sure it's mentioned that biofuels cannot be made available at the scale that diesel is used today, and that biodiesel therefore will be very expensive if it is used extensively. It may also be in greater demand by other sectors, e.g. aviation.	Noted. revisited	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53645	53	1	56	1	Clarify what "DAC FT-Diesel (low)" means (DAC = direct air capture, but FT and low?)	Clarified figure caption or axis label	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
53647	53	1	56	1	For what year are these values? Electric heavy vehicles are likely to see efficiency improvement of perhaps 50% over the coming 20 years (according to an anonymous very senior expert at a globally leading truck manufacturer). At the same time, emissions are being eliminated from manufacturing of both truck bodies and batteries. Efficiency increases are expected to be much smaller in heavy diesel vehicles, perhaps 10% (all of these from improvements to the truck body and other non-propulsion losses).	Clarified study assumptions; add general statement about limitations.	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53649	53	1	56	1	Why does a BEV have a several times greater range of emissions from the vehicle cycle than the other technologies? This looks suspicious. Is it perhaps because the numbers are taken from different studies that used different methodologies?	Noted. Revisited.	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
85515	53	3	53	3	It would be good to make people realise EMF33 uses BECCS as most readers won't know this and will assume that the biodiesel they are promoting looks great according to the IPCC. So replacing "Biofuels (EMF33)" with "Biofuels with BECCS (EMF33)" would be a welcome addition to most readers I think. Also the depiction of DAC FT-Diesel seems a bit misleading. Many people will look at this and conclude it's better than BEVs while it uses 4x more low carbon energy while this low carbon energy is scarce for the forseeable future and thus will necessiate more fossil fuel burning elsewhere. So one could imagine adding DAC FT-Diesel (medium) using the average energy mix and hydrogen from steam reforming, to make sure people don't think this is some miracle cure.	Noted. Revisited	Auke Hoekstra	Eindhoven University of Technology	Netherlands
43803	53	4	53	4	The difference between Diesel and Diesel (>2030) is not explained here nor in the text in 10.4.2, but it's first mentioned only in 10.4.3.	Same as comment 43803	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
76903	53	5			Figure 10.13: Given that there are multiple sources, it might be important to make sure that they have a similar definition (scope) for their LCA : in particular, do they all include the live cycle of the vehicle and the full emissions from the energy production? I think that it would be important to provide information on the data collection and processing as Supplementary Material.	Clarified and referred to the SI in the main text; I believe our harmonization handles this already	Philippe Marbaix	Université catholique de Louvain	Belgium
76905	53	5			Figure 10.13: Could you add data for rail powered by overhead lines (catenary) ? It seems strange to have a comparison table where only BEV trains are included (besides, it might be that hydrogen (FCEV), not batteries, could be an option for passenger trains without overhead lines : is it less documented than batteries ? There are some commercial services already).	We will check if the current submissions include this information. If not, we will look for more data	Philippe Marbaix	Université catholique de Louvain	Belgium
79335	54	1	55	5	Please add more information about logistical improvements and demand management strategies to reduce total freight vehicle travel, and cross reference the section on dematerialization. Also, please discuss how general TDM strategies, such as fuel price increases, decongestion road tolls, curb management, and Smart Growth development policies can support freight efficiency. See CIVITAS (2015), Making Urban Freight Logistics More Sustainable, CIVITAS (www.civitas.eu); at https://bit.ly/31cFUJR. Cycle Logistics (http://cyclelogistics.eu) is a European program to help develop cargo bike urban delivery systems. Maddy Ewing, et al. (2020), The Next Frontier for Climate Action Decarbonizing Urban Freight in Canada, Pembina Institute (www.pembina.org); at https://bit.ly/2VJSttG. Andrew R. Goetz and Serena Alexander (2019), Urban Goods Movement and Local Climate Action Plans: Assessing Strategies to Reduce Greenhouse Gas Emissions from Urban Freight Transportation, Mineta Transportation Institute at San Jose State University (http://transweb.sjsu.edu); at www.trb.org/main/blurbs/179038.aspx. Jose Holguín-Veras, et al. (2015), Improving Freight System Performance in Metropolitan Areas: A Planning Guide, National Cooperative Freight Research Program Report 33, Transportation Research Board (www.trb.org); at www.trb.org/Publications/Blurbs/172487.aspx. ICLEI EcoLogistics Principles (https://sustainablemobility.iclei.org/ecologistics-principles) provides specific guidance for developing sustainable urban freight. ITF (2018), Towards Road Freight Decarbonisation, International Transport Forum (www.itf-oecd.org); at https://www.itf-oecd.org/towards-road-freight-decarbonisation. Eric Jaffe (2021), "The future of last-mile delivery has arrived … in a small Dutch city," Sidewalk Talk	These issues should be covered in the systemic changes section	TODD LITMAN	Victoria Transport Policy Institute	Canada
53627	54	4	54	10	The first example given of an alternative fuel that can reduce greenhouse gas emissions is one that cannot reduce greenhouse gas emissions. This is confusing/distracting. Remove the mention or simply state that other fossil fuels like CNG do not fall in this category, just like low-particle tyres do not help with CO2 emissions.	Modified paragraph to include all available options	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
56879	54	4	54	13	It is strange that this section chooses to feature natural gas vehicles rather than battery electric and fuel cell vehicles. It is true that some markets currently have a significant number of natural gas vehicles. However, as shown in Figure 10.14, the emissions savings from CNG and LNG compared to diesel are minor. Further, especially in the MD truck space, but also in the HD truck space, global industry momentum towards decarbonization is currently centered around battery and fuel cell drivetrains. It seems like a mischaracterization of the current state of technology for freight trucks to feature natural gas, especially when technologies yielding greater emissions savings are beginning to commercialize.	Same as comment 53627	Government of United States of America	U.S. Department of State	United States of America
78901	54	5	54	10	Could make some reference here to the methane slip problem with natural gas powered trucks eg. https://bit.ly/3cz8eKl	Double checked references	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
46069	54	7	54	8	The sentence "However, … compared to diesel" lacks scientific evidence underpinning this statement. Please add at least one, especially since it seems to contradict the results displayed in Fig 10.14. Otherwise please formulate more carefully as on page 52, lines 22-25.	Noted	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
85503	54	10	54	13	As I mentioned in my comment for page 4 line 18-30, a new peer reviewed paper in a top journal shows that battery electric actually becomes *more* attractive as trucks become heavier: “The feasibility of heavy battery electric trucks” by Bjorn Nykvist and Olle Olsson in Joule. (No DOI yet.) I'm looking for the best place to include that insight and that reference that goes against the common wisdom that heavy electric long haul trucks can't be electrified. Maybe here is an option. For example by changing the paragraph in the following way: "Deep decarbonisation of medium and heavy-duty trucks requires either low carbon electricity or biofuels. New insights indicate that battery electric trucks might get a better business case as they grow heavier (Nykvist et al 2021). Other options are hydrogen in fuel-cell trucks and drop-in fuels made from electricity but those would require about two times and four times the amount of energy respectively (page 29 https://www.transportenvironment.org/sites/te/files/publications/2020_12_Briefing_feasibility_study_renewables_decarbonisation.pdf). Finally bio-based fuels (especially when combined with BECCS) offer deep decarbonisation options if they manage to avoid indirect land use change, but this is increasingly seen as challenging."	Add to new paragraph that we are going to write to address comment 53627	Auke Hoekstra	Eindhoven University of Technology	Netherlands
4053	54	11	54	13	It’s worth noting that in the absence of Government intervention for medium and heavy duty trucks, there is a significant risk that bio-NG becomes a transition fuel (which is already happening in certain countries, such as the UK). This will provide some emissions benefits in the near term, but also ultimately delay the shift to zero emission (at tailpipe) fuels.	Added a line about bio-NG, refering to its penetration levels in the IAM scenarios analyzed	Edward Ataii	KPMG	United Kingdom (of Great Britain and Northern Ireland)
1313	54	14	54	16	These GHG emissions are excluding the emissions from new infrastructural investments, as is also pointed out in line 39 (on the same page). These notion should be made before the recommendation is made to switch from trucks to rail.	Noted. Revisited	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
78899	54	15	54	20	this paragraph seems to under-estimate the proportion of rail freight tonne-kms hauled by electric locomotives. As I mentioned earlier, according to IEA (2019) this was 48% in 2016. The same report shows the % of electrified track and how this in increasing in most parts of the world (except North and South America) https://www.iea.org/reports/the-future-of-rail	Modified the text after reading through reference	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
86671	54	18	54	20	There is an important opportunity to decarbonise rail using direct, private wire renewable energy, displacing imported power at (higher) retail price, instead of selling into the network at wholesale prices, and thus providing carbon savings at the same time as cost saving. Riding Sunbeams with Ricardo Energy and Environment are developing the first private wire solar farm supplying power direct to the traction side of the rail network in East Sussex UK.	This comment refers to energy market mechanisms that we don't address in this chapter	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
53629	54	19	54	20	Are there sources available that show that batteries, biofuels, synthetic fuels or hydrogen are likely to be cheaper options than catenary solutions for rail systems that currently run on diesel or that are yet to be built? (In what markets? When?)	Noted	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
86673	54	28		29	Low-carbon synthetic fuels, biofuels or waste derived fuels are discussed in different places for freight, rail (page 54 lines 28-29), shipping and aircraft. Developed in different academic silos. It needs a hierarchy. Can it all be met? Is it more valuable in one end use than another? What sector will see earlyuptake- is this the same sector as the highest value? This is discussed for rail at	We are tyring to address this issue with the new figure in section 10.3	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
5505	54	29	54	30	replace Renewables" by "low carbon sources", on each line.	Noted	Michel SIMON	Retraité/ Pdt d'association	France
53631	54	32	54	33	"The latter three [syntheric diesel, BEV and FCEV] are unlikely to offer the greenhouse gas reductions needed for deep decarbonisation of the transportation sector." <-- This claim has no support and conflicts with the rest of the chapter. These are the ONLY feasible options for deep decarbonisation!	Need to clarify, author is referring to the three 'former technologies' rather than the latter	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
28863	54	34	54	34	"shown in 3" - it's not clear if this is supposed to be a citation or a cross-reference (possibly to Figure 10.13?).	Yes, to be updated to 10.14.	Eoin Devane	United Kingdom Climate Change Committee	United Kingdom (of Great Britain and Northern Ireland)
53633	54	38	54	41	It would be helpful to elaborate here. Already built infrastructure will not cause new future emissions just by being used. Infrastructure yet to be built does not need to be built with as high emissions as that of the past. What path should a country take if it is currently deciding between investing heavily in road or rail construction? What do the emissions trajectories look like for asphalt, tyres, concrete and steel?	Noted	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
78903	54	47	55	1	brief reference is made to improvements in vehicle efficiency, but this is not elaborated. Does this mean just the fuel efficiency of the vehicle or also its loading and routeing? The chapter overall is unbalanced in discussing in great detail the switch from fossil fuel to low carbon energy, but scarcely mentioning the huge potential for loading and routeing freight vehicles more efficiently. There are large literatures on both of these topics, including many papers and reports published since AR5. I reviewed much of this literature in my 2018 book on Decarbonizing Logistics, which is cited in the chapter, but, in the interests of completeness, it would have been good to see this transport chapter in AR6 assess in much more detail the managerial, operational, behavioural and IT options for decarbonising the freight transport system. There is much more literature cited on Arctic shipping than there is on the opportunities managing logistics systems and supply chains in ways that cut carbon emissions.	Efficiency discussions are in sections 10.2 and 10.3	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
43805	55	1	55	3	The emissions for Diesel after 2030 are shown also in Fig. 10.13 for passenger transport, although not discussed in the text. Does this refer to the same technology to improve vehicle efficiency?	Clarified	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
76909	55	4			Figure 10.14: As for passenger rail, it seems strange that the figure only refers to BEV for rail. Could you add data for rail powered by overhead lines (catenary) ? If BEV is a typo and actually includes overhead line powering, then I would wonder why the production of the battery and the constraints implied by its use do not increase the emissions of the heavy trucks (BEV) wrt. to rail (overhead line).	Noted. Revisited	Philippe Marbaix	Université catholique de Louvain	Belgium
85517	55	4	55	4	It would be good to make people realise EMF33 uses BECCS as most readers won't know this and will assume that the biodiesel they are promoting looks great according to the IPCC. So replacing "Biofuels (EMF33)" with "Biofuels with BECCS (EMF33)" would be a welcome addition to most readers I think. Also the depiction of DAC FT-Diesel seems a bit misleading. Many people will look at this and conclude it's better than BEVs while it uses 4x more low carbon energy while this low carbon energy is scarce for the forseeable future and thus will necessiate more fossil fuel burning elsewhere. So one could imagine adding DAC FT-Diesel (medium) using the average energy mix and hydrogen from steam reforming, to make sure people don't think this is some miracle cure.	Same as 85515	Auke Hoekstra	Eindhoven University of Technology	Netherlands

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
85519	56	1	56	1	It would be good to make people realise EMF33 uses BECCS as most readers won't know this and will assume that the biodiesel they are promoting looks great according to the IPCC. So replacing "Biofuels (EMF33)" with "Biofuels with BECCS (EMF33)" would be a welcome addition to most readers I think. Also the depiction of DAC FT-Diesel seems a bit misleading. Many people will look at this and conclude it's better than BEVs while it uses 4x more low carbon energy while this low carbon energy is scarce for the forseeable future and thus will necessiate more fossil fuel burning elsewhere. So one could imagine adding DAC FT-Diesel (medium) using the average energy mix and hydrogen from steam reforming, to make sure people don't think this is some miracle cure. Finally there is a new strongly improved 2020 version of the CE Delft study from 2017 you used: https://www.ce.nl/publicaties/download/3035	Same as 85515	Auke Hoekstra	Eindhoven University of Technology	Netherlands
53651	56	5	56	6	100% biodiesel (or even 50%) is not feasible in most regions (not only vehicles as is stated). There is just no way we can grow that much plant mass sustainably.	Fuel supply potential is beyond our scope	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
52471	56	11	58	37	Include a figure that summarizes the cost discussion presented in section 10.4.4	We have new figures for LCC	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52473	56	11	58	37	Include a summary of the cost discussion presented in this section in the executive summary for chapter 10	We are completely revamping the LCC discussin	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52475	56	11	58	37	Include a summary of the cost discussion presented in this section in the SPM	Noted. Thanks	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
53653	56	11	58	37	For most claims and numbers in this section, it is not clear if they refer to light vehicles or heavy vehicles. This needs to be clarified for the section to make sense.	Noted	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
75819	56	11	58	37	It would be great to have some of these numbers similar to the LCA to be able to: 1. Compare powertrains; 2. Identify ranges; 3. Identify breakdown of the cost. I realize the LCA part had the benefit of a call for data collection but there could be a way of at least giving a sense of benchmark and contributions to the cost	We have new figures for LCC	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
81951	56	11	58	37	This section could benefit greatly from a table to make the data easier accessible. Also, there should be a call for "harmonized" comparison of BEVs and ICEs in cradle to grave approaches.	We have new figures for LCC	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
53655	56	20	56	22	There is an unsourced claim here that maintenance costs are similar between ICE and electric, but I work in R&D at a truck maker and I have never seen such a claim before. It is easy to find sources for that maintenance is far cheaper for electric vehicles, in particular heavy duty ones.	Noted	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
23221	56	25	56	28	This indicates a field of researches on battery ageing, lifetime	Don't understand the comment	Government of France	Ministère de la Transition écologique et solidaire	France
79235	56				Suggest subheadings for Section 10.4.4 for each transport technology: passenger car, trucks, buses, etc. A synthesis plot of disaggregated (upfront, maintenance, disposal) lifecycle costs, and corresponding abatement costs (where available) per vehicle technology would be very useful. Where data is missing or limited (maintenance costs for EVs) indicate so, which would also be helpful to demonstrate information gaps that need to be addressed. Could include disaggregated lifecycle costs for ICEVs per mode (passenger, truck, bus) in the same plot for comparison.	Noted. Revisited	Martino Tran	UBC	Canada
28865	57	1	57	15	The fuel costs figures in this paragraph seem strange - ICEVs = 0.04-0.17 USD/vkm; HEVs = 0.02-0.9 USD/vkm; PHEVs = 0.02-0.10 USD/vkm; BEVs = 0.02-0.11 USD/vkm. From these figures, it appears that HEVs can have substantially more expensive fuel (up to 0.9 USD/vkm) than ICEVs. The range for BEVs also appears higher than for PHEVs, which is contrary to what I would expect (and counter to what is stated in the text).	Revisited. Revised	Eoin Devane	United Kingdom Climate Change Committee	United Kingdom (of Great Britain and Northern Ireland)
43807	57	1	7	15	It would be useful to summarize the numbers discussed in this paragraph in a figure.	Similar to comments 52471	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
52495	57	1	57	15	Include a discussion on the carbon abatement cost of electric light-duty vehicles similar to the carbon abatement cost discussion for BEV trucks on page 10-58. Check and consider including: Azarafshar, Roshanak, and Wessel N. Vermeulen. 2020. "Electric vehicle incentive policies in Canadian provinces." Energy Economics no. 91:104902. doi: https://doi.org/10.1016/j.eneco.2020.104902. Dua, Rubal, Omar Al Harbi, Yagyavalk Bhatt, Gabriel Collins, Geetika Dang, Puneet Kamboj, Anushree Majumdar, Tamara Sheldon, and Dimpy Suneja. 2020. "A cost-effective pathway to a low-emissions transportation future." https://www.g20-insights.org/wp-content/uploads/2020/11/a-cost-effective-pathway-to-a-low-emissions-transportation-future-1606059751.pdf.	We have a discussion about LCC, but abatement cost should be in the costs and potentials chapter. Honestly, abatement cost should be derived from the IAM data because it is hard to combine LCA and LCC data from different sources, with very different assumptions	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52477	57	2	57	5	Purchase costs of hybrids are usually relatively higher than the purchase costs of ICEVs. If not, what factors would explain the low hybrid sales relative to ICEVs?	Rejected	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52479	57	2	57	3	Reference is needed	Agreed	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52481	57	4	57	4	Reference is needed	Agreed	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
53657	57	4	57	5	Over what time period? Is this for cars?	Clarified	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
45581	57	5	57	6	It doesn't seem fair to call plug-in hybrid the "most expensive solution" if they are just 1 - 2 ct/km more expensive with uncertainty ranges of 20 - 30 ct/km.	Fair point. Revised	Kornelis Blok	Delft University of Technology	Netherlands
52483	57	5	57	6	Reference is needed	Agreed	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52485	57	7	57	9	Reference is needed	Agreed	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52487	57	9	57	10	Reference is needed	Agreed	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52489	57	10	57	11	Reference is needed	Agreed	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52491	57	11	57	12	Reference is needed	Agreed	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52493	57	12	57	14	Reference is needed	Agreed	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
47925	57	13	57	14	What's the source for EV fuel costs? This is a recent study for the US showing a huge variability in charging cost for EV depending on multiple factors: https://doi.org/10.1016/j.joule.2020.05.013	Added reference, similar to previous comments	Matteo Muratori	NREL	United States of America
53659	57	14	57	14	As help for readers, I think it would be very educational to give examples of how these costs vary between countries, and what impact that has on today's vehicle sales. For instance, compare the TCO of a common ICE sedan, ICE SUV and BEV model in the US, China, Nigeria and Norway.	We have new figures for LCC	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
47927	57	16	57	17	Compared to conventional vehicles or all options? A figure on costs by powertrain would be really helpful	Noted	Matteo Muratori	NREL	United States of America
47931	57	16	57	24	Do costs include refueling infrastructure? That's a major added cost for H2, and should at least be mentioned	We have added text about infrastructure costs	Matteo Muratori	NREL	United States of America
47929	57	18	57	19	H2 costs in the Us are much higher than conventional fuels (>$15/GGE, so ~ 4-5 times higher than gasoline): https://ww2.energy.ca.gov/2019publications/CEC-600-2019-039/CEC-600-2019-039.pdf	We have new figures for LCC that should address this comment	Matteo Muratori	NREL	United States of America
52497	57	18	57	20	Reference is needed	Agreed	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
12583	57	19	57	20	I'm not sure this is correct that the fuel costs are in the same range as fossil fuels today. There should be a source in any case. Current fuel costs are also likely artificially low as government subsidies are often used for refuelling infrastructure.	Similar to 47929 (FCEV fuel costs) and 47931 (infrastructure)	Matteo Craglia	International Transport Forum	France
53661	57	19	57	19	Clarify that the so-called "state-of-the-art technologies" are all fossil sourced, and result in greater CO2 emissions than diesel if the carbon is not captured and taken out of circulation. I doubt the prices include carbon capture, which means the figures are not a particularly relevant cost comparison for the topic of this section.	Replaced with "incumbent" or "mature technologies". Revised	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
12581	57	20	57	21	The author could be more clear about where these numbers are sources from (I assume IEA but it isn't clear). The 0.26 USD/vkm is also likely a hypothetical price in a future year. This needs to be made more clear. E.g. The fuel costs could reach 0.26 USD/vkm given high availability of low cost renewable electricity in 2050.	Added reference	Matteo Craglia	International Transport Forum	France
53663	57	21	57	21	Change "can reach 0.26" to a range as for the others. Based on the BEV numbers above, it would be around 0.05-0.26.	Noted	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53665	57	23	57	24	Can FCEV realistically become cost competitive with BEV (using identical assumptions on cost development for electricity, batteries and including cost of additional energy production)? If so, in what regions of the world?	We have new figures and text about LCC	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53667	57	28	57	29	In 2016, or when is "currently" (BEV TCO is plummeting for heavy vehicles)? Everywhere, or given some country's NG and electricity prices?	Noted. Revised	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
56881	57	28	57	29	Recommend using more recent cost estimates than Tong et al. (2017). Battery pack costs have declined rapidly since the 2016-2017 time frame of this assessment and the conclusion may be different regarding TCO of BEV buses versus NG buses now. For example, more recent work by the Caley Johnson and colleagues at the U.S. National Renewable Energy Lab suggests that BEV buses may be cheaper than diesel buses on a TCO basis in some circumstances (https://www.nrel.gov/docs/fy20osti/74832.pdf), to say nothing of NG buses. In general, recommend not using studies published before 2020 to provide estimates of current costs of BEV and FCEV technologies as such studies are generally already out of date with respect to current battery pack and electrolyzer costs.	Agreed. We are expanding the literature review and will include the paper listed	Government of United States of America	U.S. Department of State	United States of America

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
11297	57	29	57	32	I suggest that the following sentence, or similar, be added after "BEV are already commercially available and are being deployed in municipalities around the world." "Dynamic charging BEV buses, which are also referred to as battery trolleybuses, are a well proven option for larger buses in demanding applications including bus rapid transit." References: Bartłomiejczyk M., Połom M. (2020) Dynamic Charging of Electric Buses as a Way to Reduce Investment Risks of Urban Transport System Electrification. In: Gopalakrishnan K., Prentkovskis O., Jackiva I., Junevičius R. (eds) TRANSBALTICA XI: Transportation Science and Technology. TRANSBALTICA 2019. Lecture Notes in Intelligent Transportation and Infrastructure. Springer, Cham. https://doi.org/10.1007/978-3-030-38666-5_32 / https://www.researchgate.net/publication/338682809_Dynamic_Charging_of_Electric_Buses_as_a_Way_to_Reduce_Investment_Risks_of_Urban_Transport_System_Electrification Bergk, F., Biemann, K., Lambrecht, U., Pütz, R., & Landinger, H. (2016). Potential of in-motion charging buses for the electrification of urban bus lines. Journal of Earth Sciences and Geotechnical Engineering, 6(4), 347-362. www.scienpress.com/Upload/GEO/Vol%206_4_21.pdf Doherty E. (2019) "Trolleybuses are one of the UK's best chances to deal with the climate emergency" www.independent.co.uk/climate-change/news/trolleybus-climate-change-uk-ebus-environment-public-transport-a8803426.html Doherty E. (2020) "Best electric-bus charging system is already overhead in Vancouver" www.straight.com/news/eric-doherty-best-electric-bus-charging-system-is-already-overhead-in-vancouver	Will review papers and incorportae as appropriate	Eric Doherty	Ecopath Planning	Canada
75815	57	29	57	39	Quoting the TCO numbers from studies is not representative since BEV/FCEV can be both cheaper and more expensive than ICE. It all depends on the assumptions for electricity/hydrogen price, infrastructure, battery/fuel cell, so perhaps either 1. Quote one or two studies with those underlying assumptions clear; 2. Make a more general statement on the boundary conditions that would make BEV/FCEV attractive; 3. Construct a bottom-up TCO where the influence of those key parameters can be seen (similar to the LCA comparison where ranges are identified)	This concern should be addressed by our new LCC figures and discussion	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
12585	57	33	58	25	See https://ieeexplore.ieee.org/document/8793108 for a detailed assessment showing BEV buses are already competitive in many contexts especially when wider benefits such as grid services are considered. There are likely to be important country/regional differences in cost competitiveness of options that ought to be considered.	We will review the paper and include as appropriate	Matteo Craglia	International Transport Forum	France
52503	57	33	57	42	All the cost numbers in this whole section are from just one source, i.e., Hydrogen Council. Should expand this section and include numbers from other sources too, preferably non-profit organizations	We are expanding the review to include other papers that are appropriate	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
85561	57	33	58	37	This section bases the price of FCEV on repeated use of the Hydrogen Council as the only source. However, the Hydrogen Council is a lobby organisation for the FCEV industry, not an independent organisation, let alone a scientific peer reviewed source. Maybe that also explains their exceptionally optimistic outlook for hydrogen (line 35-37). Also people might wonder why the hydrogen council is the source for the cost of BEVs in the AR6 (page 58 line 30-33) since they basically advocate for hydrogen instead of BEV. In order to seem objective it might be better if the IPCC didn't use reports by lobby groups like the Hydrogen Council as a source of quantified information. (The use on page 38 line 6 and 7 is less problematic but here also a peer reviewed source would be better.)	We are expanding the review to include other papers that are appropriate	Auke Hoekstra	Eindhoven University of Technology	Netherlands
43809	57	34	57	44	Does USD refers to USD_2015 as in the rest of the section? Please specify.	We need to be more precise with the $ values we report	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
52499	57	36	57	37	Reference is needed	Will review and correct	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52501	57	36	57	37	The total cost of ownership numbers for ICEVs are very close to the total cost of ownership numbers for BEVs. How come when the total cost of ownership numbers are so similar, the sales of BEV buses are lower relative to ICEVs and require subsidies for deployment? The total cost of ownership numbers for BEVs and ICEVs seem incorrect.	We are reporting the values in the literature and can't comment on why purchasing is lagging. There are many other variables that may drive purchasing behavior besides cost. We will try to add a note about these issues.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
53669	57	39	57	44	The last clause with the EU DGMT source states that the previous claims are bogus. Given this, "Hydrogen Council" comes across as a biased source. Perhaps different assumptions were made (e.g. location or technology development), in which case these could be clarified and/or reconciled.	The new parametric analysis and new references should address this concern	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
69833	57	41	57	44	The figures USD 7-12 per kilometre seem to have been extracted from exhibit 23 of Hydrogen Council 2020 (op. cit.), where USD 7 is for electric catenary train with existing infrastructure, and USD 12 for electric catenary train with new infrastructdure - vs. diesel trains at USD 4/km. These numbers are given for four trains travellling a distance of 100 km and 24 return trips per day. There are hardly credible in suggesting that the cost of electricity, used with excellent efficiency via existing catenaries in electric trains, is today 75% higher than the cost of diesel fuel used with the efficiency of disel ICE (around 40% for trains), while maintenance costs are also significantly higher for ICEs. A study in Norway shows diesel costs of 2.50 NOK/kWh plus maintenance 33 NOK/km (+emission taxes 17 NOK/km) vs. electricity cost 0.53 NOK/kWh and maintenance 11.5 NOK/kW (Zenith, F. (Sintef), 2019, Techno-economic Analysis of Alternative Rail Electrification Technologies, MoZEES workshop on heavy-duty transport solutions, Oslo, 22 October. Arguably, there is a threshold in the trafic density above which the lower costs of electricity justify the additional investment in line electrification - something that would be impossible if the cost of electric traction on already electrified lines was higher than that of diesel, as the misleading Exhibit 23 of Hydrogen Council 2020 suggests. The same norwegian study shows that battery trains and hydrogen-fuelled trains have very similar costs.	We will reivew additional papers, including the one listed	Cédric PHILIBERT	Institut Français des Relations Internationales	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
53671	57	45	57	46	Be clear here. Captured CO2 could result in negative emissions, but the tech is not yet available. Neither synthetic diesel nor hydrogen can have lower emissions than BEV when made from grid electricity. The main benefit of synthetic fuels in the coming 20 years is that they can reduce emissions from ICE vehicles while they are being phased out. However, this requires investment for production at scale, and possibly tax reforms to make them cost competitive vs. fossil fuels. Unlike most biofuels, electrofuels are unlikely to raise global food prices or have negative impact on biodiversity.	Noted	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
75817	58	8	58	25	Some other references that might be useful for providing some cost figures are: [17] http://www.theicct.org/sites/default/files/publications/Zero-emission-freight-trucks_ICCT-white-paper_26092017_vF.pdf [18] http://www.fondation-tuck.fr/upload/docs/application/pdf/2019-03/future-fuel-road-freight-report_lbst-hinicio_2019-02-19.pdf [19] https://www.theccc.org.uk/wp-content/uploads/2019/05/CCC-Zero-Emission-HGV-Infrastructure-Requirements-Ricardo-Energy-Environment.pdf (focus on infrastructure costs) [20] https://www.fch.europa.eu/sites/default/files/file_attach/FCH%20HDT%20-%20Study%20Report_final_vs.pdf (page 133-149 have the TCO analysis and associated spreadsheet also has some numbers) In general, what the section is missing are some overarching numbers or trends rather than listing 2-3 studies and mentioning the values they found. For instance, the fuel component is much more relevant for ships which require a cheap hydrogen, while the CAPEX component is much larger for cars requiring a cheap fuel cell, but trucks are in the middle (similar contributions from fuel and fuel cell) and require both to become competitive. The other cost aspect is the on/off-site hydrogen production and the trade-off between production cost vs transport cost. Cost shares of batteries and fuel cells with respect to the total truck cost could also be mentioned (along with the assumptions). A key number of CO2 abatement cost is mentioned, which is good, but drawing upon two studies that have very different values limits the validity of the numbers	We will reivew the papers listed and include as appropriate	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
79173	58	8	58	25	As my comment on 5:27–39 noted, the electric HEV discussion (also medium trucks, though my empirical data were from a Class 8) is several years out of date and will now attract puzzlement at best, even though you do offer Sen's contrary view. A two-year payback does not make a Semi more expensive on lifecycle than its diesel version, and you can't expect a 2016 reference to say so because the Semi didn't then exist. You need only examine the extraordinarily rapid uptake of E-logistics in Shenzhen and parts of India (see RMI.org publications on both) to understand that the economics have flipped. I suggest you use the industry-standard North American Center for Freight Efficiency's recent Confidence Report on the economics of electric trucking, and cross-check against the Semi data. Currently, your trucking description is far from "state-of-the-knowledge" as claimed at 58:40.	The new parametric analysis and new references should address this concern	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
85505	58	8	58	25	A new study by Nykvist and Ollson in Joule called "The feasibility of heavy battery electric trucks" (DOI expected in March 2021) shows that costs for heavy trucks become negative with batteries that are 100 USD/kWh and weight 175 Wh/kg, which according to Bloomberg New Energy Finance will be achieved before 2023 (https://about.bnef.com/blog/battery-pack-prices-cited-below-100-kwh-for-the-first-time-in-2020-while-market-average-sits-at-137-kwh/). Thus this would result in negative carbon abatement costs for the most interesting (in terms of CO2 emissions) truck segment. I think this study deserves to be added to this paragraph.	We will review the paper and include as appropriate	Auke Hoekstra	Eindhoven University of Technology	Netherlands
12579	58	13	58	37	The literature review of this section could be further strengthened here by including insights from http://www.csrf.ac.uk/2020/07/white-paper-long-haul-freight-electrification/ which is a highly detailed assessment and suggests catenary trucks would be the cheapest option via PHEV or BEV. There is also no discussion on PHEVs (plugin hybrids) which are an important technology option in this context to manage the transition from diesel trucks to an electrification pathway via pantograph retrofits. Indeed the Mojtaba Lajevardi et al. 2019 report the author refers to suggests PHEVs have the lowest cost options with potential negative ambatement costs 'Plug-in parallel hybrid diesels have the lowest abatement cost, with negative costs on most drive cycles either using diesel or bio-diesel', hydrogen council 2020 report is not peer reviewed literature.	We will review the paper and include as appropriate	Matteo Craglia	International Transport Forum	France
53673	58	13	58	14	I disagree and I feel this section is very biased against heavy duty BEV. See for instance these well-sourced calculations (which also provide a year for their claim) https://www.elaad.nl/uploads/files/Auke_Hoekstra_-_Electric_trucks_economically_and_environmentally_desirable_but_misunderstood.pdf	We will review the paper and include as appropriate	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53675	58	15	58	16	No region, timeframe or tax structure is provided for these numbers. Is this a comparison between a Volvo BEV fueled with German consumer electricity prices that also has to buy its own charging infrastructure, vs. a poorly serviced Isuzu ICE in Saudi Arabia, or how did they arrive at such a disparity? Maybe the BEV prices are from 2015, which isn't very helpful to the discussion.	We are updating the literature review and will make sure to be more explicit about the assumptions behind the numbers we report	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53677	58	19	58	19	USD 57 <-- Where and when?	These values will probably be updated with the improved lit. review	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53679	58	24	58	25	USD 140-300 <-- When and where? What assumptions differed vs. the other study that arrived at USD 57?	These values will probably be updated with the improved lit. review	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53681	58	28	58	28	USD 520-580 <-- When and where?	These values will probably be updated with the improved lit. review	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53683	58	31	58	33	[numbers] <-- Where?	These values will probably be updated with the improved lit. review	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53685	58	34	58	35	I am very sceptical of these numbers vs. the BEV numbers immediately above, especially given that Hydrogen Council is the source. Did the study concluding that FCEV can be cheaper than BEV take into account the cost of the additionally needed energy production, and did it use equivalent time and tech development assumptions for both technologies? Typically arguments about cheap hydrogen are based on strategies like peak shaving, which are close to impossible to scale to the combined energy needs of national truck fleets. E.g. in the UK, trucks run on electricity-sourced H2 would together use as much electricity as the current national electricity production. H2 production as energy storage also needs to be compared to alternatives like batteries and pumped hydro, not counted as a free solution.	We are updating the literature review, which will likeley address this concern	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
43273	58	38	59	25	The section of "Decarbonisation of Motorised Land-Based Transportation" present a different structure compared with the same sections for Aviation and Shipping, in terms of the final words. In the case of Land-Based Transportation a "Conclusion" section is present which show the results of the analysis. However, in the Aviation and Shipping sections, a synthesis is presented with a resume of the different option analysed. It is important that all sections has the same structure, in therms of analisys and conclusions.	We have restructure the chapter and the section to address this concern	Government of Chile	Ministry of Environment	Chile

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
48063	58	39	58	48	This section does not bring any quantitative information regarding biofuels GHG emissions reduction potential for light vehicles, although extensive literature is available. The assessment of this issue in different sections of Chapter 10 should be carefully reviewed, and could greatly benefit from additional references and literature – some of it indicated below: This section does not bring any quantitative information regarding biofuels for light vehicles, although extensive literature is available, e.g.: Staples, M. D., Malina, R., & Barrett, S. R. (2017). The limits of bioenergy for mitigating global life-cycle greenhouse gas emissions from fossil fuels. Nature Energy, 2(2), 1-8. Liu, B., & Rajagopal, D. (2019). Life-cycle energy and climate benefits of energy recovery from wastes and biomass residues in the United States. Nature Energy, 4(8), 700-708. Kang, Y., Yang, Q., Bartocci, P., Wei, H., Liu, S. S., Wu, Z., ... & Chen, H. (2020). Bioenergy in China: Evaluation of domestic biomass resources and the associated greenhouse gas mitigation potentials. Renewable and Sustainable Energy Reviews, 127, 109842. Liu, X., Kwon, H., Northrup, D., & Wang, M. (2020). Shifting agricultural practices to produce sustainable, low carbon intensity feedstocks for biofuel production. Environmental Research Letters, 15(8), 084014. Moreira, M. M., Seabra, J. E., Lynd, L. R., Arantes, S. M., Cunha, M. P., & Guilhoto, J. J. (2020). Socio-environmental and land-use impacts of double-cropped maize ethanol in Brazil. Nature Sustainability, 3(3), 209-216. Melissa J. Scully et al 2021 Environ. Res. Lett. in press https://doi.org/10.1088/1748-9326/abde08 HERNANDES, THAYSE APARECIDA DOURADO ; SCARPARE, FABIO VALE ; SEABRA, JOAQUIM EUGÊNIO ABEL . Assessment of the recent land use change dynamics related to sugarcane expansion and the associated effects on water resources availability. JOURNAL OF CLEANER PRODUCTION , v. 197, p. 1328-1341, 2018. SOUZA, SIMONE P. ; SEABRA, JOAQUIM E.A. . Integrated production of sugarcane ethanol and soybean biodiesel: Environmental and economic implications of fossil diesel displacement. Energy Conversion and Management, v. 87, p. 1170-1179, 2014. SOUZA, SIMONE PEREIRA ; SEABRA, JOAQUIM E.A. . Environmental benefits of the integrated production of ethanol and	Noted. Our chapter focuses on the use of biodules in the transport, so any discussions about feedstocks and agricultural practices are not appropriate for our chapter and are part of the biomass chapter.	Marcelo moreira	UNICAMP - Agroicone	Brazil
50983	58	39	58	48	There is litle evidence presented to support the statement that "of the available technologies and fuels, vehicle electrification offered the greatest opportunity for decarbonisation of personal passenger transport". In fact, IEA's projected emissions reduction on a well-to-wheel basis from transport vehicle electrification in the (ambitious) EV30@30 Scenario amounts to a mere 535.6 Mt CO2eq, out of total projected transport sector emissions of 8.9 Gt CO2 eq. There is no similar projection available to 2050 (IEA Global EV Outlook 2019). Models cited in the IPCC report have not adequately considered the fact that most BEVs will continue to be charged for several years out of a predominantly fossil-based and high carbon power mix and put additional demand in a strained sector, thus severely constraining their mitigation potencial. On the other hand, this section does not bring any quantitative information regarding biofuels GHG emissions reduction potential for light vehicles, although extensive literature is available. The assessment of this issue in different sections of Chapter 10 should be carefully reviewed, and could greatly benefit from additional references and literature – some of it indicated below: Staples, M. D., Malina, R., & Barrett, S. R. (2017). The limits of bioenergy for mitigating global life-cycle greenhouse gas emissions from fossil fuels. Nature Energy, 2(2), 1-8. Liu, B., & Rajagopal, D. (2019). Life-cycle energy and climate benefits of energy recovery from wastes and biomass residues in the United States. Nature Energy, 4(8), 700-708. Kang, Y., Yang, Q., Bartocci, P., Wei, H., Liu, S. S., Wu, Z., ... & Chen, H. (2020). Bioenergy in China: Evaluation of domestic biomass resources and the associated greenhouse gas mitigation potentials. Renewable and Sustainable Energy Reviews, 127, 109842. Liu, X., Kwon, H., Northrup, D., & Wang, M. (2020). Shifting agricultural practices to produce sustainable, low carbon intensity feedstocks for biofuel production. Environmental Research Letters, 15(8), 084014. Moreira, M. M., Seabra, J. E., Lynd, L. R., Arantes, S. M., Cunha, M. P., & Guilhoto, J. J. (2020). Socio-environmental and land-use	Referenced the findings in Section 10.7 that show electrification is a significant driver of decarbonization in the modeling literature. The papers cited in this comment seem more relevant for the biomass chapter than the transportation chapter	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
56883	58	39	59	25	Consider adding: "Although LCA are valuable tools for assessing the "complete" picture of emissions, there are challenges in communicating LCA analyses to policymakers. These challenges include explaining the approach, the impacts and dependencies that cross sectors (and often cross government organizations/departments), the difficulty of establishing clear metrics, and the variation in timescales for different portions of the LCA analysis."	Revisited. Revised	Government of United States of America	U.S. Department of State	United States of America
28465	59	1	59	2	If you calculate BEV emissions over their lifetime (including the fact that electricity is slowly getting greener over the lifetime) they already emit half of the CO2 compared to ICE (doi.org/10.1016/j.joule.2019.06.002). In order to reflect this I could imagine rephrasing to e.g. "However, in order to provide maximum mitigation benefits, the development of renewable electricity and electrification of transport should go hand in hand"	Will do	Naud Loomans	Eindhoven University of Technology	Netherlands
43123	59	1	59	2	...transitions to low-carbon technologies.'. This should say ' ... transitions to low carbon generation pathways'.	Will correct	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
79337	59	1	59	2	The statement, "However, vehicle electrification will only provide carbon mitigation benefits in so far as electricity generation transitions to low-carbon technologies" is incomplete, since it does not mention embodied emissions or rebound effects. I suggest changing this to: "However, fuel shifting, such as vehicle electrification, only reduces lifecycle emission rates by 40-80%, depending on energy source, and some of these savings may be offset if lower vehicle opreating costs increase annual vehicle-kilometers (a rebound effect), so these strategies must be implemented with TDM incentives to reduce total vehilce."	We should consider how to deal with rebound effects... presumably if all EV are charged with clean electricity, more driving (rebound) would not increase emissions	TODD LITMAN	Victoria Transport Policy Institute	Canada

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
85559	59	1	59	2	If you calculate BEV emissions over their lifetime (including the fact that electricity is slowly getting greener over the lifetime) they already emit half of the CO2 compared to ICE (as I argue here doi.org/10.1016/j.joule.2019.06.002). In order to reflect this I could imagine rephrasing to e.g. "However, in order to provide maximum mitigation benefits, electricity generation must also transition to low carbon technologies."	Same as comment 28465	Auke Hoekstra	Eindhoven University of Technology	Netherlands
81957	59	3	59	3	The entire chapter 10.4 does not mention mode shift once but sets a focus on improving / replacing energy carriers - which is a legitimate focus of the chapter. but then it seems odd to bring up mode shift as a facilitator in the chapter conclusion for the first time.	Section 10.4 focuses on the technologies available for land-based transport. Mode shift is discuessed in the section about systemic changes	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
43125	59	5	59	6	… or battery-electric buses'. This should say ' … or electric buses', as hydrogen buses are also being deployed around Europe and China.	Noted	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
43127	59	6	59	8	Here the author talks about natural-gas fuels technologies not leading to deep decarbonisation of the bus fleet. This is not technically correct, because while NG technology using NG doesn't really yield savings when counting for gas leakages, the same technology can be used with biogas or biomethane. As revealed in the Low Emission Freight Trial monitored and evaluated by my organisation, Compressed biomethane HDVs can yield GHG reductions of 80-85% depending on duty cycle. Liquid biomethane saved 65-66%.	Revisited information about bio-methane.	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
53687	59	9	59	9	No, the choices are the same. But charging infrastructure for heavy vehicles hasn't been built out yet, which in part seems to be due to the oil lobby spreading irrational doubt about the feasibility of abandoning the ICE. Hydrogen being lauded as a fantastic (and worth waiting for!) option is the best example.	Noted	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53689	59	10	59	11	"…there are still challenges associated with…" <-- Including comparable taxes, BEV tech is TCO competitive with ICE now or within a few years. My view could be biased towards high-income countries where premium truck brands dominate. Due to higher CAPEX and lower OPEX vs ICE, the best business cases for BEV are those with the greatest annual fuel consumption (e.g. long haulage). Though not BEV, catenary-powered 570 ton HEVs are used in at least one mine (Aitik), with great cost savings results. Depending on global region, the main barriers to adoption are lack of charging infrastructure, tax structures that favor fossil fuels, a local transport market that buys primarily second, third or even fourth hand trucks, greater than average electricity costs, or a political unwillingness to add externalized societal costs to fossil fuel consumption.	Noted	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53691	59	12	59	12	"Hydrogen is more viable…" <-- I do not have time to dig up good sources, but I work in heavy vehicle R&D. Fossil fueled hydrogen is unlikely to be cost competitive vs fossil fueled ICE for road freight before 2030 (optimistic) to 2050 (pessimistic). Beyond this point in time, BEV TCO is expected to be a fraction of today's (perhaps 15-25% of a heavy 2020 BEV only with regards to the propulsion system). The vehicle fleet is replaced approximately every 15-20 years. This means FCEV tech is unlikely to to play a significant role in decarbonizing road freight in the 2020-2040 time frame.	Noted	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
43129	59	17	59	18	Battery powered freight locomotives are not feasible as a conventional locomotive running on diesel weights 32t, 31t when hydrogen fuel cells, and 250 t when batteries. The penalty on payload it too large. Source: Rail Industry Decarbonisation Taskforce, 2019. Final Report to the Minister for Rail. RSSB, London.	Noted	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
53693	59	18	59	18	"unless … haulage." <-- Or unless the social cost of carbon is added to the fossil fuel price, which would immediately make electric drive by far the cheapest available option.	Noted	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
46071	59	26	70	16	The section heading "Decarbonisation of Aviation" already indicates that the focus will be on CO2. CO2 is referred to in the text as the "principal greenhouse gas of aviation" and the measures and scenarios mainly relate to CO2. In fact, the non-CO2 / SLCF / indirect effects of aviation have a greater impact on climate and have hardly been addressed in the past. In the case of non-CO2 effects, there is no incentive from the fuel costs. Non-CO2 effects should therefore be given at least the same weight as CO2 in the section. Please consider the mitigation options laid down in the latest EASA analysis, 2020. Updated analysis of the non-CO2 climate impacts of aviation and potential policy measures pursuant to the EU Emissions Trading System Directive Article 30(4): "EASA (2020)" : Updated analysis of the non-CO2 climate impacts of aviation and potential policy measures pursuant to the EU Emissions Trading System Directive Article 30(4) https://ec.europa.eu/clima/news/updated-analysis-non-co2-effects-aviation_en. Please amend the title of the section to reflect that CO2 is not the only problem, e.g. "Mitigation the climate impacts of aviation".	Partially accepted: decarbonisation is the mandate given to the authors. NON-CO2 is referered to.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
51551	59	26	70	16	General comment : whatever the mitigation options, they will not be adopted by the industry unless they are profitable, and in this case the emissions might well continue to increase because of the rebound effect. To avoid that, and force the industry to reduce aviation emissions, there are two main options : either set a cap on emissions or price those emissions appropriately. The latter will encourage to pick the most appropriate winning technology or operational improvements to deliver best value under those constraints.	noted	eric lombard	Stay Grounded	France
56885	59	26	70	16	The aviation section of this chapter makes no mention whatsoever of battery electric technologies. It is fair to say that battery electric aircraft are at best a long-term mitigation option. But the same can be said of hydrogen-powered aircraft and large scale low-carbon bio-jet fuels. None of these technologies has been proven at commercial scale, yet battery electric aircraft are the only one that is ignored in this chapter. LIke bio-jet fuels and hydrogen aircraft, battery electric aircraft are currently receiving hundreds of millions of dollars of private sector R&D funding. So while all three are speculative at this point, all three also deserve equal consideration as they may be the only ways to truly decarbonize the aviation sector. For technical assessment of the potential of battery electric aircraft, see Schafer et al. (2018, https://www.nature.com/articles/s41560-018-0294-x) and Gnadt et al. (2019, https://www.sciencedirect.com/science/article/pii/S0376042118301179?via%3Dihub).	Rejected - electrification of aviation is discussed	Government of United States of America	U.S. Department of State	United States of America
61187	59	26	59	27	A discussion on aviation is incomplete without at least aknowledging the emmissions from the emmissions produced by airports. In particular- ground usppport equipment can produce non-trivial emmissions. There are electrification ofptions for some but not all equipment. Citation can be shared if requested. For an example of the magnitude of GHG from ground support equipment- consider all the policies in Europe, Boston Logan, LAX, and PANYNJ to electriy.	Rejected - the mandate is aviation meaning the airplanes, not the infrastructure	Andrea Cristina Ruiz	Abdul Latif Jameel Poverty Action Lab and Member of Committee on Extreme Weather and Climate Change Adaptation Transportation Review Board-National Academy of Science	United States of America
70339	59	26	61	24	Fantastic introduction: concise, clear, information, bulding the case…. Congratulations! (and good to have a chapter of its own for aviation.)	noted and thank you	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79175	59	26	70	16	With all due respect to the authors, this aviation section reflects mastery of the conditions of several years ago, but now has become quite misleading. The efficiency discussion in section 10.5.3.1 is sketchy and grossly insufficient. Even my own ATAG keynote in June 2019 (https://rmi.org/insight/aviation-efficiency-revolution/) is badly outdaed. Please start with my aviation comments at 5:40–6:5 and 7:13–20, and rewrite the section to reflect (a) the huge overhang of unbought airframe (and some engine) efficiency and (b) the implications of Otto Aviation's laminarization of fuselage, wings, and tail as an existence proof for far outside-the-box disruptions on the demand side.	rejected - no literature cited	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
86739	59	26	70	16	Change every mention to "Decarbonisation" (that has not been multilaterally agreed) for "greenhouse gas emission reductions" or "low greenhouse gas emissions".	Rejected - decarbonisation is the mandate	Government of Argentina	Ministry of Environment and Sustainable development of Argentina	Argentina
86741	59	26	70	16	The technical information contained in section 10.5 must be in accordance with the body of knowledge used or researched by OACI.	noted	Government of Argentina	Ministry of Environment and Sustainable development of Argentina	Argentina
79339	59	27	59	37	It is important to mention here that high altitude emissions have particularly strong GHG impacts, making aviation a particularly important target for emission reductions.	noted	TODD LITMAN	Victoria Transport Policy Institute	Canada
10789	59	43	59	45	Section 10.3.2.2. does not deal with non-CO2 aviation effects on climate. Section 10.5.2 is a possibility.	accepted	Philippe Waldteufel	CNRS	France
56887	59	44	59	44	Use of "although" implies comparison between "principal greenhouse gases" and "aviation has a number of other effects on climate". Recommend replacing with: "... although a number of other non-CO2 emissions also affects climate ...".	Noted	Government of United States of America	U.S. Department of State	United States of America
12595	59	45			the reference to Section 10.3.2.2 is not clear, since in this section there is no mention of non-CO2 emissions in aviation.	Noted	Michel Noussan	Fondazione Eni Enrico Mattei	Italy
51511	59	45	59	45	Section 10.3.2.2 not relevant to non-CO2 emissions (probabbly not the right ref)	Noted	eric lombard	Stay Grounded	France
56889	59	46	59	46	Recommend including a brief description of total sectoral emissions.	accepted	Government of United States of America	U.S. Department of State	United States of America
61183	59	46	59	46	When discussing where total emmissions from aviation come from- it is important to note the findings from Gossling and Humpe when discussing the % of sector emmissions that come from international emmisisons. They find that Only 2-4% of the global population flew in ternationally in 2018. Further 1% of the world population emits 50% of CO2. Including this citation is in alignment with the framework set out in Chapter 1, where just transitions and burdens of mitigation are discussed. Citation: Stefan Gössling, Andreas Humpe,The global scale, distribution and growth of aviation: Implications for climate change. Global Environmental Change, Volume 65, 2020, 102194, ISSN 0959-3780, https://doi.org/10.1016/j.gloenvcha.2020.102194.	rejected - a very good point but dealing with the social dimension would add to the text, when the current pressure is tor educe by at least 20%	Andrea Cristina Ruiz	Abdul Latif Jameel Poverty Action Lab and Member of Committee on Extreme Weather and Climate Change Adaptation Transportation Review Board-National Academy of Science	United States of America
76153	60	1	60	5	This is important information.Coordination between chapter 14 and 10 is needed for consistency check.	CHECKED and largely OK	Jan Fuglestvedt	CICERO	Norway
51513	60	2	60	3	The Paris agreement requires all parties to address all emissions! That's explicit in the agreement – parties are to establish 'economy-wide' emission reduction targets. https://www.transportenvironment.org/newsroom/blog/planes-and-ships-cant-escape-paris-climate-commitments This also applies to Box 10.5 (10-101)	rejected - the text is correct as written although I agree with the reviewer's implied assertion of ambiguity in the PA	eric lombard	Stay Grounded	France
86675	60	4	60	5	ICAO and IMO must be drawn into Paris temperature goals. Without the right institutional framework, the changes necessary will never be delivered	noted	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
56891	60	13	60	15	Recommend adding an inset or a panel of normalized aviation CO2 (CO2/ASK or APK) to Figure 10.15.	rejected - limited space available and this would require a second graph. Such a graphic is available in Lee et al. 2021 and is referred to.	Government of United States of America	U.S. Department of State	United States of America
76157	60	18			This is a useful section. And good that a reference to WGI Ch6 is given. You may consider adding a refernce to a paper by Lund et al 2017 here. Earth Syst. Dynam., 8, 547–563, 2017 https://doi.org/10.5194/esd-8-547-201	Accepted	Jan Fuglestvedt	CICERO	Norway
45583	60	19	61	24	Just for understanding: non-CO2 is 66% of the ERF, so CO2 is 34%? This means that the total forcing is about 3 times the CO2 forcing. This factor 3 is important, as such a factor is often used in carbon footprinting analysis. Important question is of course what the uncertainty range is in this factor.	Rejected - this misunderstands forcing vs CO2-e	Kornelis Blok	Delft University of Technology	Netherlands
86677	60	19			Aviation's warming is not a "signal"it is an impact	Accepted	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
75137	60	20	60	20	Strictly, only a very small fraction of total SO2/SO4 is emitted directly in aerosol form. Would rather say aviaiton emissions of sulfur dioxide (which form sulphate aerosols in the atmosphere)"	Accepted	Marianne Tronstad Lund	CICERO Center for International Climate Research	Norway
1255	60	21	60	21	Lee et al. (2020) is not in reference list. Maybe this should be Arrowsmith et al. (2020)??	Noted. Checked	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
76155	60	23	60	23	You may consider adding a more recent reference here. Also WGI Ch5	Accepted	Jan Fuglestvedt	CICERO	Norway
56893	60	24	60	25	Recommend adding a sentence to note that NOx emissions also contribute to adverse air quality impacts.	rejected - space pressures and would also imply qualification of soot and S emissions	Government of United States of America	U.S. Department of State	United States of America
75139	60	24	60	24	I think it would be useful if there is space to explain what is contained in this "net" effect.	Accepted	Marianne Tronstad Lund	CICERO Center for International Climate Research	Norway
76159	60	44	60	44	I think this may need some more explanation: "net (overall) aviation GWP".	Accepted	Jan Fuglestvedt	CICERO	Norway
43811	61	1	61	1	The concept of ERF should be briefly explained or a cross reference to the respective WG1 chapter could be given.	Accepted- in Glossary	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
43813	61	3	61	9	In this paragraph it would be helpful to distinguish between the aviation-aerosol effect on high-level (natural) ice clouds (cirrus) and low-level warm clouds. Both effects are very uncertain, with the first being further complicated by the limited knowledge on the ice nucleating abilities of (aviation) soot, which in turn controls the impact of aviation on the radiative properties of cirrus. Also please assign the reference correctly for the two effects. On the cirrus effect: Gettelman and Chen (2013), Zhou & Penner (2014), Penner et al. (2018), and you could also add Hendricks et al. (2011). On the warm clouds effect: Gettelman and Chen (2013), Righi et al. (2013), Kapadia et al. (2016). Hendricks, J.; Kärcher, B.; Lohmann, U. & Ponater, M. Do aircraft black carbon emissions affect cirrus clouds on the global scale? Geophys. Res. Lett., American Geophysical Union (AGU), 2005, 32.	Accepted, references are supposed to largely update 2014 (AR5)	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
75141	61	3	61	9	For comprehensiveness, this section could/should also describe the possible effect of soot aerosols on cirrus clouds, since the traditional aerosol-cloud interactions from sulfate are described in detail.	Accepted	Marianne Tronstad Lund	CICERO Center for International Climate Research	Norway
43815	61	5	61	5	The reference Righi et al. (2014) is not correct, please change it to Righi et al. (2013): Righi, M.; Hendricks, J. and Sausen, R.: The global impact of the transport sectors on atmospheric aerosol: simulations for year 2000 emissions. Atmos. Chem. Phys., Copernicus GmbH, 2013, 13, 9939-9970.	Accepted	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
43817	61	6	61	6	A more recent estimate on the H2SO4 fraction by Jurkat et al. (2011) found 2.2 +/- 0.5%. Jurkat, T.; Voigt, C.; Arnold, F.; Schlager, H.; Kleffmann, J.; Aufmhoff, H.; Schäuble, D.; Schaefer, M. & Schumann, U. Measurements of HONO, NO, NO_y and SO_2 in aircraft exhaust plumes at cruise Geophys. Res. Lett., American Geophysical Union (AGU), 2011, 38	Accepted	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
43819	61	9	61	9	The reference Righi et al. (2014) is not correct, please change it to Righi et al. (2013): Righi, M.; Hendricks, J. and Sausen, R.: The global impact of the transport sectors on atmospheric aerosol: simulations for year 2000 emissions. Atmos. Chem. Phys., Copernicus GmbH, 2013, 13, 9939-9970.	Accepted	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
43821	61	10	61	11	On the impact of non-CO2 emissions see also Grewe et al. (2019), who pointed out some methodological issues in existing estimates, and the review Grewe et al. (2017). - Grewe, V., Dahlmann, K., Flink, J., Frömming, C., Ghosh, R, Gierens, K., Hendricks, J., Jöckel, P., Kaufmann, S., Kölker, K., Linke, F., Luchkova, T., Lührs, B., Van Manen, J., Matthes, S., Minikin, A., Malte, N., Plohr, M., Righi, M., Rosanka, S., Schlage, R., Schmitt, A., Schumann, U., Terekhov, I., Unterstrasser, S., Vazquez-Navarro, M., Voigt, C., Wicke, K., Yamashita, H., Zahn, A., and Ziereis, H.: Mitigating the Climate Impact from Aviation: Achievements and Results of the DLR WeCare Project, Aerospace, 4, 34, doi:10.3390/aerospace4030034, 2017. - Grewe et al 2019 Environ. Res. Lett. 14 121003 doi:10.1088/1748-9326/ab5dd7	Accepted	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
60771	61	10	61	11	The sentence „The net ERF (effective radiative forcing) from aviation's non-CO2 SLCFs is ~66% of aviation's total forcing" has high relevance for Policy Makers and should be included in the SPM	Rejected - this is not a general statement-the fraction is date and scenario-specific	Manfred Treber	Germanwatch	Germany
75143	61	12	61	13	Presumably a proper reference will be added later, but does this ref refer to the whole sentence or only the "atmopsheric" trade-offs part?	Accepted - editorial correction	Marianne Tronstad Lund	CICERO Center for International Climate Research	Norway
75145	61	12	61	12	the term "atmospheric trade-offs" sound a bit strange. Is it better to say trade-offs in terms of climate impact? Or is that not what is meant?	Accepted	Marianne Tronstad Lund	CICERO Center for International Climate Research	Norway
56895	61	13	61	14	Recommend adding a sentence before "Moreover …": "In particular, reduction in CO2 emissions will likely lead to increase in NOx emissions that will cause premature mortality increases due to air quality disbenefits (Grobler et al., 2019)."	Rejected - this does not necessarily follow	Government of United States of America	U.S. Department of State	United States of America
56897	61	17	61	24	Recommend rewriting this paragraph to capture that CO2 and non-CO2 impacts go together. CO2 increases due to growth will likely lead to increases in non-CO2 impacts. Use of SAF will mitigate CO2 but NOx effects (both climate and air quality) will remain.	rejected - although a good point, this is not the point of this para and while NOx may be unaffected (may), contrails would not be - this is all dealt with elsewhere	Government of United States of America	U.S. Department of State	United States of America
75147	61	17	61	19	I'm not convinced that reducing other aviation emissions is much easier than reducing CO2. I see the point about the longevity, but that more an argument for why CO2 may be most important to mitigate in my view.	Accepted	Marianne Tronstad Lund	CICERO Center for International Climate Research	Norway
51515	61	21	61	22	Replace "As a result, CO2 mitigation of aviation to 'net zero' levels, as required in 1.5 ºC emission scenarios, requires fundamental shifts in fuel types, and in changes of behaviour or demand" by "As a result, CO2 mitigation of aviation to 'net zero' levels, as required in 1.5 ºC emission scenarios, requires fundamental shifts in technology, fuel types, and changes of behaviour (See section 10.2.2) or measures to reduce demand."	Partially accepted	eric lombard	Stay Grounded	France
73079	61	21	61	24	Add this sentence following that one: If the global sense of 'climate emergency' intensifies, reduction of aviation emissions to 'net zero' levels may need to occur faster than suggested by the IPCC's 1.5 ºC scenarios.	Rejected - no references to support	Larry Edwards	Larry Edwards Environmental Consulting	United States of America
75821	61	27	62	14	This section would benefit from a more structured approach with: 1. Specific list of improvements that could be done; 2. Quantifying those as much as possible. This report [16] (Tables 5, 6, sections 3.2 and 3.3) has input for those two aspects where perhaps one of the tables could end up in this report [16] https://www.destination2050.eu/wp-content/uploads/2021/02/Destination2050_Report.pdf	rejected - there is already an overall stucture to 10.5.3 that is coherent and furth breakdown to a suv=bsection is unneessary	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
56899	61	39	61	40	What investments and research are lacking to help improve fuel reduction for air transport, given the noted primary opportunities for fuel reduction are anticipated to come from aerodynamic efficiency, aircraft mass reduction, and propulsion system improvements.	Rejected - rhetorical question	Government of United States of America	U.S. Department of State	United States of America
51517	61	47	61	47	Section 10.4 doesn't seem to be the right reference. Rather 10.3	Noted.	eric lombard	Stay Grounded	France
51519	62	1	61	3	Formation flying is an operational improvement, not technology. Should be put in 10.5.3.2	Accepted	eric lombard	Stay Grounded	France
51523	62	1	61	1	"Xu et al., 2014" not listed in the references at the end of the chapter	Accepted	eric lombard	Stay Grounded	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
51549	62	1	62	3	Formation flying doesn't seem to have a large potential. Quoting a reduction of up to 8% of fuel burn is misleading, because in the real world it would only apply to a few flights : complexity of organising aircraft to travel together in the same direction, at exactly the same time... presumably leaving from different airports... forget everything else. Also, probably different airlines. Who takes the aero hit and who takes the aero benefit?	Accepted	eric lombard	Stay Grounded	France
75823	62	4	62	6	I think there are 8 certified pathways (Table 22 of [16]) (seven under ASTM D7566 [21] and one under ASTM D1655) [16] https://www.destination2050.eu/wp-content/uploads/2021/02/Destination2050_Report.pdf [21] http://www.caafi.org/focus_areas/fuel_qualification.html#approved	rejected - no refernce here to fuels	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
56901	62	6	62	6	The chapter states "gains of about 31% against current aircraft". Based on what? Recommend providing a short description.	rejected - reference is provided	Government of United States of America	U.S. Department of State	United States of America
73067	62	7			Add information, to read: "..., would take one or more decades to penetrate the fleet, ...".	Accepted	Larry Edwards	Larry Edwards Environmental Consulting	United States of America
51521	62	8	62	8	The projected growth of aviation is much more than 2% per annum. Replace : "growth expected to be in excess of 2% per annum" by "growth expected to be about 4% per annum" See page 10-66 Line 40 (IEA : 3,4% per annum, ICAO : 4,3%) See also : - IATA 2019-2039 forecasts : 3,2 - 5,3% per annum (avg 3,7%) https://www.iata.org/contentassets/e938e150c0f547449c1093239597cc18/pax-forecast-infographic-2020-final.pdf - Boeing 2020-2039 : 4% per annum https://www.boeing.com/commercial/market/commercial-market-outlook/	rejected - this is fuel/CO2, not rpk	eric lombard	Stay Grounded	France
56903	62	8	62	9	Recommend changing "Any large changes in aircraft configuration WILL also require airport infrastructural changes" to "Large changes in aircraft configuration MAY also require airport infrastructural changes". There are some configurations that would require it, such as where wing span would drastically exceed today's gate spacing, or where a new energy source/storage is required at the airport, but not all configuration changes would create those situations.	Accepted	Government of United States of America	U.S. Department of State	United States of America
73069	62	8			Change "2% per annum" to "3% to 5% per annum, post-pandemic."	rejected - this is fuel/CO2, not rpk (clarified)	Larry Edwards	Larry Edwards Environmental Consulting	United States of America
51539	62	10	62	10	To be added to operational improvements : - encourage countries to open up their airspace and to drop their prices for flying over their airspace to allow airlines take the most direct route, which would be a huge improvement. - strongly reduce fuel tankering (Ref: Fuel Tankering: economic benefits and environmental impact, June 2019, Eurocontrol https://www.eurocontrol.int/publication/fuel-tankering-european-skies-economic-benefits-and-environmental-impact) - better use of winds: potential savings on transatlantic flights range from 0.7% to 7.8% when flying west and from 0.7% to 16.4% when flying east (Ref: Reducing transatlantic flight emissions by fuel-optimised routing, Cathie A Wells et al 2021 Environ. Res. Lett. 16 025002, https://iopscience.iop.org/article/10.1088/1748-9326/abce82) - electric traction on the ground - increased use of turboprop versus jet - smoother ascents/descents	part rejected as it is unclear that the aircraft performance model employed in Wells et al accounts for fuel and wind correctly; accepted to mention Eurocontrol study	eric lombard	Stay Grounded	France
84049	62	10	62	10	This short summary provides a case for demand reduction using "avoid" and "shift" options, yet these are not very well described in this part of the report. There should be much more coverage of these options in section 10.5	rejected - demand reduction is not referred to here	Michał Czepkiewicz	University of Iceland	Poland
61185	62	16	26	62	When thinking of operational improvements, opportunities to reduce emmissions throug behavioral changes should not be downplayed. A recent randomized evaluation found that incentives to airline pilots reduced 266,000-704,000 Kg of fuel and reduced emmissions at a marginal abatement cos of $250 per ton of CO2 Citation: "A new approach to an age old problem" Solving externalities by incenting workers directly" Gosnell, List, and Metcalfe. 2016. https://www.nber.org/papers/w22316	rejected - this is not a behavioural change section - it is a strict operational change, i.e. how the aircraft fly	Andrea Cristina Ruiz	Abdul Latif Jameel Poverty Action Lab and Member of Committee on Extreme Weather and Climate Change Adaptation Transportation Review Board-National Academy of Science	United States of America
63095	62	19	62	20	It is not necessary to give an example here. please delete “(e.g., Europe, North America, PR China)”.	Accepted	Changke WANG	National Climate Center, China Meteorological Administration	China
46073	62	27	62	30	At this point, the detours of connecting flights and the increased consumption due to stopovers on shorter routes should also be discussed. REFERENCE: KG Debbage, N Debbage, 2019, Aviation carbon emissions, route choice and tourist destinations: Are non-stop routes a remedy? - Annals of Tourism Research, 2019	noted but already considered in the section cited	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
51609	62	27	62	30	Although "intermediate stop operations" could save fuel, they are not desirable because they would require more airport capacity and increase the nuisances (noise, air pollution) for people living nearby.	Accepted	eric lombard	Stay Grounded	France
56905	62	27	62	30	Recommend modifying line 29 as follows: "Linke et al. (2017) modelled this on a global basis and calculated a fuel savings of 4.8% over a base case in which normal fuel loads were carried, though further optimization and potentially aircraft design modifications may be required to achieve a net climate benefit and address operator needs." This caveat is important to capture because even the paper says that the 4.8% fuel benefit comes with an overall climate disbenefit due to emissions of NOx and H2O at higher cruise levels. It's also probably not desirable to airlines or passengers, given the increased maintenance/landing fees, scheduling issues, and longer flight times.	Accepted - in that the 4.8% is specofic to applicable routes and 1.3% of global CO2 - corrected	Government of United States of America	U.S. Department of State	United States of America
51555	62	31	63	29	The report doesn't highlight the problematic carbon balance effects of widespread use of biofuels. The very principle of carbon neutrality of biofuels is questionable, as shown by the following publications : Haberl H, et al. (2012) Correcting a fundamental error in greenhouse gas accounting related to bioenergy. Energy Policy 45:18–23.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3617913/ DeCicco, J.M., Liu, D.Y., Heo, J. et al., Carbon balance effects of U.S. biofuel production and use. Climatic Change 138, 667–680 (2016). https://link.springer.com/article/10.1007/s10584-016-1764-4 Mary S. Booth 2018, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 035001 (2018) https://iopscience.iop.org/article/10.1088/1748-9326/aaac88	Accepted but addressed elsewhere in the report	eric lombard	Stay Grounded	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
78759	62	31	64	28	research by Ram et al. (http://energywatchgroup.org/wp-content/uploads/EWG_LUT_100RE_All_Sectors_Global_Report_2019.pdf ; also part of the AR6 scenario database) and a recent report by the German Energy Agency (https://www.powerfuels.org/fileadmin/powerfuels.org/Dokumente/Global_Alliance_Powerfuels_Study_Powerfuels_in_a_Renewable_Energy_World.pdf) have clearly shown that synthetic fuels for a fast growing aviation sector can be provided on a fully renewable and non-bioenergy basis at affordable cost for Fischer-Tropsch based jet fuel and hydrogen. Such reserach insights may be of relevance for this section.	rejected - while very interesting, there is insufficient detail provided that is aviation fuel-production related in this grey literature report.	Christian Breyer	LUT University	Finland
43131	62	36	62	37	electric energy produced renewably'. Electric energy can be produced from nuclear with extremely low carbon intensity. Hence, I would eliminate the 'produced renewably' or I would add '..renewably, for example'.	noted	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
86679	62	36		37	biofuel or synthetic fuel	noted	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
86681	62	37	62	38	Aircraft with a electric drivetrain are thought of as having potential for a signifiantly larger range (500-600 nautical miles, not 300km which at 1.8km per nm is only166nm) though this may be with a gas turbine or fuel cell 'range extender' in hybrid mode. There is already one craft claiming a 440nm range in electric only mode https://www.eviation.co/aircraft/#4, and 500-600nm is envisgaed. See for example Sahoo, S.; Zhao, X.; Kyprianidis, K. A Review of Concepts, Benefits, and Challenges for Future Electrical Propulsion-Based Aircraft. Aerospace 2020, 7, 44. https://doi.org/10.3390/aerospace7040044. In any case progress in this area is likely to be rapid, and retaining a figure of 300km would date over the years AR6 remains in place. This is a substantive point, becasue the larger the range of electric or hybrid aircraft, the less dependent decarboisation is on Sustainable Aviation Fuels, whcih may be bio or waste derived. the same point is made again at p.70 line 8.	More discussion incoroporated	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
63231	62	39	62	41	Comment - Is there a more recent source? The text points to availability of fuels in "recent years" but it is from 2015. this is a fast moving field	noted and agreed - but that it is still more costly than fossil kerosene is self evident, as is it's limited availability.	Government of Canada	Environment and Climate Change Canada	Canada
84051	62	39	62	44	There are also numerous other social and environmental risks and side effects from reliance on biofuels in aviation, such as competition with food production, land ownership issues, etc., siilar as in BECSS	addressed elsewhere in the report	Michał Czepkiewicz	University of Iceland	Poland
48065	62	44	62	44	The authors are invited to carefully consider and include reference to the following peer reviewed study that presents and updated comprehensive assessment of the GHG emissions reduction potential of 14 different sustainable aviation fuels pathways under six different LCA approaches, including four regulatory schemes: Capaz, R. S. et al. (2020) 'The carbon footprint of alternative jet fuels produced in Brazil: exploring different approaches', Resources, Conservation and Recycling, p. 105260. doi: 10.1016/j.resconrec.2020.105260.	Accept	Marcelo moreira	UNICAMP - Agroicone	Brazil
50985	62	44	62	44	The authors are invited to carefully consider and include reference to the following peer reviewed study that presents and updated comprehensive assessment of the GHG emissions reduction potential of 14 different sustainable aviation fuels pathways under six different LCA approaches, including four regulatory schemes: Capaz, R. S. et al. (2020) 'The carbon footprint of alternative jet fuels produced in Brazil: exploring different approaches', Resources, Conservation and Recycling, p. 105260. doi: 10.1016/j.resconrec.2020.105260.	duplicate	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
56907	63	2	63	4	"certified to the same standard as Jet A" is technically incorrect. These fuels are certified to a separate Standard D7566 which is recognized as equivalent to meeting the Jet A standard D1655. Suggest "certified to an equivalent standard as Jet A".	Accepted	Government of United States of America	U.S. Department of State	United States of America
56909	63	4	63	5	ASTM International is no longer an acronym. The "American Society for Testing and Materials" should be corrected to simply read "ASTM International" or "standards organization ASTM International".	Accepted	Government of United States of America	U.S. Department of State	United States of America
56911	63	5	63	5	As of 2/2021, ASTM International has certified "seven different fuel types" of SAF rather than "five".	Accepted	Government of United States of America	U.S. Department of State	United States of America
56913	63	5	63	6	Now seven different pathways are certified by ASTM. Two additional (CH and HHC-HEFA) were added in 2020: http://www.caafi.org/focus_areas/fuel_qualification.html#approved. Co-processing of lipids in existing refineries up to 5% of feedstock is also specified, but under D1655 (jet fuel) instead of D7566 (synthetic turbine fuels).	Accepted	Government of United States of America	U.S. Department of State	United States of America
43823	63	6	63	6	Maybe better 10 to 50% (or is it a typo and you mean 5 to 10%?).	ckecked and correct	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
75149	63	9	63	10	I could be remembering wrong, but I think that an important effect is also that one gets optically thinner contrail-cirrus and hence a lower forcing.	noted but already considered in the section cited	Marianne Tronstad Lund	CICERO Center for International Climate Research	Norway
60773	63	13	63	15	The sentence on bio based fuels „Each of these different sources can have different associated life-cycle emissions, such that they are not net zero-CO2 but have some associated emissions of CO2 or other GHGs from their production, land use and distribution" has political relevance and should be included in the SPM	rejected - opinion only	Manfred Treber	Germanwatch	Germany
56915	63	15	63	17	Recommend deletion of last part of sentence "...especially for aviation which has such high safety standards." This clause follows a reference to "inherent large uncertainties" which refers to GHG benefits. The structure of the sentence seems to imply that the end product fuel has large uncertainties that may make it unsafe which isn't the case. There are uncertainties in their GHG reduction potential, but not the safety of the fuel.	Accepted	Government of United States of America	U.S. Department of State	United States of America
75825	63	17	63	17	This sentence "especially for aviation which has such high safety standards" does not seem to fit. The paragraph is referring to higher lifecycle emissions from biofuels which has no effect over safety	Accepted	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
30549	63	18	63	19	Here is LCA default vale for SAF meaning more than 70% reduction compaered to conventoinal jet fuel(89g-CO2/MJ) https://www.icao.int/environmental-protection/CORSIA/Documents/ICAO%20document%2006%20-%20Default%20Life%20Cycle%20Emissions.pdf	noted	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
45585	63	18	63	23	Are the low numbers (2%) due to the limited penetration of SAFs or due to the limited impact of replacing 1 energy unit of jet fuel by 1 energy unit of SAF? Asking because the 2% number seems to be very low.	rephrased	Kornelis Blok	Delft University of Technology	Netherlands
75827	63	18	63	23	The idea on LCA belongs to the previous section (10.4), the idea on biofuels penetration belongs to the following section on scenarios	noted	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
51559	63	19	63	23	Knowing that the life-cycle emissions reductions range between approximately 2% and 70% (p 10-49 lines 43-44), the key indicator is not the penetration, but the CO2e abatement rate (penetration x abatement yield).	noted	eric lombard	Stay Grounded	France
47933	63	21	63	23	This single reference is proposed to "dismiss" SAF. I think this conclusion should be revised: SAF could play a large role in decarbonizing aviation and more research is surely needed but this section seesm to quickly discmiss SAF without any solid reason. See for example https://doi.org/10.1016/j.energy.2017.07.077 or some projections of increased biojet fuel from IAM: https://doi.org/10.1016/j.trd.2017.03.006	finding good references is problematic as many papers, including the first cited here just provide sweeipin unsupported statements. An IAM analysis is 'forced' by assumptions but doesn't explain how those assumptions may come about in detail other than C price. Second reference used later	Matteo Muratori	NREL	United States of America
56917	63	21	63	21	Edit "(HERFA/HVO)" to read "(HEFA/HVO)".	Accepted	Government of United States of America	U.S. Department of State	United States of America
27807	63	22	63	23	Delete "This is not therefore the transformative option that has been the IPCC agenda.". What is meant by "IPCC agenda"?	Accepted - I didn't write this and I don't know where it came from	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
56919	63	22	63	23	This sentence dismisses the usefulness of SAF based on a forecast. Recommend rewriting.	sentence removed	Government of United States of America	U.S. Department of State	United States of America
60775	63	22	63	23	„This (SAF - 'sustainable aviation fuels') is not therefore the transformative option that has been the IPCC agenda." has high political relevance and should be included in the SPM	rejected - the IPCC does not have an 'agenda'	Manfred Treber	Germanwatch	Germany
56921	63	26	63	26	Edit "SAFS" to read "SAFs".	editorial	Government of United States of America	U.S. Department of State	United States of America
45617	63	30	63	39	You might want to consider Gossling et al's (2021) study on Solar PV requirement for low carbon air transport in 2050. https://iopscience.iop.org/article/10.1088/1748-9326/abe90b	Accepted and great suggestion	Annika Bose Styczynski	O.P. Jindal Global University	India
24687	63	32	63	33	Hydrogen produced via electrolysis: both renewable and nuclear power can be used in this process (see reference already used in the chapter: Bicer, Y., and Dincer, I. (2017). Life cycle assessment of nuclear-based hydrogen and ammonia production options: A comparative evaluation. International Journal of Hydrogen Energy, 42(33), 21559–21570. https://doi.org/https://doi.org/10.1016/j.ijhydene.2017.02.002). So we recommend replacing "This process would involve the utilisation of renewable electricity, CO2 and water to synthesise jet fuel" with "This process would involve the utilisation of low-carbon electricity, CO2 and water to synthesise jet fuel"	Accepted	Ann Jessica Johnson	FORATOM (European Atomic Forum)	Belgium
5507	63	33	63	38	replace Renewables" by "low carbon sources, 3 times.	Accepted	Michel SIMON	Retraité/ Pdt d'association	France
24689	63	33	63	35	Hydrogen produced via electrolysis: both renewable and nuclear power can be used in this process (see reference already used in the chapter: Bicer, Y., and Dincer, I. (2017). Life cycle assessment of nuclear-based hydrogen and ammonia production options: A comparative evaluation. International Journal of Hydrogen Energy, 42(33), 21559–21570. https://doi.org/https://doi.org/10.1016/j.ijhydene.2017.02.002). So we recommend replacing "Hydrogen is produced via an electrochemical process, powered by renewable energy and combined with CO2 captured directly from the atmosphere and combined either by the Fischer-Tropsch or methanol synthesis." with "Hydrogen is produced via an electrochemical process, powered by low-carbon energy and combined with CO2 captured directly from the atmosphere and combined either by the Fischer-Tropsch or methanol synthesis."	Accepted	Ann Jessica Johnson	FORATOM (European Atomic Forum)	Belgium
69835	63	37	63	39	The biomass is rich in carbon but relatively poor in hydrogen by comparison with oil products. Hence there is another option in between "biofuels" and pure "electrofuels" with DAC: that of adding H2 from renewable-based water electrolysis to the biomass being process as biofuels. This would allow to increase the production of sustainable aviation fuels by factor 2, 3 or even 4 in making full use of all the carbon in a given amount of biomass. See, e.g. Hannula I. 2016, Hydrogen enhancement otential of synthetic biofues manufacture in the European context: A techno-economic assessment, Energy, vol. 104, 199-212; Albrecht et alii, 2017 A strandardized methodology for the techno-economic evaluation of alternative fuels - a case study, Fuel, 194: 511-526.	Accepted and thank you!	Cédric PHILIBERT	Institut Français des Relations Internationales	France
56923	63	38	63	39	Power-to-liquids could have a transformative carbon benefit if using renewable electricity, but these are not yet economically feasible and face economic challenges with regard to both technology (catalysts, electrolyser cost) and renewable energy cost and availability. If acknowledging the cost of bio-SAF, should also acknowledge this for e-fuels.	Accepted	Government of United States of America	U.S. Department of State	United States of America
46075	63	40			Please add sentence: "To overcome these constraints, some major production sites in Europe are under construction, e.g. in Norway and Germany." The links referring to these sites are "https://www.sunfire.de/en/news/detail/norsk-e-fuel-is-planning-europes-first-commercial-plant-for-hydrogen-based-renewable-aviation-fuel-in-norway" and "https://ineratec.de/power-to-liquid-pionieranlage-2022-in-deutschland/"	unfortunately this is not literature	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
51557	63	40	63	43	There is another issue around cost, it's the cost per ton of CO2e reduced, which is quite high (200 to 500 €) According to the International Council for Clean Transportation (ICCT) "the most cost effective fuel for carbon abatement in the near term is used cooking oil–derived HEFA at approximately €200 per tonne of CO2 equivalents (CO2e) reduced; however, waste fats and oils are already widely used by the road sector and therefore their supply may be limited. The next most effective options are the gasification of municipal solid waste and lignocellulosic feedstocks, which have a cost of approximately €400 to €500 per tonne of CO2e reduced." It would therefore be important to also mention that new generation jetfuels pathways and productions highly depend on carbon pricing policies and in particular on the price targets that some countries have set (like "valeur tutélaire du carbone" in France). The cost of supporting alternative jet fuels in the European Union, Pavlenko et al (2019), ICCT https://theicct.org/publications/cost-supporting-alternative-jet-fuels-european-union (peer-reviewed sources of the analysis may be obtained from the ICCT)	included	eric lombard	Stay Grounded	France
56925	63	42	63	42	Comment on "SAF is currently around three times the price of kerosene": In the Executive Summary it was stated that (page 4, line 18): "However, decarbonisation options for long-haul trucks, ships, and planes are still lacking". Here, that option does not exist. Also the cost of kerosene does not include the cost of mitigation.	unclear	Government of United States of America	U.S. Department of State	United States of America

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
43133	63	44	64	28	This section would benefit from mentioning the latest research in this area. The EU CleanSky foresees CO2 reductions of 75% by 2050. The study found that hydrogen – as a primary energy source for propulsion, either for fuel cells, direct burn in thermal (gas turbine) engines or as a building block for synthetic liquid fuels – could feasibly power aircraft with entry into service by 2035 for short-range aircraft. Costing less than €18 [$20] extra per person on a short-range flight, and reducing climate impact by 50 to 90%, hydrogen could play a central role in the future mix of aircraft and propulsion technologies. Source: https://cleansky.eu/publication/hydrogen-powered-aviation. Take a look at the infographic as it also includes breakthrough technologies applicable to aircrafts, Source: https://cleansky.eu/discover-the-new-clean-sky-2-infographic	Accepted	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
51611	63	44	64	28	An important argument against liquid hydrogen is missing : it is not currently envisaged for long-haul flights because aircrafts would need to be entirely redesigned (Blended wing body, for instance, promoted by Airbus). Drop-in fuels are therefore more cost effective for that segment. Hydrogen-powered aviation. A fact-based study of hydrogen technology, economics, and climate impact by 2050. May 2020. Clean Sky 2 JU and Fuel Cells and Hydrogen 2 JU (Joint Undertakings) https://www.fch.europa.eu/publications/hydrogen-powered-aviation	Accepted	eric lombard	Stay Grounded	France
75829	63	44	64	28	This section on hydrogen misses some aspects: - Reference to Airbus announcement of developing a hydrogen commercial aircraft by 2035 [22] - Plan above receiving support from the government (EUR 1.5 billion in the coming 3 years) [23] - [24] has a detailed analysis of: proposal for methodology to assess the climate impact of water vapor/hydrogen aircrafts; detailed assessment of the infrastructure requirements; hydrogen suitability by type of flight; aircraft redesign needed. It would be good to mention briefly some of those aspects in this section [22] https://www.airbus.com/innovation/zero-emission/hydrogen/zeroe.html [23] https://fuelcellsworks.com/news/france-minister-of-transport-supports-plans-for-hydrogen-plane/ [24] https://www.fch.europa.eu/sites/default/files/FCH%20Docs/20200507_Hydrogen%20Powered%20Aviation%20report_FINAL%20web%20%28ID%208706035%29.pdf	Accepted	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
85385	63	44	63	44	Proposed new language: Liquid hydrogen (LH2) as a fuel has been discussed for aeronautical applications since the 1950s (Brewer, 1991) and a few experimental aircraft have flown using such a fuel. Experimental small aircraft have also flown using hydrogen fuel cells. Although the fuel has an energy density per unit mass about 3 times greater than kerosene, it has a much lower energy density per unit volume. The increased volume, exacerbated by the need for thick layers of insulation, creates challenges for its use in aviation since it would require the wings to be thickened or else fuel to take up space in the fuselage. Bicer and Dincer (2017) found that LH2-powered aircraft compared favourably to conventional kerosene-powered aircraft on a life cycle analysis (LCA) basis, providing that the LH2 was generated from renewable energy sources (0.014 kg CO2 per tonne km cf 1.03 kg CO2 per tonne km, unspecified passenger aircraft). However, Pereria et al. (2014) also made a LCA comparison, and found much smaller benefits of LH2-powered aircraft (manufactured from renewable energy) compared with conventional fossil-kerosene, the two studies exposing the sensitivities of boundaries and assumptions in the analyses. Harsha (2014) and Rondinelli et al. (2017) conclude that there are many infrastructural barriers but that the environmental benefits of renewably-sourced LH2 would be considerable. Khandelwal et al. (2013) take a more optimistic view of the prospect of LH2-powered aircraft but envisage them within a hydrogen-oriented energy economy. Even if the CO2 impact could be made to be zero with the usage of LH2, the non-CO2 impacts remain poorly understood, since the emission index of water vapour would be much higher (estimated to be 2.6 times greater by Ström and Gierens, 2002) than for conventional paraffinic fuels, and contrail and occurrence of contrail cirrus formation may be greater incidence when compared with conventional contrail cirrus RF (Marquart et al., 2005). Potentially, NOx emissions would be lower, since combustion temperatures may be lower (Khandelwal et al., 2013). In conclusion, there are favourable arguments for LH2-powered aircraft both on an efficiency basis (Verstraete, 2013) and an overall reduction in GHG emissions, even on an LCA basis. However, LH2 is unattractive from the design and operability of the aircraft and the liquefaction process consumes energy equivalent to a significant fraction of the energy content of the fuel. A major constraint is the infrastructural issues associated with fuel manufacture, storage and distribution at airports, which are unlikely to be overcome unless there was a more general move towards a hydrogen-based energy economy. This is a conclusion applicable to the hydrogen option for most vehicles (aircraft, ships, trains and trucks). However, one option that does not have some issues associated with biofuels and hydrogen (liquid or in fuel cells) from being a potentially transformative option seems to be synthetic jet fuel or e-fuel, though in cost terms it is still in lower readiness levels.	Noted	Neil Dickson	ICAO	Canada
51525	63	47	63	47	Liquid hydrogen has a "much lower energy density per unit volume". It could be worth giving an order of magnitude (about 4 times less)	Accepted	eric lombard	Stay Grounded	France
52505	64	3	64	3	Language needs to be revised	rejected - no indication of what needs to be revised or why, or literature support	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
5509	64	4	64	6	replace Renewables" by "low carbon sources", 2 times	accepted	Michel SIMON	Retraité/ Pdt d'association	France
56927	64	12	64	17	Recommend a rewrite of this paragraph. Also, it is not clear the contrail formation would be the same since nucleating sites would be reduced also. Check to make sure that the combustion temperatures are lower.	accepted	Government of United States of America	U.S. Department of State	United States of America
51531	64	16	64	17	The combustion tepmperature of hydrogen is intrinsically higher than that of kerosene, but can be lowered by engine design modifications. Hydrogen combustion challenges face engine makers, Aviation Week & Space Technology, Sept 30, 2020	noted	eric lombard	Stay Grounded	France
23223	64	21	64	25	The consistency of the report should be checked regarding this specific statement. Note that for trucks, this is not what the executive summary says.	accepted	Government of France	Ministère de la Transition écologique et solidaire	France
60777	64	25	64	27	The sentence „However, the only option that does not have the complex problems that appear to eliminate biofuels and hydrogen (liquid or in fuel cells) from being a potentially transformative option seems to be synthetic jet fuel or e-fuel though in cost terms it is in its infancy" has high political relevance and should be included in the SPM	rejecte - not my call	Manfred Treber	Germanwatch	Germany

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
46077	64	36	64	40	The estimation of the advantages or disadvantages of CO2 compared to NOx does not only depend on the climate impact. Please discuss that NOx is an air pollutant that is harmful to health in the airport environment and beyond. REFERENCE: Health aspects of air pollution with particulate matter, ozone and nitrogen dioxide: Report on a WHO working group, Bonn, Germany 13-15 January 2003	qualified as being in terms of climate	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
75151	64	39	64	39	Additionally, Lund et al. 2017 (https://doi.org/10.5194/esd-8-547-2017) could/should be cited as this is a metrics study specific for aviation	accepted	Marianne Tronstad Lund	CICERO Center for International Climate Research	Norway
51613	64	41	64	41	GWP*, a metric alternative to GWP or GTP that overcomes the issue of the time horizon, has been put forward by Lee et al, 2020. It indicates that the net impact of aviation is 3 times that of CO2 alone. Why not mention it here ?	rejected: GWP* is a usage of GWP and the sense here is to give examples of equivalency metrics not their magnitude	eric lombard	Stay Grounded	France
56929	64	41	64	46	There is also another option of converting the RF changes to temperature changes and monetizing them. The time horizons could then be handled using a discount rate. Uncertainties are easier to capture in this context. Recommend this paragraph contain some information on this approach as outlined in Grobler et al. (2019).	rejected - the statement is true but this does not obviate the use of the equivalency metrics to get there, it is simply a step further down the chain of impacts and the uncertainties are actually larger. Moreover the Grobler results combine AQ and cliamte costs for a net but do not necessarily contradict the Freeman study.This section is dealing strictly with the climate CO2/NOx tradeoffs in terms of atmospheric effect/impact	Government of United States of America	U.S. Department of State	United States of America
73071	64				Add a new section 10.5.3.4 (to follow the alternative fuels section), something like as follows and renumber subsequent sections. 10.5.3.4 Put a declining cap on the jet fuel supply, nationally or regionally. A direct and straightforward way to reduce aviation's GHG emissions that could be considered in climate emergency inspired policymaking the national or multi-nation level is to place an annually declining limit on the supply of kerosene aviation fuel. Fuel allotments to airports or airlines could be managed by ICAO or some other governmental or non-governmental body. Although matters concerning aircraft fuel for international flights are presently controlled through article 24 of the 1944 Chicago Convention on International Civil Aviation, the UNFCCC could supplant those controls with new ones, because UNFCCC adopts its policies through international accord. (Stay Grounded's Talanoa Dialogue, 18 Oct 2018, at Sec 3A). Such a measure would be most effective if implemented in any or all of the continents of North America, Europe or East Asia, in that order. {Figure 10.1(b)}	rejected. - no litereature cited	Larry Edwards	Larry Edwards Environmental Consulting	United States of America
56931	65	1	65	13	Recommend including latest knowledge on contrail avoidance and feasibility with no fuel burn impacts (Teoh et al., 2020 and Avila et al., 2019).	partially accepted the Teoh reference is included. They found reduced fuel consumption for an exceptional minority of cases of sub-optimal flights in their Japanse case study. The Avila et al findings are questionable as increasing the cruise altitudes by 2000 to 4000' decreasing fuel consumption flies in the face of many other studies and the basic way aircraft are operated. The point here is that outcome is uncertain and met models cannot predict ISS with sufficient accuracy in time and space.	Government of United States of America	U.S. Department of State	United States of America
56933	65	7	65	8	Is research needed in U.S. on potential benefits from flight patterns on net climate impacts?	yes, probably, but rejected as an edit as the mandate does not require us to fomulate research questions	Government of United States of America	U.S. Department of State	United States of America
51553	65	9	65	10	The simulations made for transatlantic flights and long haul flights overflying Japan show that huge benefits can be cropped at a minimal cost in terms of incremental CO2 emissions. Even if there could be a minor penalty on the longer term, the large short term benefits should be considered as they are needed to delay reaching critical threshold. - Roger Teoh, Ulrich Schumann, Arnab Majumdar, Marc E. J. Stettler, Mitigating the Climate Forcing of Aircraft Contrails by Small-Scale Diversions and Technology Adoption, https://pubs.acs.org/doi/abs/10.1021/acs.est.9b05608 - Greener by design 2018-2019, Atmospheric science (Royal Aeronautical society), https://www.aerosociety.com/media/12007/greener-by-design-report-2018-2019.pdf	rejected: this ignores completely our inability to predict contrails with sufficient accuracy in time and space and also depends on very uncertaint assumptions on absolute contrail cirrus forcing, and the added uncertainty of trading short term benefots for long-term disbenefits.	eric lombard	Stay Grounded	France
51529	65	10	65	13	According to Arrowsmith et al., 2020, contrail avoidance coud take 5-8 years to mature, not 10 years.	revised to of the order up to a decade Such a specific range of 5-8 years is judged to be spurious accuracy	eric lombard	Stay Grounded	France
60779	65	11	65	13	The sentence „current meteorological models cannot currently predict the formation of persistent contrails with sufficient accuracy in time and space (Gierens et al., 2020) such that this mitigation option is speculated to take of the order a decade to mature" has political relevance and should be included in the SPM	rejected	Manfred Treber	Germanwatch	Germany
51509	65	12	65	12	"Gierens et al., 2020" not listed in the references at the end of the chapter	accepted	eric lombard	Stay Grounded	France
85387	65	15	65	15	Market-based measures have been introduced in various regions of the world, based on emissions trading of CO2, notably in Europe but also for domestic aviation in New Zealand. The European Union (EU) introduced aviation into its CO2 emissions trading scheme (ETS) in 2012. This initially included flights between the European Economic Area (EEA) states and non-EEA states. However, the extension of the scheme to non-EEA states was highly controversial and in 2014 the EU deferred the inclusion of these flights under the so-called 'stop-the-clock' derogation. Currently, the EU-ETS for aviation includes all flights within the EU as well as to and from EEA states. At around the same time, Member States under the International Civil Aviation Organisation (ICAO) proposed to develop a global offsetting scheme, which was agreed in 2016 to commence in 2020, the 'Carbon Offset and Reduction Scheme for International Aviation' (CORSIA). CORSIA has a phased implementation, with an initial pilot phase (2021–2023) and a first phase (2024–2026) in which states will participate voluntarily. The second phase will then start (2026–2035) in which all states will participate unless exempted. States may be exempted if they have lower aviation activity levels or based on their UN development status. As of 16 July 2019 June 2020, 88 ICAO Member States 81 States, representing ~77% of international aviation activity, intend to voluntarily participate in CORSIA from its outset. In terms of routes, only those where both States are participating are included. There is currently no "third phase" described and the fate of the CORSIA beyond 2035 is unclear. By its nature CORSIA does not lead to a reduction in the emissions by aviation as it deals mostly in approved offsets, so at best it is a transition arrangement to allow aviation to reduce its impact in a more meaningful way. Moreover, before the end of CORSIA in 2035, it is possible that offsets may be in short supply because all countries should be striving to reduce their emissions as part of their NDCs and may restrict their sale. The use of CORSIA credits to fund demonstration projects in synthetic fuels would appear to be a way ahead in terms of creating a suitable drop-in jet fuel.	Largely accepted	Neil Dickson	ICAO	Canada
56935	65	23	65	23	Recommend changing "... agreed to commence in 2020 ..." to "... agreed to commence in 2019 ...". The CORSIA Standards and Recommended Practices required operators to submit Emissions Monitoring Plans to State Authorities in 2019 and to begin monitoring their 2019 emissions for the 2019-2020 CORSIA Baseline Period.	reject: completely correct but unnecessary detail with space at a premium	Government of United States of America	U.S. Department of State	United States of America

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
63233	65	23	65	24	agreed in 2016 to commence in 2020, the 'Carbon Offsetting and Reduction Scheme for International Aviation' (CORSIA).	accepted	Government of Canada	Environment and Climate Change Canada	Canada
51533	65	25	65	37	To be added : Corsia suffers from severe limitations : it excludes all domestic flights and it deals only with the growth of CO2 emissions above the level reached in 2019, a level that will not be reached again before several years due to the Covid-19 pandemic. As a result, it will concern only 12% of worldwide CO2 emissions of aviation in 2030. Janina Scheelhaase, Sven Maertens, Wolfgang Grimme et Martin Jung, « EU ETS versus CORSIA–A critical assessment of two approaches to limit airtransport's CO2 emissions by market-based measures », Journal of Air Transport Managemen, vol. 67, 2018, p. 55-62 (DOI 10.1016/j.jairtraman.2017.11.007). Moreover, Corsia doesn't adress non-CO2 emissions that currently represent 2/3 of the Effective Radiative forcing (ERF) of aviation.	rejected: much of this is self evident already from the description of the scheme. The article, while interesting deals with issues that connot be implemented by ICAO (domestic aviation) and is so a tangential point here	eric lombard	Stay Grounded	France
51535	65	25	65	37	To be added : the very low price of Corsia credits (currently less than 10 $/ton CO2) undermines measures aimed at reducing aviation emissions, like SAFs or even operational improvements.	rejected - opinion only	eric lombard	Stay Grounded	France
77635	65	25	65	37	It should be noted explicitly that CORSIA's "targets" are to fully offset the growth of aviation sector GHG emissions from 2019 baseline emissions. This was revised due to the impacts of COVID-19 on the aviation sector.	accepted	Alex Rau	Climate Wedge LLC	United States of America
56937	65	28	65	28	Recommend updating "As of 16 July 2019, 81 States ..." to "As of 1 January 2020, 88 States ...". See latest figure in the January ICAO CORSIA Newsletter, here: https://www.icao.int/environmental-protection/CORSIA/Pages/corsia-newsletter-jan21.aspx	accepted and updated further	Government of United States of America	U.S. Department of State	United States of America
63235	65	28	65	29	88 States (not 81), representing ~77% of international aviation activity, intend to voluntarily participate in CORSIA from its outset. These states confirmed their participation ahead of the deadline of June 30, 2020.	accepted and updated further	Government of Canada	Environment and Climate Change Canada	Canada
30551	65	30	65	31	The last sentence "There is currently no "third phase" described and the fate of the CORSIA beyond 2035 is unclear." should be replaced with "There will be a special review of CORSIA by end of 2032 to determine the termination of the scheme, its extension, or any other improvements of the scheme beyond 2035." to reflect ICAO Assembly Resolution A40-19, paragraph 17 c).	accepted	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
30553	65	32	65	34	"By its nature CORSIA does not lead to a reduction in the emissions by aviation as it deals mostly in approved offsets, so at best it is a transition arrangement to allow aviation to reduce its impact in a more meaningful way." SAF is calculated to be less lifeccle GHG value, so CORSIA eligible SAF leads to emission reduction. This description should be revised.	accepted	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
46079	65	32	65	32	Please replace "By its nature CORSIA does not lead to a reduction" by "At current price levels of approved offsets, CORSIA does not lead to a significant reduction"".	rejected - this misunderstands the point being made	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
48067	65	32	65	37	Recent literature converges to the conclusion that CORSIA's focus as an offset scheme may discourage or postpone investments in alternative fuels in the short-term since offsets are much cheaper than alternative drop-in fuels. This important conclusion should be included in the paragraph. Moreover, there is no reason to singularize reference to synthetic fuels in line 36: the use of an additional fund can greatly benefit the development of projects of sustainable aviation fuels as a whole, without any pre-selection on the technology and conversion process. Alternative wording is proposed as follows: "According to the current guidelines of CORSIA (ICAO, 2020), the carbon offset is equally accounted for as the carbon reduced for demonstrating the decarbonization targets achievement. It can discourage or postpone the use of alternative fuels in the short-term since the carbon offset (USD/tCO2e) is much cheaper than carbon reduced through drop-in biofuels (Pavlenko, Searle and Christensen, 2019; Capaz et al., 2021). Although the carbon offset is seen as a transition arrangement to allow aviation to reduce its impact in a more meaningful way, before the end of CORSIA in 2035, it is possible that offsets may be in short supply because all countries should be striving to reduce their emissions as part of their NDCs and may restrict their sale. Therefore, the use of CORSIA credits to fund demonstration projects in sustainable aviation fuels would appear to be a way ahead in terms of creating a suitable drop-in jet fuel." Complete reference to the authors and documentation is presented below: Capaz, R. S. et al. (2020) 'The carbon footprint of alternative jet fuels produced in Brazil: exploring different approaches', Resources, Conservation and Recycling, p. 105260. doi: 10.1016/j.resconrec.2020.105260. Capaz, R. S. et al. (2021) 'Mitigating carbon emissions through sustainable aviation fuels: costs and potential', Biofuels, Bioproducts and Biorefining, 15(2), pp. 502–524. doi: 10.1002/bbb.2168. ICAO (2020) Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), International Civil Aviation Organization. Available at: https://www.icao.int/environmental-protection/Pages/market-based-measures.aspx (Accessed: 28 April 2020).	Partially accepted. This is a good point but the Capaz et al. 2021 literature does not make the "postpone" or "discourage" points. The other reference is an NGO grey litereature citation, which we judge is not of higfh enough quality to use. The point is made on the differential costs without the value judgement.	Marcelo moreira	UNICAMP - Agroicone	Brazil

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
50987	65	32	65	37	Recent literature converges to the conclusion that CORSIA's focus as an offset scheme may discourage or postpone investments in alternative fuels in the short-term since offsets are much cheaper than alternative drop-in fuels. This important conclusion should be included in the paragraph. Moreover, there is no reason to singularize reference to synthetic fuels in line 36: the use of an additional fund can greatly benefit the development of projects of sustainable aviation fuels as a whole, without any pre-selection on the technology and conversion process. Alternative wording is proposed as follows: "According to the current guidelines of CORSIA (ICAO, 2020), the carbon offset is equally accounted for as the carbon reduced for demonstrating the decarbonization targets achievement. It can discourage or postpone the use of alternative fuels in the short-term since the carbon offset (USD/tCO2e) is much cheaper than carbon reduced through drop-in biofuels (Pavlenko, Searle and Christensen, 2019; Capaz et al., 2021). Although the carbon offset is seen as a transition arrangement to allow aviation to reduce its impact in a more meaningful way, before the end of CORSIA in 2035, it is possible that offsets may be in short supply because all countries should be striving to reduce their emissions as part of their NDCs and may restrict their sale. Therefore, the use of CORSIA credits to fund demonstration projects in sustainable aviation fuels would appear to be a way ahead in terms of creating a suitable drop-in jet fuel." Complete reference to the authors and documentation is presented below: Capaz, R. S. et al. (2020) 'The carbon footprint of alternative jet fuels produced in Brazil: exploring different approaches', Resources, Conservation and Recycling, p. 105260. doi: 10.1016/j.resconrec.2020.105260. Capaz, R. S. et al. (2021) 'Mitigating carbon emissions through sustainable aviation fuels: costs and potential', Biofuels, Bioproducts and Biorefining, 15(2), pp. 502–524. doi: 10.1002/bbb.2168. ICAO (2020) Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), International Civil Aviation Organization. Available at: https://www.icao.int/environmental-protection/Pages/market-based-measures.aspx (Accessed: 28 April 2020).	Partially accepted. This is a good point but the Capaz et al. 2021 literature does not make the "postpone" or "discourage" points. The other reference is an NGO grey litereature citation, which we judge is not of higfh enough quality to use. The point is made on the differential costs without the value judgement.	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
56939	65	32	65	37	Given the Technical Summary indicates CORSIA is not sufficient to meet Paris Agreement targets, at least a sentence or two here would help set that context. While the limitations of offsets are mentioned here, how it affects the Paris Agreement targets is not.	Later versions clarified this.	Government of United States of America	U.S. Department of State	United States of America
84053	65	32	66	15	There seems to be missing a whole section (10.5.3.7?) on demand-side options of "avoid" type. Since CORSIA does not and will not lead to reduction in the emissions in aviation, and most of the new fuels are in their infancy, have high uncertainties, barierrs to implementation, and other challenges, more space should be given for discussing demand-side options of "avoid" type. These could include introduction of taxes in aviation, such as excise on kerosene, VAT on international flights, higher ticket taxes, frequent flyer levy, or expansion of appropriately high carbon tax (see Larsson et al. 2019 for discussion of some options). The pricing issues should be discussed in the context of the luxury status of aviation, very highly unequal access to aviation services (Ivanova & Wood 2020, Oswald et al. 2020, Gössling & Humpe 2020), and the unnecessary character of many trips (Gössling et al. 2019) with an implication that an increase inprices will likely be progressive (i.e. will impact the wealthier more strongly) and will not limit the satisfaction of basic human needs of people. Some supply-side options that impact demand could also be discussed in such a section such as limiting the provision of new aviation infrastructure (e.g. airport moratoria). Larsson, J., Elofsson, A., Sterner, T., Åkerman, J. (2019). International and national climate policies for aviation: a review. Climate Policy, 19(6), 787–799. https://doi.org/10.1080/14693062.2018.1562871 Ivanova, D., & Wood, R. (2020). The unequal distribution of household carbon footprints in Europe and its link to sustainability. Global Sustainability, 3. https://doi.org/10.1017/sus.2020.12 Oswald, Y., Owen, A., & Steinberger, J. K. (2020). Large inequality in international and intranational energy footprints between income groups and across consumption categories. Nature Energy, 5(3), 231–239. https://doi.org/10.1038/s41560-020-0579-8 Gössling, S., & Humpe, A. (2020). The global scale, distribution and growth of aviation: Implications for climate change. Global Environmental Change, 65(November). https://doi.org/10.1016/j.gloenvcha.2020.102194 Gössling, S., Hanna, P., Higham, J., Cohen, S., & Hopkins, D. (2019). Can we fly less? Evaluating the 'necessity' of air travel. Journal of Air Transport Management, 81(August). https://doi.org/10.1016/j.jairtraman.2019.101722	demand management is not considered	Michał Czepkiewicz	University of Iceland	Poland
69837	65	33	65	34	Corsia could evolve to promote only compensation by CDR (negative emissions). It's been argued that, for example, DAC would be required for either making e-kerosene or for CDR with DACCS, but that the energy and capital requirement of DACCS would be much less than the production of e-kerosene with carbon from DAC. See. e.g. Deben, 2019, Net-zero and the approach to international aviaition and shipping emissions, letter from the Chairman of the UK Committee on Climate Change to Rt Hon Grant Shapps, 24 September.	rejecte - speculation with no supporting litereature	Cédric PHILIBERT	Institut Français des Relations Internationales	France
56941	65	34	65	36	Recommend deleting this claim unless a citation is provided. Claiming "... it is possible that offsets may be in short supply ..." comes across as speculation since it is also possible that offsets will be abundant in supply. Further, given impacts of COVID-19 (lowering the emissions baseline), one would expect lower demand for offsets than originally anticipated when CORSIA was agreed.	accepted	Government of United States of America	U.S. Department of State	United States of America
86683	65	34	65	36	Before the end of CORSIA in 2035 it is possible that offsets may be in short supply. This would be a really important sentence to test. I personally agree, and that CERTIFIED offsets may be in short supply IF CERTIFICATION is meanigful. But there is a whole market to be described and delivered. Forgive me if it is elsewhere in the report, but the long term offset market would important to describe, assess value, describe international regulation, assess risks of carbon leakage, double counting etc. If this IS already done elsewhere, a cross reference would be helpful.	text is being deleted	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
56943	65	36	65	37	Recommend deleting this sentence; it is not accurate. "CORSIA credits" ("eligible emissions units" in the CORSIA SARPs) do not directly fund "demonstration projects in synthetic fuels" (nor "CORSIA eligible fuels" in the CORSIA SARPs). An operator subject to CORSIA may purchase eligible emissions units AND/OR CORSIA eligible fuels to meet their compliance obligations; however, they are separate compliance mechanisms and the former does not fund the latter.	accepted	Government of United States of America	U.S. Department of State	United States of America
63237	65	36	65	37	CORSIA does not support the use of credits to fund demonstration projects in synthetic fuels so this text needs to be deleted. In CORSIA, aeroplane operators are able to reduce their offsetting requirements though the use of Sustainable Aviation Fuels.	Later versions clarified this.	Government of Canada	Environment and Climate Change Canada	Canada

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
47937	65	38	65	38	I would not dismiss the opportunity to replace short flights (like connections) since most energy use and emissions are associated with take off and landing. Replacing short flights with automated on-road vehicles or rail might prove effective at reducing emisisons	rejected - we do not dismiss this	Matteo Muratori	NREL	United States of America
51537	65	38	65	38	To be added : Improving and expanding the network of long distance intercity train and bus routes, including larger number of and more comfortable night trains and buses. Overnight trains are suitable for distances from 500 to 1500 km and several large countries have overnight trains running during two nights or more (35 hours or more), which allow to cross distances from 3000 km to 6000 km, or even more. Overnight train is associated with “best in class” external costs (accidents, atmospheric pollution, climate change, soil degradation and artificialization, biodiversity destruction ...) and it is not dependent on kerosene. They also may be faster and cheaper to settle, since no large infrastructure projects are needed. As a matter of fact night trains were disregarded and have suffered from a lack of investment for the last decades. However, there are very few other comfortable low-carbon means of transport for distances over 1000km. Therefore, a major modal shift to overnight transport could happen [https://www.europeanceo.com/lifestyle/night-trains-to-return-as-european-train-operators-change-track/]. Moreover, carbon taxation on aviation could set a level playing field for more overnight train services to revive. There is significant scope for increasing the share of overnight train traffic leveraging on existing railway network and upgrading the interconnecting systems across countries, e.g. in Europe [https://blogs.mediapart.fr/ouiautraindenuit/blog/170820/10-millions-de-voyageurs-choisiront-le-train-de-nuit-plutot-que-lavion-ou-la-route]. Several countries like Austria, Sweden or France have already showed interest in developing night train connections as an action for climate defense [https://www.railtech.com/infrastructure/2020/12/08/new-night-trains-will-connect-13-european-metropolises-until-2024]. The potential is not limited in western countries, and this action could mobilize also countries like Russia, India, Algeria, Kazakhstan, etc. During last decades the elimination of overnight trains in western Europe pushed tourist to chose farther destinations using low-cost air flights. On the contrary, developing a network of overnight trains could encourage tourists to opt for closer destinations thus made accessible by train instead of flying to farther destinations.[https://www.bbc.com/worklife/article/20201006-are-europes-night-trains-back-in-fashion]	rejected - this is too detailed with our space constraints	eric lombard	Stay Grounded	France
63239	65	38	66	15	Comment - Is there more recent sources comparing high speed rail and the impact on short haul aviation routes? For example, here is a paper from 2019 which shows how air travel fell after high speed rail was introduced - https://www.sciencedirect.com/science/article/pii/S0967070X18303226 Also, this text " type of modal substitution has the potential for generating a counter effect if the air traffic departure and arrival slots which become available as the result of the modal shift" needs to be factchecked with more recent studies as opposed to the ones that are currently used, which are from 1993 and 1999. The aviation industry has changed a lot since then with many more "point to point" flights as opposed to the "hub and spoke" model.	considered	Government of Canada	Environment and Climate Change Canada	Canada
78905	65	38	65	38	this section only considers the potential for moving passengers from aircraft to high speed rail. Could also mention the opportunity for shifting freight from China-Europe aircargo services to trans-Asian railfreight services, which are currently expanding quite rapidly, though admittedly from a low base.	rejected - this is too detailed with our space constraints	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
79767	65	38	66	15	There must be more literature on ex-post analyses of HSR impact on air travel and emissions, in particular from China	checked. Thanks	Stefan Bakker	KiM Netherlands Institute for Transport Policy Assessment	Netherlands
60781	65	41	65	43	„HSR services are competitive with short-haul air travel only for ranges no more than between 400 and 800 km“. 800 km is too short. For some regions (e.g. in China) this distance can be extended to 1200 km, see e.g. Beijing – Shanghai in 4h travel time.	rejected - this is what the reference says	Manfred Treber	Germanwatch	Germany
60783	65	41	65	43	See World Bank (in Railway Gazette International, Murray Hughes, 19 June 2020)	Later versions clarified this.	Manfred Treber	Germanwatch	Germany
73073	65				Add a new section 10.5.3.6 (to follow the “Market-based measures” section), something like as follows and renumber subsequent sections. 10.5.3.6 Limit or ban inducements to travel by air. Airlines and associated travel-related businesses have developed a marketing device that is a compelling inducement to travel often and far. Through these inducements, operating upon a significant segment of the societies of many nations, the amount of travel business, and particularly air travel, grows. This marketing device is frequent flyer programs (FFPs). While FFPs in one sense tend to create brand loyalty to an airline, more broadly they “reward unsustainable behavior with considerable access to privilege (e.g. lounges, extra luggage) and opportunities to fly more when converting points” to tickets.” (Bicken 2020). FFPs induce private, emission-causing travel by subsidizing it, through points acquired through credit card purchases or employer-purchased tickets, both of which increase society’s costs for goods.	Considered. Thanks	Larry Edwards	Larry Edwards Environmental Consulting	United States of America
73075	65				(Continuing)… An invited report to the UK’s CCC recommended, “Introduce regulation to ban frequent flyer reward schemes that stimulate demand.” (Carmichael 2019). In the past domestic FFPs were banned in Norway and Denmark, setting a precedent. (Refereces: [1] Storm 1999, ref’d above; [2] Carmichael 2019, “Behaviour change, public engagement and Net Zero”, Rept. to UK CCC, Oct. 2019, https://www.theccc.org.uk/wp-content/uploads/2019/10/Behaviour-change-public-engagement-and-Net-Zero-Imperial-College-London.pdf.)	Considered. Thanks	Larry Edwards	Larry Edwards Environmental Consulting	United States of America
20119	66	7	66	11	This message does not seem to be valid : "the substitution of HSR for short-haul air travel may not translate into a reduction in aviation CO2 emissions but may increase them, in absolute terms". It is backed by very old publications that postulates that airport capacity will always be used, even if some passenger chose the train, for other air services. This does not seem to be backed by recent analysis of market observation (and the context for modal choice of people is certainly different from the one during the 1990s). On the contrary, recent examples in real world tend to show that when people choose the train, there is less aviation activity : https://www.theguardian.com/world/2019/jun/04/stayontheground-swedes-turn-to-trains-amid-climate-flight-shame So the message should be something like : "in some recent circumstances, modal shift to train from plane has proved to be an effective way to reduce climate impact. This was the case in countries like Sweden where the Flygskam movement has emerged".	Later versions clarified this.	Noé Lecocq	Inter-Environnement Wallonie	Belgium
47935	66	7	66	15	I have a hard time following this reasoning and the refs are really old	Later versions clarified this.	Matteo Muratori	NREL	United States of America

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
70341	66	7	66	11	These lines on carbon leakage are technically correct but are not exclusive to rail. It is possible for any demand reduction or efficiency saving which allows someone to use a resource. This is why Parties to the Paris Agreement are supposed to move towards absolute economy-wide mitigation, and why it is necessary to bring aviation into international climate governance.	Later versions clarified this.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
81953	66	7	66	11	This framing can lead to misinterpretation: "Therefore, the substitution of HSR for short-haul air travel may not translate into a reduction in aviation CO2 emissions but may increase them, in absolute terms." Obviously, shift measures need policy frameworks to be effective. in recent years, there have been new experiences with shift policies; not sure, if literature from 1993 1999 is still adequate here?	Later versions clarified this.	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
84055	66	7	66	15	Discuss the potential of reducing prices of trains and increasing prices of flights on modal shifts. Discuss the potential measures to avoid rebounds, e.g. by curtailment of aviation infrastructure or service (e.g. caps) so the arrival and departure slots cannot be taken by other kinds of flights.	rejected. - no supporting literature	Michał Czepkiewicz	University of Iceland	Poland
17137	66	10	66	11	The substitution of HSR for short-haul air travel would not result in increased emissions if slot assigment was limited/ regulated to make sure that slots are not reassigned to longer-haul flights.	rejected. - no supporting literature	Giulio Mattioli	TU Dortmund University	Germany
46081	66	10	66	11	We kindly urge the authors to consider and discuss the non-CO2-effects. Limiting the comparison of rail and air transport only to CO2 is strongly misleading since the climate impact of airplanes is much (2-5 times) higher than the bare CO2 emissions. Please clarify. MAJOR REFERENCE: Lee et al, 2021, https://www.sciencedirect.com/science/article/pii/S1352231020305689	rejected for this point in the text- brevity is needed and the sections above makes clear that there are non-CO2 effects from aviation on climate	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
5511	66	15	66	15	after Renewable, add : or low carbon sources	Accepted this text has now gone but there is still a citation to 'renewable', since this is terminology that the specific literature uses at this point	Michel SIMON	Retraité/ Pdt d'association	France
17139	66	16	66	16	Section 10.5.4: a new relevant study presenting projections for aviation is Gössling, S., Humpe, A., Fichert, F., & Creutzig, F. (2021). COVID-19 and pathways to low-carbon air transport until 2050. Environmental Research Letters.	Noted but these are not comparable scenarios but sensitivity studies	Giulio Mattioli	TU Dortmund University	Germany
78761	66	16	68	31	research by Ram et al. (http://energywatchgroup.org/wp-content/uploads/EWG_LUT_100RE_All_Sectors_Global_Report_2019.pdf ; also part of the AR6 scenario database) and a recent report by the German Energy Agency (https://www.powerfuels.org/fileadmin/powerfuels.org/Dokumente/Global_Alliance_Powerfuels_Study_Powerfuels_in_a_Renewable_Energy_World.pdf) have clearly shown that synthetic fuels for a fast growing aviation sector can be provided on a fully renewable and non-bioenergy basis at affordable cost for Fischer-Tropsch based jet fuel and hydrogen. Such reserach insights may be of relevance for this section.	noted	Christian Breyer	LUT University	Finland
85389	66	34	66	34	Proposed language: The IEA (IEA, 2020) has more recently presented aviation scenarios to 2070 in their 'Sustainable Development Scenario' that assume some limited reduced post-COVID-19 pandemic demand, and potential technology improvements in addition to direct reductions in fossil kerosene usage from substitution of biofuels and synthetic fuels (see also Tetter and Tattini, 2020). There is much uncertainty in how will aviation recover from the COVID pandemic but, in this scenario, air travel returns to 2019 levels in three years, and then continues to expand, driven by income. Government policies are envisaged that dampen demand (12% lower by 2040 than the IEA 'Stated Policies Scenario' which envisages growth at 3.4% yr 40 -1 which in turn is lower than ICAO at 4.3%). Mitigation takes place largely by fuel substitution – lower-carbon biofuels and synthetic fuels, with a smaller contribution from technology. Approximately 85% of the actual cumulative CO2 emissions (to 2070) are attributed to use of fuel at their lowest Technology Readiness Level of 'Prototype' which is largely made up of biofuels and synthetic fuels (Figure 10.17). Details of the technological scenarios and the fuel availability/uptake assumptions are given in IEA (2020), which also makes clear that the relevant policies are not in place to make any such scenario happen.	Accepted	Neil Dickson	ICAO	Canada
81565	66	37	66	37	Correct spelling is Jacob Teter (instead of "Tetter").	Accepted	Marine Gorner	International Energy Agency (former)	France
51541	67	1	67	5	Figure 10.16 is misleading, because it only covers emissions of international flights. Should not be used ! Need to find an equivalent graph for total emissions.	Later versions clarified this.	eric lombard	Stay Grounded	France
51543	67	6	67	6	In Figure 10.17, need to explain what STEPS means. Would be best with an additional vertical scale in Mt CO2.	Reject, STEPS is clearly described in the figure legend	eric lombard	Stay Grounded	France
86685	68	4	68	4	The IEA work is important in being international, but is not the only future view of aviation emissions. It is worth exploring others, even though regional or national in context, to explore different technical, tax, and capacity constraint combinations. In particular, industry perspectives are more agressive about passenger growth and technological solutions, where government advisers (eg UK CCC) are more willing to consider demand constraint (with UK CCC recommending no new net airport capacity unless and until technological solutions re delivered). See: •UK Aviation Industry perspective (Sustainable Aviation Group Roadmaps on Carbon, www.sustainableaviation.co.uk/wp-content/uploads/2020/02/SustainableAviation_CarbonReport_20200203.pdf and on Sustainable Aviation Fuel www.sustainableaviation.co.uk/wp-content/uploads/2020/02/SustainableAviation_FuelReport_20200231.pdf •From an EU industry perspective (Destination 2050 – A route to net zero European aviation, www.destination2050.eu/ which foresees a greater impact from hydrogen •the UK CCC sixth carbon Budget www.theccc.org.uk/wp-content/uploads/2020/12/Sector-summary-Aviation.pdf	rejected. Global estimates are needed	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
76161	68	5	68	16	This is useful and links nicely to other chapters and WGI.	noted	Jan Fuglestvedt	CICERO	Norway
75153	68	19	68	20	Figure 10.18: would be useful to overlay the historical data until 2018 from Lee et al. here.	noted	Marianne Tronstad Lund	CICERO Center for International Climate Research	Norway
84057	68	22	68	31	Please discuss how Covid-19 could be used as an opportunity to transform the aviation industry in the direction of reduced demand, e.g. through introduction of taxes and reducing short-haul connections as part of the government bailouts.	no literature that is beyond informal	Michał Czepkiewicz	University of Iceland	Poland
85391	68	22	68	22	Comment: Please make reference to the ICAO work on impact g of COVID19 on the aviation sector. https://www.icao.int/sustainability/Pages/Economic-Impacts-of-COVID-19.aspx	noted but this is economic impacts, not emissions or traffic	Neil Dickson	ICAO	Canada
17141	69	1	69	31	ICAO's CORSIA has been widely criticised as ineffective in reducing GHG emissions from aviation. See e.g. Gössling, S. (2020). Risks, resilience, and pathways to sustainable aviation: A COVID-19 perspective. Journal of Air Transport Management, 89, 101933. Lyle, C. (2018). Beyond the ICAO's CORSIA: Towards a more climatically effective strategy for mitigation of civil-aviation emissions. Climate Law, 8(1-2), 104-127. Also relevant for Box 10.5	noted but these references only provide weak criticism (the first reviews others') of the basis for CORSIA and doesn't add anything substantive to the text already there.	Giulio Mattioli	TU Dortmund University	Germany

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
51545	69	1	69	14	The Paris agreement requires all parties to address all emissions! That's explicit in the agreement – parties are to establish 'economy-wide' emission reduction targets. https://www.transportenvironment.org/newsroom/blog/planes-and-ships-cant-escape-paris-climate-commitments	rejected - through their NDCs, that's why interantional international aviation is ambiguous	eric lombard	Stay Grounded	France
56945	69	1	70	39	Unclear if the BAU scenario keeps international aviation emissions level due to CORSIA while it is taken into account through 2035, or if there is a nuance in the assumptions about international aviation (e.g., reduction in CO2 due to offsets/SAF but no reduction in contrails).	noted	Government of United States of America	U.S. Department of State	United States of America
85393	69	2	69	2	The first proposal is to avoid a misleading concept and to underscore that ICAO is represented by 193 Member States. The second comment is bcause the statement is incorrect. The third edit reflects the CO2 standard properly. Under Article 2.2 of the Kyoto Protocol, Annex I countries were called to "…pursue limitation or reduction of emissions of GHGs not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organisation and the International Maritime Organisation, respectively." The Paris Agreement is different, in that ICAO (and the IMO) are not named, so that international aviation emissions of CO2 do not appear to be covered, in that the Paris Agreement deals with states, and their Nationally Determined Contributions (NDCs). This would imply that domestic aviation emissions of CO2 (currently 35% of the global total) are covered by NDCs but international emissions are not. A number of states and regions have declared their intentions to include international aviation in their net-zero commitments including the UK, France, Sweden, and Norway, with the intentions of the European Union, New Zealand, California and Denmark being as yet unclear but under consideration (Committee on Climate Change, 2019). Clearly, this is a less than ideal situation for clarity of governance of international GHG emissions from both aviation and shipping. The ICAO CORSIA is a part of ICAO's aspirational 'carbon-neutral growth goal, 2020', such that through CORSIA and technological and operational improvements, 193 ICAO Member States aim ICAO aims that international aviation emissions of CO2 should not grow above 2020 levels. The ICAO projections for their overall goal is to be achieved largely by offsetting. In addition, ICAO has a goal of global annual average fuel efficiency improvements of 2 percent until 2020 and an aspirational global fuel efficiency improvement rate of 2 percent per annum from 2021 to 2050, which as noted above is substantially greater than currently being achieved or envisaged (Cumpsty et al., 2018). ICAO has also adopted in 2017, a whole aircraft emissions standard for CO2. To ensure the latest fuel efficient technologies are implemented in the next generation of aircraft, ICAO has also adopted a new aeroplane CO2 emission standard in 2017.	Reject: edit 1 - the PA is a temperature based target, there is nothing misleading about this, and anternational aviation's coverage is therefore ambiguous edit 2 does not correct an incorrect statement! edit 3 adds no substantive information "193 states" added	Neil Dickson	ICAO	Canada
86687	69	10	69	10	The UK has NOT yet included aviation in its NDC or net zero commitments. It has indicated (in its response to CCC progress Report to Parliament in October 2020) it is 'minded to' subject to progress at ICAO in 2022. But the UK is under pressure to include in in legislation in 6th Carbon Budget due in June, but	rejected - overtaken by events	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
30555	69	15	69	18	The words "ICAO aims" should be "ICAO and its 193 Member States aim" to clarify that ICAO is represented by 193 governments, similar to Parties to the UNFCCC.	accepted	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
51547	69	15	69	17	Corsia baseline was changed further to the Covid-19 pandemic. Replace 2020 by 2019 in "ICAO aims that international aviation emissions of CO2 should not grow above 2020 levels."	accepted	eric lombard	Stay Grounded	France
56947	69	17	69	17	Note that CORSIA was intended to not allow growth above 2020 levels, as indicated. However, in summer of 2020, ICAO adopted a 2019 baseline (rather than the originally planned average of 2019/2020 as a baseline) due to the COVID crisis and economic difficulties in the aviation sector. The anticipated slow recovery of aviation means the sector may not have to actively offset emissions for at least a couple of years of the pilot phase of CORSIA.	accepted	Government of United States of America	U.S. Department of State	United States of America
46083	69	18	69	18	Please replace "offsetting" by "offsetting on routes between States covered by CORSIA." REFRENCE: ICAO Annex 16, Volume IV, Part II, Chapter 3, 3.1.1	rejected: this misunderstands the statement which is referring to the bulk of projected out of sector reductions, so the statement in the text is correct and needs no further qualification	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
84059	69	23	69	28	Please describe some governance options that go beyond current very ineffective measures. For instance ICAO could be pushed by the UN to introduce kerosene taxes, so that its actions finally align with its stated goals and UN's goals on the climate change mitigation and SDGs.	rejected - ICAO cannot tax	Michał Czepkiewicz	University of Iceland	Poland
20121	69	32	70	16	In the tree scenarios of 10.5.6, only the BAU give a message on the evolution of demand. Messages on the evolution on demand should also be included in the 'incremental' and ine the 'transformational' scenarios. The 'incremental scenario' could consider that demand become progressively affected by prices signal and by the Flygskam movement in the developped world. The 'transformative scenario' should consider that some countries forbid very-short haul flights and implement more taxes on air travel, resulting in a peak in short-haul air travel in those countries, with a stronger shift in the social norm. Such short haul ban is already in discussion in France : https://www.forbes.com/sites/alexledsom/2020/06/23/france-to-permanently-ban-many-short-haul-flights/	rejected - implicit in bullet 4 on demand	Noé Lecocq	Inter-Environnement Wallonie	Belgium
76163	69	33	69	33	please consider if the term 'business as usual' (BAU) scenario is consistent with the rest of the report.	Noted	Jan Fuglestvedt	CICERO	Norway
23225	69	44	69	44	Missing in the report further pricing signal policies such as "frequent flyer levy" devised by Carmichael 2019 "Behavior change, public engagement net zero, report for the Comittee on Climate Change, Impreial College London" in which a tax based on miles traveled by an individual applies	rejected - non-peer reviewed	Government of France	Ministère de la Transition écologique et solidaire	France
69839	70	1	70	16	The transformational scenario is excellent, the few variants that could be included here include the generation of "bio-electro fuels" by addition of renewable hydrogen in the production of biofuels to make use of all the biogenic carbon in limited biomass supply; and the possibility to opt for fossil-based kerosene if fully compensated by negative emissions from DACCS as a possible evolution of CORSIA.	noted	Cédric PHILIBERT	Institut Français des Relations Internationales	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79341	70	1	70	15	Rather than simply saying that price inceases my reduce air travel demand this section should discuss the concept of air transport demand management, including targetted programs to reduce total air travel and encourage shifts to less polluting modes. At a minimum, this should challenge common policies that subsidize aviation infrastructure and underprice aviation fuel. See Susanne Bohler, et al. (2006), "Encouraging Environmentally Sustainable Holiday Travel," Transportation Research A, Vol. 40, Issue 8 (www.elsevier.com/locate/tra), Oct. 2006, pp. 652-670. Murray May (2006), "Aviation Meets Ecology – Redesigning Policy and Practice for Air Transport And Tourism," Transport Engineering in Australia, Vol 10, No 2 (wwwistp.murdoch.edu.au/research/journal/TEA.html), 2006, pp. 117-128. Murray May and S.B. Hill (2006), "Questioning Airport Expansion – A Case Study of Canberra International Airport," Journal of Transport Geography, Vol. 14, pp. 437-450. Michael Sivak (2019), Flying First Class on a Single Domestic Round Trip Can Contribute More Greenhouse Gas Emissions than a Year of Driving, Green Car Congress (www.greencarcongress.com); at www.greencarcongress.com/2019/07/20190701-sivak.html.	demand management is not considered	TODD LITMAN	Victoria Transport Policy Institute	Canada
85395	70	1	70	1	While this statement is fair, we would like to understand why there is a specific focus on land use change.	unclear - no reference to LUC here	Neil Dickson	ICAO	Canada
86689	70	1		2	The Transformational objective here should include the policy option of capacity constraint. The UK Committee on Climate Change in in its Advice on the UK Sixth Carbon Budget proposed no net airport capacity expansion, unless progress could be shown with technical mitigation options. On the face of it this would challenge a projected UK airport capacity expansion from around 340million passengers to around 480 or 500million passengers. Whilst ICAO and CORSIA remain inadequate, such land use and planning policy remains a key tool in the policy and institutional framework. It may be that such an approach is limited to the largely developed world, but must remain on the table, as an important stimulous to technical change. At present I dont see how aviation gets even close to net zero without such an approach. (I have to declare an interest since I am an expert witness at two public nquiries on carbon emissions and airport expansion, and invovled in advising several other airports or airport groups).	rejected - it's dealt with under bullet 4	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
51617	70	3	70	4	"Phase-out of fossil fuel usage by 2050, requiring considerable private and governmental investment in technologies and production facilities for synthetic fuels." No need to specify who should invest. Change to : "Phase-out of fossil fuel usage by 2050, requiring considerable investment in technologies and production facilities for synthetic fuels."	rejected - disagree	eric lombard	Stay Grounded	France
86239	70	4	70	5	CH4 and HFC with short lifetimes are part of SLCFs. (cf WG1 chapter 6)	Noted. Thanks	Sophie Szopa	LSCE	France
5513	70	5	70	6	replace Renewables" by "low carbon sources", 2 times	Accepted and include literature	Michel SIMON	Retraité/ Pdt d'association	France
86241	70	7	70	7	warming should be cooling here	There is no refernce here to cooling	Sophie Szopa	LSCE	France
11299	70	8	70	10	I suggest adding "and sleeper trains" to the end of the sentence "Very-short haul aviation (<300 kms) might potentially be powered by all- or hybrid-electric powered propulsion and middle-distance aviation (<800 kms) might increasingly be shifted to High Speed Rail" High Speed Rail is an important option in some areas, but in lower density regions (such as much of Canada and Nordic Europe) sleeper trains are a more realistic option in the short and medium term. Source https://theconversation.com/could-sleeper-trains-replace-international-air-travel-130334	rejected - unnecessary detail and qualification, no peer-reviewed literature to support	Eric Doherty	Ecopath Planning	Canada
86691	70	8			Aicraft are though tto have up to 500nm range on electric or hybrid see point above	editorial - distance removed	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
84061	70	14	70	15	Describe how this could be done, for instance in the proposed section 10.5.3.7 on demand-side options of "avoid" type in aviation. This is the major shortcoming of the chapter, and it has to be improved if the chapter is to enable and support the "transformational scenario"	rejected - this would be prescriptive	Michał Czepkiewicz	University of Iceland	Poland
46085	70	17			Chapter 10.6: The chapter lists a lot of options to mitigate GHG emissions and climate change. Some of those options lead to incremental improvements. While they may be a progress in the short-term by reducing carbon emission to a small extend, they may be cumbersome in order to reach substantial reductions, which is required in the mid- and long term. Please add and discuss the aspect that those options could either lead to lock-ins or to stranded investments.	Accepted but beyond the scope of changes to text at this stage	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
70343	70	17	70	17	As the transport sector, including shipping, emits a range of compounds in addition to CO2, is it ok to call it decarbonising or transitioning to climate neutrality would be better suited?	Rejected	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73077	70	17			Add a new paragraph above the "Decarbonisation of Shipping" section, as a fourth paragraph in the listing of "Future options for aviation mitigation": A 'disruptive scenario' matching the 'climate emergency' might be one that acts on the increase sense among global governments and the global populace – or at least among those in the three continents engaging in high levels of air travel in Figure 10.1(b) – that the world is already in a climate emergency, and emergency action is required. *<bullet> Phase out nearly all fossil fuel usage by aviation by 2030, through (to the degree possible and reasonable) technological and operational improvements and the use of alternate fuels or electric flight, and through the banning of frequent flyer programmes (FFPs) and a declining cap on the supply of fossil jet fuel. *<bullet> Substitute (to the degree that is sustainable in view of the climate emergency) travel by conventional and high speed rail and other surface means, preferentially creating a system that in operation and construction is most consistent with society's and individuals' functions in an age of climate and ecological emergency.	Later versions clarified this.	Larry Edwards	Larry Edwards Environmental Consulting	United States of America
23227	70	20	70	20	We sugges to temper this part. There are indeed many solutions to decarbonise the maritime sector, but there is no real low or zero carbon solution that is mature today.	Taken into account. The text has been softened somewhat.	Government of France	Ministère de la Transition écologique et solidaire	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
46087	70	26	70	28	It would be interesting to say which percentage of CO2 emissions is due to fishing activities alone.	The paragraph has changed and the text this is refering to has been removed.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
23229	70	31	70	33	Is not this part already partially written above lines 26 to 28 ? Perhaps this one is more detailed and cautious.	Taken into account. The earlier text has been removed and the paragraph has been rephrased.	Government of France	Ministère de la Transition écologique et solidaire	France
333	71	2	71	10	This whole paragraph is confuse and also contains some errors. Chapter 6 WGI authors could provide support.	Taken into account. The text has been amended and WG1 has been conferred with	Sandro Fuzzi	ISAC CNR	Italy
75155	71	2	71	3	Language: one cannot have emissions in addition to CO2 and then divide these into CO2 and SLCFs	Taken into account. The text has been corrected.	Marianne Tronstad Lund	CICERO Center for International Climate Research	Norway
75161	71	2	71	11	A number of studies have suggested that the net impact of shipping emissions has been a cooling of climate until date when considering both CO2 and non-CO2. While CO2 dominates on long time scales, the net cooling is also shown in short time scales following a pulse emission in WG1 Ch6. WG3 Ch.6 should probably think about how and to what extent to address this point.	Taken into account. The text has been updated and WG1 has been conferred with	Marianne Tronstad Lund	CICERO Center for International Climate Research	Norway
75159	71	5	71	6	Need to also mention their interaction with clouds, which is part of perturbation to the energy balance	Taken into account. The text has been updated.	Marianne Tronstad Lund	CICERO Center for International Climate Research	Norway
1319	71	6	71	8	Line 7 mention "others cotribute to warming the climate", but the given example of sulfur refers to a regional cooling effect.	Taken into account. The text has been corrected.	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
43825	71	6	71	8	"Others contribute to warming the climate, for example sulphur – based pollution can have a regional cooling effect, as it may interact with clouds to brighten these and reflect sunlight." This sentence is unclear: sulphur-based pollution is mentioned an example for warming, although it actually has a cooling effect.	Taken into account. The text has been corrected.	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
30487	71	7	71	8	Clarify wording. So2 cools both due to direct effect (reflective aerosol particles) and interaction with clouds. See WG I.	Taken into account. The text has been updated.	Steven Smith	PNNL/JGCRI	United States of America
75157	71	7	71	7	Sulfate does not have a warming climate effect	Taken into account. The text has been corrected.	Marianne Tronstad Lund	CICERO Center for International Climate Research	Norway
43827	71	8	71	10	Technically speaking, sulphur itself is not a climate forcer, but it leads to the formation of aerosol sulfate which is a climate forcer (via both direct and indirect aerosol effects). I would rephrase it more precisely.	Taken into account. The text has been updated.	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
43829	71	8	71	10	"Fraction of the lifetime of the warming" is hard to understand. I would rather write that short-lived climate forcers have a shorter life time that the associated CO2 emissions and that these short-lived forcers can have both a cooling (e.g., sulfate) or a warming (e.g., ozone from NOx) effect.	Taken into account. The text has been updated.	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
75163	71	8	71	9	Strictly, it's not the sufur in the fuel but the emission of SOx upon combustion that is the SLFC. Needs some modification.	Taken into account. The text has been corrected.	Marianne Tronstad Lund	CICERO Center for International Climate Research	Norway
30489	71	10	71	10	It is incorrect to say "The cooling from the SLCF from a pulse emission will be insignificant ", it is only the forcing that is insignificant. Cooling will still be present (and is non-trivial) due to thermal inertial of oceans. This is particularly the case for shipping emissions.	Taken into account. The text has been updated.	Steven Smith	PNNL/JGCRI	United States of America
56949	71	10	71	11	"The cooling from the SLCF from a pulse emission will be insignificant after a couple of decades, whilst the warming from the long-lived substances lasts for centuries.": Suggest rephrasing if possible. The way this is worded currently seems to diminish the importance of "decade", especially with the backdrop of widely reported planet-only-having-one-decade-to-act before irreversible impacts. If SLCFs stick around for, say, 20 years, they aren't persisting in a vacuum. They're persisting in the current atmosphere. Is that really "insignificant" given the lag in climate effects?	Taken into account. The text has been updated.	Government of United States of America	U.S. Department of State	United States of America
75165	71	10	71	10	The word "insignificant" seems a bit problematic to me, as it implies a statistical basis. The net impact of NOx for instance is present on 20 year time scales in n these types of pulse based calculations, so how small does it have to become to be insignificant? Perhaps rephrase to "negligible compared to the initial effect" or "decays rapidly" or something?	Taken into account. The text has been updated.	Marianne Tronstad Lund	CICERO Center for International Climate Research	Norway
30557	71	12	71	16	The deletion of this paragraph is proposed, because it is based on the outdated information and it could mislead readers into thinking that the challenges on sulfur emissions from shipping has not been addressed yet. The paragraph describes the challenges caused by sulfur emissions from shipping based on the simulation result in the referred paper in 2013, but they has been already addressed based on the International Convention for the Prevention of Pollution from Ships (MARPOL). The amendment of MARPOL which was approved by IMO had been entered into force on January 2020. From 2020, it requires that the sulfur content in fuel oil used in vessels shall be reduced from 3.5% to 0.5% in global sea areas in order to reduce sulfur emissions from shipping. Consequently, sulfur emissions from shipping must have been substantially improved compared with those in 2013. Therefore, the paragraph including the challenges which have been addressed and the recommendation of “more studies” on such challenges could mislead readers and should be deleted.	Partially accepted. The paragraph has been modified and the sulphur regulations are covered in the text.	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
70345	71	12	71	16	The ocean - singular form is better suited.	Taken into account. It has been corrected.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
23231	71	14	71	15	The sentence "Increase in sulphur deposition … from the ocean to the atmopshere" needs a reference	Taken into account. Reference has been added	Government of France	Ministère de la Transition écologique et solidaire	France
31679	71	14	71	15	If possible kindly include a reference to this statement: "Increase in sulphur deposition on the oceans has also been shown to increase the flux of CO2 from the oceans to the atmosphere."	Taken into account. Reference has been added	Shreya Some	Ahmedabad University	India
86243	71	26	71	26	The section dealing with future SLCF emissions in chapter 6 is now 6.7.1. thanks	Taken into account. It has been corrected.	Sophie Szopa	LSCE	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
85825	72	0	76	0	Suggest that the role of ports in the reduction of GHG emissions could also be mentioned in this section. The important role of ports has been identified by the International Maritime Organization (IMO) in Resolution MEPC. 323(74). Ports can support the reduction of emissions in a number of ways, including the provision of onshore power to a vessel at berth; provision of infrastructure for alternative fuel supply; incentive schemes that address GHG emissions and sustainable shipping; and port call optimisation, which assists ships in managing their arrival time and travel speed.	Taken into account. The text has been updated.	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
11491	72	1	72	41	The section of 10.6.3 focuses on the impacts of shipping in the Arctic on the climate change, since it is expected that the increasing navigation activity in this new corridor caused by the warming climate, especially for commercial vessels, will profoundly reform the global shipping network. Due to the reduction of the travel time and cost, with no policy or regulation interventions, shipping companies are likely to use this corridor instead of the Suez route between the Europe and Asia. In this context, the section of 10.6.3 mainly summarizes the possible negative impacts of this alternative route, such as the insufficient navigation supporting conditions and the possible hazardous impacts on the environment and climate for the vulnerable ecosystem in the Arctic.	Taken into account. Both potential benefits and side-effects of shipping networks through the Arctic are considered in the text.	Ouchen Cai	China Waterborne Transport Research Institute	China
11493	72	1	72	41	However, as a technical and fundamental report for the governments dealing with the climate change, I think a very important part should be added to this section to answer the following questions: what are the expectation in the scientific manner that this potential route may contribute to the global climate change? In the various scenarios, will it increase or decrease the total GHGs emissions of the maritime sector across the world? Against the reduced travel distance and time, what are the impacts on the climate, from the possible infrastructure constructions, hinterland transportation and other economic activities and the emission performance of the vessels with the ice-breaking capability?	Taken into account. We are pointing to unknowns and some knowns that could come from this increased activity	Ouchen Cai	China Waterborne Transport Research Institute	China
56951	72	1	72	41	Section 10.6.3 should mention that emissions from shipping outside the Arctic can impact Arctic climate and that changes in Arctic climate may have global climate impacts.	Taken into account. The text has been added to the section.	Government of United States of America	U.S. Department of State	United States of America
23233	72	11	72	11	We suggest for the part "may pose a threat to local ecosystems" that giving few examples would be of great interest for the reader.	Taken into account. Text has been updated to include this.	Government of France	Ministère de la Transition écologique et solidaire	France
4153	72	14	72	15	LNG has not been officially declared as not being low-carbon, the industry required this technology for the transition period ; so those opinion will be presented here?	Taken into account. Text has been updated to reflect on this.	Monique Giese	KPMG AG	Germany
56953	72	16	72	18	"Observations have shown that 5-25% of local air pollution stems from shipping in the Canadian Arctic." Local where?	Taken into account. The paragraph has been reworded	Government of United States of America	U.S. Department of State	United States of America
43831	72	19	72	20	On these topic, you may also cite the modelling studies by Righi et al. (2013, 2015) and Peters et al. (2012), as well as the assessment by Eyring et al. (2010). Also note that the effect of shipping emissions on shortwave radiative forcing is expected to decrease in view of the IMO regulations on FSC (see Lauer et al., 2009 and Righi et al., 2011). - Righi, M., Hendricks, J., and Sausen, R.: The global impact of the transport sectors on atmospheric aerosol: simulations for year 2000 emissions, Atmos. Chem. Phys., 13, 9939–9970, https://doi.org/10.5194/acp-13-9939-2013, 2013. - Righi, M., Hendricks, J., and Sausen, R.: The global impact of the transport sectors on atmospheric aerosol in 2030 – Part 1: Land transport and shipping, Atmos. Chem. Phys., 15, 633–651, https://doi.org/10.5194/acp-15-633-2015, 2015. - Peters, K., Stier, P., Quaas, J., and Graß l, H.: Aerosol indirect effects from shipping emissions: sensitivity studies with the global aerosol-climate model ECHAM-HAM, Atmos. Chem. Phys., 12, 5985–6007, doi:10.5194/acp-12-5985-2012, 2012. - Eyring, V., Isaksen, I. S. A., Berntsen, T., Collins, W., Corbett, J. J., Endresen, O., Grainger, R. G., Moldanova, J., Schlager, H., and Stevenson, D. S.: Transport impacts on atmosphere and climate: Shipping, Atmos. Environ., 44, 4735–4771, doi:10.1016/j.atmosenv.2009.04.059, 2010. - Righi, M., Klinger, C., Eyring, V., Hendricks, J., Lauer, A., and Petzold, A.: Climate impact of biofuels in shipping: global model studies of the aerosol indirect effect, Environ. Sci. Tech., 45, 3519–3525, doi:10.1021/es1036157, 2011. - Lauer, A.; Eyring, V.; Corbett, J. J.; Wang, C.; Winebrake, J. J. Assessment of near-future policy instruments for oceangoing shipping: Impact on atmospheric aerosol burdens and the Earth's radiation budget. Environ. Sci. Technol. 2009, 43, 5592–5598.	Accepted.Taken into account. Citations have been added.	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
56955	72	34	72	35	"Arctic environments pose unique hazards and challenges with regards to safe and efficient operations: low temperature challenges, implications for vessel design, evacuation and rescue systems, communications, oil spills, variable sea ice and meteorological conditions (e.g., Buixade-Farre et al., 2014)." Can the connection to climate be strengthened?	Accepted but beyond the scope of changes to text at this stage	Government of United States of America	U.S. Department of State	United States of America
10791	72	38	72	41	This paragraph needs to be improved, as the authors are certainly aware.The holistic view helps, but does not provide practical solutions. In other chapters of this report, when mitigation impacts environmental (beyond climate) or social issues, useful analysis tools are synergies, trade-offs, co-benefits.	Taken into account. The paragraph has been reworded.	Philippe Waldteufel	CNRS	France
23235	72	38	72	41	Introducing how Indigenous Arctic Peoples and their knowledge have to be taken into account and can help designing better routes would be relevant. (Dawson et al. 2020) (Downing, 2019) (Martire, 2011)	Taken into account. References have been added, and text updated.	Government of France	Ministère de la Transition écologique et solidaire	France
12575	72	42	74	20	I think the discussion of technologies is quite focussed on fuels (as these give the largest long term reductions in emissions). I think there would be value in discussing energy efficeincy options and wind assistance in greater depth as these are available today and are urgently needed to begin to reduce emissions. See this excellent report https://bmcenergy.biomedcentral.com/articles/10.1186/s42500-020-00015-2 as well as this again https://www.itf-oecd.org/navigating-towards-cleaner-maritime-shipping	Taken into account. References have been added, and text updated.	Matteo Craglia	International Transport Forum	France
23237	72	42	72	42	In the section 10.6.4, we recommand to add a list of solutions that exist to decarbonise the maritime sector. Wind technologies and shore power are missing. Furthermore, it would also be necessary to specify that many solutions are not yet mature for the international market (high power, need for autonomy, availability of fuels, etc.).	Partially accepted. Wind and shore power, autonomy, fuel availability ++ is already mentioned. And there is both a bullet point list and a figure present.	Government of France	Ministère de la Transition écologique et solidaire	France
78763	72	42	76	17	research by Ram et al. (http://energywatchgroup.org/wp-content/uploads/EWG_LUT_100RE_All_Sectors_Global_Report_2019.pdf ; also part of the AR6 scenario database) and a recent report by the German Energy Agency (https://www.powerfuels.org/fileadmin/powerfuels.org/Dokumente/Global_Alliance_Powerfuels_Study_Powerfuels_in_a_Renewable_Energy_World.pdf) have clearly shown that synthetic fuels for a fast growing marine sector can be provided on a fully renewable and non-bioenergy basis at affordable cost for synthetic methane based LNG, Fischer-Tropsch based diesel and hydrogen. Such reserach insights may be of relevance for this section.	Accepted but beyond the scope of changes to text at this stage	Christian Breyer	LUT University	Finland
29745	72	44	72	46	Please reconsider if LNG should be placed here as an alternative fuel option to mitigate climate change. The mitigation effect is disputed and depends highly on engine technology, and it is still a fossil fuel. The uncertain mitigation effect is mentioned on page 73, line 17.	Taken into account. The text has been removed.	Government of Norway	Norwegian Environment Agency	Norway

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
46089	72	45			Please discuss the issues with ammonia as fuel: Combustion of ammonia could lead to high NOx and maybe N2O and NH3 emissions, so there is a risk that switching to ammonia as a fuel could not be sustainable. Reference: https://www.dnv.com/Publications/ammonia-as-a-marine-fuel-191385, see page 17	Taken into account. Text and reference have been added.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
85829	73	0	73	0	In Section 10.6.4, besides vessel mitigation measures, consideration should also be given to referencing port measures to reduce greenhouse gas emissions, such as i) provision of on-shore power; and ii) implementation of vessel arrival systems (with the potential for emissions savings of up to18% per voyage, refer to https://www.portauthoritynsw.com.au/sustainability/vessel-arrival-system/).	Taken into account. Text has been added to reflect this.	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
23239	73	4	73	4	Not involving Wind Assisted Ship Propulsion (WASP) is greatly missing as it is very seriously thought about. What is more, a lot of different options are proposed when talking about WASP (Clodic et al. 2018) (Atkinson et al. 2018) (Tillig, Ringsberg. 2020)	Taken into account. Text has been added.	Government of France	Ministère de la Transition écologique et solidaire	France
5515	73	10	73	10	replace Renewables" by "low carbon sources"	Noted. The text is no longer in this section.	Michel SIMON	Retraité/ Pdt d'association	France
43135	73	13	73	13	I would add ' and liquid hydrogen organic carriers (LHOC) (Staffel et at, 2019)	Accepted but beyond the scope of changes to text at this stage	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
56957	73	14	73	75	The part of the sentence that says "may not be considered as a low-carbon alternative" could be read two different ways. One is to suggest that the term "low-carbon" may not apply to LNG, but it could also mean that countries should not consider using LNG because it is not low-carbon. This ambiguity could be interpreted as a policy statement. Therefore, suggest a minor editorial edit of swapping the word "considered" for "treated" or "viewed."	Taken into account. The text has been amended to reflect this.	Government of United States of America	U.S. Department of State	United States of America
79177	73	14	73	29	From this discussion, I'd never have guessed the extend of shippers' (starting with Maersk) enthusiasm for e-NH3.	Accepted but already part of the text here and elsewhere	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
85827	73	14	73	15	Suggest correcting this statement: "LNG has been found to have a relatively limited mitigation potential and may not be considered as a low-carbon alternative". This is a subjective statement which does not fairly represent studies that indicate up to a 30% CO2 emissions reduction (refer to line 17 of page 10-73) from the use of LNG as a marine fuel. The interim use of LNG, while zero-carbon fuel production is being up scaled, can assist in accumulating immediate greenhouse gas emissions savings. Without smaller step improvements utilising existing technologies (e.g. LNG) along the decarbonisation path, achieving the magnitude of IMO's emissions reduction ambitions for 2030 and 2050 is likely to become increasingly harder to achieve. Suggest the following statement is inserted at line 18, prior to the sentence commencing with "Methane produced from renewable electricity (e-methane) has the potential to reduce emissions by ~80%": 'Nevertheless, as a proven technology, the use of LNG as a transitional fuel in the interim can accumulate immediate greenhouse gas emissions savings on the pathway to zero-carbon fuels. Analysis by the IEA indicates LNG can reduce lifecycle emissions by 18-28% compared to fuel oil.' (Table 8 in IEA(2017), Biofuels for the marine shipping sector https://www.ieabioenergy.com/wp-content/uploads/2018/02/Marine-biofuel-report-final-Oct-2017.pdf)	Accepted but already part of the text here and elsewhere	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
46091	73	16	73	18	We suggest to use more recent data such as ICCT (2020), Working Paper 2020-02, "The Climate implications of using LNG as a marine fuel, International Council on Clean Transportation", https://theicct.org/sites/default/files/publications/LNG%20as%20marine%20fuel%2C%20working%20paper-02_FINAL_20200416.pdf.	Accepted and changes made	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
85833	73	17	73	18	Suggest more up-to-date literature on the emission reduction potential of LNG could be referenced here. For example, see https://info.thinkstep.com/lng-ghg-study?hs_preview=iCocCGSo-8445007461. Analysis by the IEA indicates LNG can reduce lifecycle emissions by 18-28% compared to fuel oil. (Table 8 in IEA(2017), Biofuels for the marine shipping sector https://www.ieabioenergy.com/wp-content/uploads/2018/02/Marine-biofuel-report-final-Oct-2017.pdf)	Accepted but already part of the text here and elsewhere	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
5517	73	18	73	28	replace Renewables" by "low carbon sources" on lines 18 and 28	Not accepted	Michel SIMON	Retraité/ Pdt d'association	France
29747	73	18	73	19	Please consider revising this sentence to moderate the potential and impacts of producing e-methane. Suggestion: "Methane produced from renewable electricity (e-methane) has the potential to reduce emissions by ~80% but will require substantial amounts of renewable energy in its production."	Accepted and already part of the text here and elsewhere	Government of Norway	Norwegian Environment Agency	Norway
85831	73	21	73	22	Suggest rephrasing the text that reads: "...with no current regulation on emission caps as there are for NOx and SOx..." The regulations that control and reduce emissions of SOx and NOx are not technically emissions caps. The reduction in SOx emission from shipping is achieved through limits on the sulphur content in fuel. The reduction in NOx emissions is achieved through performance standards for marine engines. Suggest this sentence would better read "unlike SOx and NOx, there are no current IMO regulations to control methane emissions from international shipping".	Accepted and taken into account	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
46093	73	22			Additional literature might be helpful: International Council on Clean Transportation (ICCT), 2020, Working Paper 2020-02, The Climate implications of using LNG as a marine fuel, https://theicct.org/sites/default/files/publications/LNG%20as%20marine%20fuel%2C%20working%20paper-02_FINAL_20200416.pdf.	Taken into account. ICCT numbers added to the mitigation potential figure.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
12569	73	25	73	29	I have an issue with the assertion that e-methanol reduces emissions by 80%. This assumes a renewable source of carbon feedstock (from DAC or biomass) can be acquired. Could this be made more explicit. There also needs to be a note that carbon feedstocks from fossil fuels and CCS would not necessarily be low carbon options. The sentence could be rephrased as 'e-methanol' has the potential to reduce emissions by 80% w.r.t HFO when coupled with very low carbon feedstocks from biomass or DAC. However, this emissions benefit would be substantially reduced if CO2 from fossil fuel power generation and CCS is used as a feedstock. Please see our latest report for more details https://www.itf-oecd.org/navigating-towards-cleaner-maritime-shipping	Accepted but already part of the text here and elsewhere	Matteo Craglia	International Transport Forum	France
29749	73	26	73	27	Please consider to add "based on renewable energy" after "hydrogen from electrolysis". Suggestion: "While methanol (hydrogen) produced from fossil sources induces an emission increase of +7.5% (+44%), e-methanol (hydrogen from electrolysis based on renewable energy) reduces emission by 80% (82%). " If we understand it correctly, this addition can clarify the emission difference from the different production pathways. Please consider highlighting this aspect, if this is correctly understood, or provide the relevant explanation.	Accepted. Taken into account	Government of Norway	Norwegian Environment Agency	Norway
69841	73	26	73	28	I wonder why e-methanol can reduce emissions by 80% while e-ammonia can reduce emissions by 69% only. What are the reference? E-methanol has carbon atoms, hence requires DAC of carbon from biomass to be as carbon neutral as possible, while ammonia has none. The power-to-fuel-to-power efficiency (a good proxy of power to fuel to mobility) is 35% for ammonia vs. 27% for methanol, if the nitrogen for ammonia and the carbon for methanol are both extracted from the atmosphere. It increases to 32% for methanol if the carbon is taken from concentrated flue gas (13.3 vol%), but this is still less than for ammonia (Grinberg Dana A. et al. 2016, Agnew.Chem. Int. Ed. 55: 8798-8805). Hence the figures in this paragraphs are surprising. This number for ammonia also contradicts the figure 10.20 and line 20 on p. 74.	It is likely due to different assumptions on those studies on the GHG intensity of renewable electricity and carbon capture options.	Cédric PHILIBERT	Institut Français des Relations Internationales	France
1321	73	33	73	33	There is spoken about EMF33 biofuels and these seems to be a promising option according to figure 10.2. However, availability of this biofuel is not discussed. Good to include this here briefly and not only in another chapter.	Not accepted. Biofuels will be dealt with elsewhere still, so it does not become repetitive in every section.	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
12567	74	1	74	1	Please refer to our updated report OECD/ITF (2020) https://www.itf-oecd.org/navigating-towards-cleaner-maritime-shipping rather than 2018. There are updated and more detailed LCA estimates of different fuels. Partly dependent on other literature such as Balcombe 2019 for biofuels. But with our own estimates for hydrogen and ammonia emissions importantly including latest evidence of methane slip emissions in the hydrogen fuel production chain (which are too often omitted or outdated in earlier literature).	Taken into account. used the data from the underlying references of this ITF report, deleted the LNG value from the 2018 ITF report	Matteo Craglia	International Transport Forum	France
43137	74	1	74	1	The figure should include LHOC, as they are considered as a feasible option within the literature.	Accepted but beyond the scope of changes to text at this stage	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
1257	74	2	74	17	fig 10.20: The list of literature sources is very long, but it is not clear which data have been used for each source and which calculations have been made. It would be very difficult to reproduce the figure based on this list.	Accepted but beyond the scope of changes to text at this stage	Saeda Moorman	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
23241	74	2	74	2	Figure 10.20: The "Emissions scope of individual data points" is difficult to read and understand.	Partially taken into account. Studies differ aldready vastly due to different input assumptions. Text as been added to clarify figure.	Government of France	Ministère de la Transition écologique et solidaire	France
46095	74	2			Fig. 10.20; Boxplots for the e-fuels methanol, methane, hydrogen and ammonia: Emission reduction potential seems to be roughly 80%. Please explain the remaining share. Does it result from additional fossil fuels needed to ensure good ignition? There is no reason to suppose this ignition fuel has to be fossil, as it can be produced synthetically like other e-fuels. https://www.dnv.com/Publications/ammonia-as-a-marine-fuel-191385, see pages 9 and 16. Another source „Techno-economic assessment of zero carbon fuels“ of Lloyds Register and UMAS in March 2020, endorses the argument of zero GHG emissions for e-hydrogen, e-ammonia, e-diesel and e-methanol (see Fig. 9).	Partially taken into account. For many publications, the resulting share stems from the GHG emissions of renewable electricity. Included the study from Llods and UMAS.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
46097	74	2			Fig. 10.20: For nuclear propulsion, only well-to-wake seems to be considered. This perspective seems shortened as extensive and complex long-term waste storage is needed for nuclear energy which also incorporates substantial GHG emissions. Thus, the emission reduction potential for nuclear seems to be overestimated. Please check. REFERENCE: Sovacool, B. K. (2008): Valuing the greenhouse gas intensity from nuclear power: A critical survey. Energy Governance Program, Centre of Asia and Globalisation, Lee Kuan Yew School of Public Policy, National University of Singapore	Not taken into account. Reference is rather old.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
5519	74	18	74	18	replace Renewables" by "low carbon sources"	Not taken into account	Michel SIMON	Retraité/ Pdt d'association	France
24691	74	18	74	18	Hydrogen produced via electrolysis: both renewable and nuclear power can be used in this process (see reference already used in the chapter: Bicer, Y., and Dincer, I. (2017). Life cycle assessment of nuclear-based hydrogen and ammonia production options: A comparative evaluation. International Journal of Hydrogen Energy, 42(33), 21559–21570. https://doi.org/https://doi.org/10.1016/j.ijhydene.2017.02.002). So we recommend replacing "Hydrogen and ammonia when produced from renewables or coupled to CCS" with "Hydrogen and ammonia when produced from low-carbon electricty or coupled to CCS"	Taken into account. The reference has been incorporated.	Ann Jessica Johnson	FORATOM (European Atomic Forum)	Belgium
78765	74	18	75	14	synthetic fuels on a renewable electricity basis are attractive for marine applications as shown in a techno-economic analysis by Horvath et al. (https://www.sciencedirect.com/science/article/pii/S0196890418302152)	Taken into account. The reference has been incorporated.	Christian Breyer	LUT University	Finland
29751	74	20	74	20	Please consider to specify if this is CO2 or CO2-equivalents or other, for clarity.	Accepted. Taken into account.	Government of Norway	Norwegian Environment Agency	Norway
46099	75	1	75	4	Please check recent developments regarding the use of ammonia in maritime motors, such as from Wärtsilä (Finland) https://www.wartsila.com/media/news/30-06-2020-world-s-first-full-scale-ammonia-engine-test---an-important-step-towards-carbon-free-shipping-2737809.	Accepted but already part of the text here and elsewhere	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
46101	75	1	75	3	See comment to Page 74/Line 2	Noted. Thanks	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
12571	75	2	75	2	Ammonia doesn't require 'blending' it requires a pilot fuel in the engine to initiate combustion. The author correctly points out that hydrogen can be used (this hydrogen can also be obtained by cracking a share of the ammonia fuel back to H2 and N2). If H2 is used as a pilot fuel there are in theory no (direct TTW carbon) emissions produced therefore the end of the sentence 'some emissions result from its use in internal combustion engines' is not necessarily correct. There are other emissions such as NOx but this is also true of fuel cells (which are discussed in the next sentence). Please see our latest report for more details https://www.itf-oecd.org/navigating-towards-cleaner-maritime-shipping	Accepted but already part of the text here and elsewhere	Matteo Craglia	International Transport Forum	France
29753	75	4	75	5	Please consider to remove "substantial" from this sentence, or use an alternative word that is more concise. Substantial space is a relative term depending on the size of the vessel and the fuel cell set-up (scale, ie. MWs).	Accepted but already part of the text here and elsewhere	Government of Norway	Norwegian Environment Agency	Norway

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
12573	75	5	75	6	The sentence 'Efficient use of LNG, ammonia and hydrogen in internal combustion 6 engines is more likely to avoid 'slip' of emissions' could do with further detail or being removed. For each of the fuels mentioned the 'slip' would refer to different gases (CH4, NH3 or H2) and there are different processe/technologies to address them (High pressure dual fuel for LNG, post ammonia scrubbers for NH3)	Accepted but already part of the text here and elsewhere (10.3)	Matteo Craglia	International Transport Forum	France
29755	75	11	75	13	Please consider rephrasing. This sentence seem to be in conflict with chapter 11.3.6 "CCS, CCU, carbon sources, feedstocks and fuels". Unless this refers to CO2 from biogenic sources or DAC, the CO2 released from combustion of syntetic hydrocarbons would lead to emissions of GHGs.	Accepted but already part of the text here and elsewhere (10.3)	Government of Norway	Norwegian Environment Agency	Norway
5521	75	12	75	16	replace Renewables" by "low carbon sources", 2 times.	Rejected	Michel SIMON	Retraité/ Pdt d'association	France
23243	75	24	75	25	after "Challenges identified include designing storage tanks for transport to shore with the large volume and weight of CO2 after capturing," we suggest to add "Up to four times more than standard oil". REF : (Morgan, Sam. (2020). World first "carbon-capture at sea" set for shipping trials.Euractiv. Available at: https://www.euractiv.com/section/energy-environment/news/worlds-first-carbon-capture-at-sea-set-for-shipping-trials/) (Sandrine Decarre, Julien Berthiaud, Nicolas Butin, Jean-Louis Guillaume-Combecave. CO2 maritime transportation. International Journal of Greenhouse Gas Control, Elsevier, 2010, 4 (5), pp.857-864. ff10.1016/j.ijggc.2010.05.005ff. ffhal-01519935f)	Accepted but beyond the scope of changes to text at this stage	Government of France	Ministère de la Transition écologique et solidaire	France
10793	75	33	75	35	Ideas suggested here are valuable but we will not find them discussed in the UNCSTADD document. This paragraph is (in the reader's opinion) actually tortuous, because it refrains from stating clearly something very simple : an efficient way to reduce emissions due to shipping consists in reducing the shipping. Yet, it is the responsability of IPCC to present every possible options. And there are ways to convey this message clearly without making people angry at once. While admittedly this chapter presents several scenarios, the part taken by mitigation on international shipping does not appear clearly.	Accepted but beyond the scope of changes to text at this stage	Philippe Waldteufel	CNRS	France
23245	75	33	75	33	The development of autonomy is linked to platooning in shipping sector. REF : Waterborne platooning in the short sea shipping sector A. Colling, R. Hekkenberg Transportation Research Part C: Emerging Technologies Volume 120, November 2020, 102778 https://doi.org/10.1016/j.trc.2020.102778	Accepted but beyond the scope of changes to text at this stage	Government of France	Ministère de la Transition écologique et solidaire	France
56959	75	36	75	38	The sentence contends that 40% of freight is fossil fuels, thus could be reduced; however, it remains to be shown that those fuels are being used for maritime purposes. Further, the discusison of drop in fuels as the preferred alternative fuel does not remove a requirement for fuel freight, but may actually increase it if the energy density of the fuel is less than the original fossil fuel, potentially increasing rates of fuel as freight.	Accepted but beyond the scope of changes to text at this stage	Government of United States of America	U.S. Department of State	United States of America
23247	75	39	75	41	It should be noted that taxes on trade already exists, and the issue of how these new taxes would interfere with the existing set of fiscal regulations will have to be addressed.	Accepted but beyond the scope of changes to text at this stage	Government of France	Ministère de la Transition écologique et solidaire	France
63241	75	42	76	5	We would suggest that any changes to vessel design and hull form (or other emission reduction measures) must not compromise other vessel characteristics, including safety, and the production of underwater radiated vessel noise (a signifcant environmmental polluter)	Accepted but beyond the scope of changes to text at this stage	Government of Canada	Environment and Climate Change Canada	Canada
4155	75	44	75	44	efficient opterations can only be achieved by adapting new technologies therefore this should be added	Accepted but beyond the scope of changes to text at this stage	Monique Giese	KPMG AG	Germany
29757	75	44	75	45	Please consider to add examples such as the Orcelle Wind, by Wallenius Wilhelmsen. The vessel has estimated maximum potential emission reductions of up to 90%. https://www.walleniuswilhelmsen.com/news-and-insights/highlighted-topics/orcelle	Accepted but beyond the scope of changes to text at this stage	Government of Norway	Norwegian Environment Agency	Norway
23249	75	46	75	46	It should be noted that taxes on trade already exists, and the issue of how these new taxes would interfere with the existing set of fiscal regulations will have to be addressed.	Accepted but beyond the scope of changes to text at this stage	Government of France	Ministère de la Transition écologique et solidaire	France
46103	75	46	76	1	To give a more balanced picture of the entire situation for nuclear propulsion please add some words concerning the strings attached with that technology (environmental risks, long-term radiation, problem of final disposal, public acceptance etc.). Please review the respective literature since Warner and Heath, 2012, https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1530-9290.2012.00472.x	Accepted but beyond the scope of changes to text at this stage	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
78907	75	46	75	46	Bouman et al reference is not in the bibliography	Accepted. Taken into account	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
81959	75	46	75	46	if the emission reduction potential of nuclear propulsion is mentioned, it should be completed with the mention of all the technology risks and unsolved challenges.	Accepted but beyond the scope of changes to text at this stage	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
85835	76	0	77	0	In Section 10.6.5, suggest including the IMO's agreement at MEPC 75 to develop a short-term combined technical and operational measure to reduce ship carbon intensity in line with the IMO Initial Strategy for implementation by 2023, with a view to adopt the measure at MEPC 76. From a technical perspective, this measure includes extending the Energy Efficiency Design Index (EEDI) for new ships to existing ships (EEXI). Section 10.6.5 currently only discusses the EEDI for new ships and fails to mention the EEXI.	Accepted but beyond the scope of changes to text at this stage	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
29761	76	1	76	5	Please consider also referring to recent development in the electrification of ferries, either in this para or another suitable place in the chapter. Eg. in Norway electrification of the ferry fleet is already well under way, and many ferries will be replaced in the next few years. By 2022, it is expected that around 80 ferries will run partly or entirely on batteries. (https://www.regjeringen.no/contentassets/2ccd2f4e14d44bc88c93ac4effe78b2f/the-governments-action-plan-for-green-shipping.pdf)	Accepted but beyond the scope of changes to text at this stage	Government of Norway	Norwegian Environment Agency	Norway
29759	76	3	76	3	Please consider to revise this sentence to give a more nuanced view of the emission reduction potential. Suggestion: "The median emission reduction potential is ~40% (Figure 10.20), but can be significantly higher."	Accepted. Taken into account	Government of Norway	Norwegian Environment Agency	Norway
56961	76	13	76	14	The sentence disusses fuel lifecycle, but does not mention the total lifecycle for ships. Unlike cars or other transportation modes, ships have 10- to 30-year or longer lifecycles. The methods discussed for structural and fuel adaptation are not "plug and play" (with the potential exception of drop-in fuels) and so the total lifecycle of a ship as well as the alternative fuels should be considered as part of the discussion for reducing emissions.	Accepted but beyond the scope of changes to text at this stage	Government of United States of America	U.S. Department of State	United States of America
69843	76	19	76	27	The involvement of the financial sector may provide a strong lever to decarbonisation. See e.g. the Poseidon principles adopted by significant financiers of maritime shipping.	Accepted but beyond the scope of changes to text at this stage	Cédric PHILIBERT	Institut Français des Relations Internationales	France
52507	76	21	76	21	Is IMO target binding or aspirational? Qualify accordingly in the statement.	Accepted but beyond the scope of changes to text at this stage	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
85837	76	21	76	22	Suggest clarification of the text "IMO regulations target a 50% reduction in emissions from the sector by 2050 compared to 2008". Suggest we clarify this is a 50% reduction in 'greenhouse gas' emissions.	Accepted but beyond the scope of changes to text at this stage	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
85839	76	23	76	23	Please update this passage, the text currently suggests that an initial strategy is to be developed. This initial strategy has been developed. See here for updated information: https://www.imo.org/en/MediaCentre/HotTopics/Pages/Reducing-greenhouse-gas-emissions-from-ships.aspx	Accepted but beyond the scope of changes to text at this stage	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
85841	76	23	76	27	Please correct this passage: "It furthermore aims for the sector to become carbon neutral by the end of the century, in line with the Paris Agreement." The initial GHG strategy envisages, in particular, a reduction in the carbon intensity of international shipping to reduce CO2 emissions per transport work, as an average across international shipping, by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008; and that total annual GHG emissions from international shipping should be reduced by at least 50% by 2050 compared to 2008. The strategy includes a specific reference to “a pathway of CO2 emissions reduction consistent with the Paris Agreement temperature goals”. It also aims to phase out GHG emissions from international shipping as soon as possible this century.	Accepted but beyond the scope of changes to text at this stage	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
46105	76	26			To be more specific please add "at least": the reduction target per transport work is at least 40%. Reference: RESOLUTION MEPC.304(72), in MEPC 72/17/Add.1 (Annex 11, page 5; download from this website: https://www.imo.org/en/OurWork/Environment/Pages/GHG-Emissions.aspx	Accepted. Taken into account	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
85843	76	28	77	30	Suggest that the paragraph could be clearer on what was approved by the IMO in 2020. We suggest the following text could replace the first sentence of this paragraph: "In 2020, the IMO approved the short-term goal-based measure to reduce the carbon intensity of existing international ships. This measure addresses both technical (how the ship is retrofitted and equipped) and operational measures (how the ship operates). The technical element is represented by the Energy Efficiency Existing Ship Index (EEXI), and the operational element is represented by a Carbon Intensity Indicator (CII)." See here for further information - https://www.imo.org/en/MediaCentre/HotTopics/Pages/Reducing-greenhouse-gas-emissions-from-ships.aspx	Accepted but beyond the scope of changes to text at this stage	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
85845	76	30	76	34	Suggest this paragraph could be clearer on the difference between the Energy Efficiency Existing Ship Index (EEXI) and Energy Efficiency Design Index (EEDI). The EEXI will apply to ships from 2023. More information on the EEXI is provided in the comments above. The EEDI aims to promote the use of energy-efficient equipment and engines by requiring a minimum energy efficiency level per capacity mile (e.g. tonne mile) for different ship types and size segments. The level is tightened every five years, so the EEDI encourages continued innovation and technical development of all the components influencing the fuel efficiency of a ship from its design phase. The first reference level was introduced in 2013. Reduction rates have been established until the period 2025 and onwards when a 30% reduction is mandated calculated from a reference line representing the average efficiency for ships built between 2000 and 2010. The EEDI is a non-prescriptive, performance-based mechanism that leaves the choice of technologies to use in a specific ship design to the industry. As long as the required energy efficiency level is attained, ship designers and builders can use the most cost-efficient solutions for the ship to comply with the regulations. See https://www.imo.org/en/OurWork/Environment/Pages/Technical-and-Operational-Measures.aspx for further information.	Accepted but beyond the scope of changes to text at this stage	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
30559	76	32	76	33	In November 2020, IMO determined that containerships which will be contracted after 2022 should be up to 50% more energy efficient than baseline. For the reasons above, “Ships built in 2025 should be 30% more energy efficient than in 2014.”should be replaced with “Depending on ship types, ships built in 2022 and beyond should be up to 50% more energy efficient than in 2013.”.	Accepted but beyond the scope of changes to text at this stage	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
56963	76	32	76	33	"The EEDI differs per ship segment. Ships built in 2025 should be 30% more energy efficient than in 2014. This legislation aims to reduce GHG emissions in particular." Suggest adding current context to this section -- i.e., what ships are being delivered now and/or the last few years? With the proliferation of ultra large container vessels (ULCV), is there a disconnect between what's happening and what the EEDI calls for?	Accepted but beyond the scope of changes to text at this stage	Government of United States of America	U.S. Department of State	United States of America
23251	76	43	76	44	We recommand to double check this statement as it seems that fine particles are not yet regulated today	Accepted but beyond the scope of changes to text at this stage	Government of France	Ministère de la Transition écologique et solidaire	France
77901	76	43	77	6	It should be noted that these IMO2020 sulfur emisisons regulations have gone into effect as of Jan 1 2020, and early indications are of very strong global compliance with the SOx emissions requirements, as well as a clear indication of successful program adoption and compliance in the relative market value of regular shipping fuel (HFO) vs IMO2020 compliant low-sulfur fuels (VLSD/ULSD). THis is despite the impact of COVID-19 during the first year of compliance with IMO2020 regulations.	Accepted but beyond the scope of changes to text at this stage	Alex Rau	Climate Wedge LLC	United States of America
85847	76	43	76	43	We suggest this line should be updated to clarify that the maximum sulphur content of fuels used by a vessel is 0.10% m/m.	Accepted. Taken into account	Government of Australia	Department of Industry, Science, Energy and Resources	Australia

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
43833	77	3	77	4	I would rephrase this as "...ozone depleting substances and ozone precursors, such as NOx and VOC from tankers", otherwise it could be misundersood as NOx and VOC being ozone depleting substances. On the role of these procursors in shipping you may want to cite the recent studies by Mertens et al. (2018) and Butler et al. (2020). - Mertens, M., Grewe, V., Rieger, V. S., and Jöckel, P.: Revisiting the contribution of land transport and shipping emissions to tropospheric ozone, Atmos. Chem. Phys., 18, 5567–5588, https://doi.org/10.5194/acp-18-5567-2018, 2018. - Butler, T., Lupascu, A., and Nalam, A.: Attribution of ground-level ozone to anthropogenic and natural sources of nitrogen oxides and reactive carbon in a global chemical transport model, Atmos. Chem. Phys., 20, 10707–10731, https://doi.org/10.5194/acp-20-10707-2020, 2020.	Accepted. Taken into account	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
85849	77	3	77	6	Suggest clarification: The current sentence implies that NOx emissions are prohibited and NOx Tier III applies to all diesel engines constructed since 2016. To clarify, NOx emissions are not prohibited. There are emissions standards on NOx implemented through Tiers (I, II and III) for engines >130kW. Tier II is the current global standard, except for in NOx emission control areas where the standard is Tier III. Tier II has applied globally since 2011. A marine diesel engine that is installed on a ship constructed on or after the following dates and operating in the following ECAs shall comply with the Tier III NOx standard: .1 1 January 2016 and operating in the North American ECA and the United States Caribbean Sea ECA; or .2 1 January 2021 and operating in the Baltic Sea ECA or the North Sea ECA	Accepted but beyond the scope of changes to text at this stage	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
85851	77	7	77	16	Suggest clarification: It is not clear what is meant by the statement "the EEDI literature shows there is a gap between the SEEMP requirements to the shipping companies and the requirements to management systems, monitoring, and reviews."	Accepted but beyond the scope of changes to text at this stage	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
85853	77	10	77	12	Suggest this statement may need to be confirmed, including against other sources. We note Stevens et al. (2015) specifically notes the EEDI may not stimulate the introduction of new ship engine technologies nor the use of alternative fuels in the first place.	Accepted but beyond the scope of changes to text at this stage	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
29763	77	12	77	13	Please consider specifying which policies that are relevant here for clarity.	Accepted but beyond the scope of changes to text at this stage	Government of Norway	Norwegian Environment Agency	Norway
85855	77	13	77	16	Suggest that consideration be given to referring to 'speed reduction and/or speed optimisation' instead of 'slow steaming' here, as both of the first two are mentioned in the Initial GHG Strategy as candidate short-term measures. Slow steaming is often used interchangeably with speed reduction.	Accepted. Taken into account	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
4157	77	22	77	22	My understanding is the the EU intends to include shipping into the ETS system. I am not aware of any decisions that have been done yet	Accepted but beyond the scope of changes to text at this stage	Monique Giese	KPMG AG	Germany
29765	77	22	77	23	As per march 2021, the EU has not formally decided to include shipping in its carbon trading system. We therefore suggest rewriting to "The EU Commission has proposed to include shipping ....". See the first point on page 1 in the Commission work program for details: https://ec.europa.eu/info/sites/info/files/2021_commission_work_programme_annexes_en.pdf, which states: "a) Revision of the EU Emissions Trading System (ETS), including maritime, aviation and CORSIA as well as a proposal for ETS as own resource (legislative, incl. impact assessment, Q2 2021)"	Accepted but beyond the scope of changes to text at this stage	Government of Norway	Norwegian Environment Agency	Norway
46107	77	26	78	14	The focus on drop-in fuels like stated in this chapter is policy-prescriptive. It does not seem justified. Many studies on this topic analyse also not-drop-in fuel options, such as hydrogen or ammonia (e.g. DNV GL, 2019: Comparison of Alternative Marine Fuels, 2019-0567, Rev. 3; UMAs, LR Techno-economic assessment of zero-carbon fuels, 2020). Therefore, we do not see the focus on drop in fuels for shipping as much as it is written in this chapter. Please revise the text. See also comment 314.	Accepted but beyond the scope of changes to text at this stage	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
23253	77	28	77	28	For this section, as a good emphasis is made on fuels, governance question also implies to question of financial aids. Reaching the goals also means rethinking the trajectories of public financial support and rethinking about whether we need to improve the current fleet or building new ships. What about the balance between old ships stopping working and new ships ?	Accepted but beyond the scope of changes to text at this stage	Government of France	Ministère de la Transition écologique et solidaire	France
23255	77	29	77	30	We recommand a clarification on this sentence, maybe there is typo	Accepted. Taken into account	Government of France	Ministère de la Transition écologique et solidaire	France
29767	77	42	77	44	Please revise for consistency if this is meant to be the 4th IMO GHG Study, as mentioned in the same chapter.	Accepted. Taken into account	Government of Norway	Norwegian Environment Agency	Norway
69845	78	10	78	23	In early 2021, ammonia already appears as a clear winner for deep sea shipping for, while not being a "drop-in fuel" stricto sensu, it can be used in a large fraction of the existing fleet with refurbishment for fuel bunkering, storage and injection in existing marine ICEs; it does not need carbon to be taken from the air or from biomass, which is a must for aviation, which could be a difficult competitor for this scarce resource; it is already handled on many ships as a refrigerant, and present as a cargo in dozens of ports worldwide; it is much easier to store and ship than hydrogen itself, and denser than liquid hydrogen; it can be partially cracked on-board with waste heat from combustion to deliver hydrogen in blend with ammonia, thereby increasing flammability (hydrogen serving as "pilot fuel"); it can be used as catalyst in selective catalytic recirculation systems ensuring low NOx emissions. Engine manufacturers, certification companys (Lloyds register, Korean register, DNV-GL, American Bureau of Ships, etc.), naval architects and shipbuilders (notably in China, Korea, Japan) are already collaborating to deliver engines and full commercial-scale ships (including ultra large containerships) running on ammonia, while about half the current large-scale green hydrogen production and export projects are dedicated to ammonia production, having in sight the fertilisers industry, the Japanese power plants and the forthcoming near-zero carbon ships.	Accepted but beyond the scope of changes to text at this stage	Cédric PHILIBERT	Institut Français des Relations Internationales	France
85857	78	10	78	11	Suggest rephrase the statement in Section 10.6.6 that "The scenarios presented by the IMO 4th GHG study do as described not bring (sic) the emissions down although they incorporate some efficiency improvements and a slight increase in the use of LNG" should acknowledge that the Fourth IMO Study does not incorporate emissions reduction projections from IMO's recently agreed combined technical and operation measure to reduce the carbon intensity of global shipping.	Accepted but beyond the scope of changes to text at this stage	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
10795	78	12	78	22	It is striking that, along this discussion of options, no reference to literature is proposed. Have the references already been given earlier in this subchapter? Alternatively, this is an mute but eloquent demonstration of the need for more R&D as pointed out on line 23 same page.	Accepted but beyond the scope of changes to text at this stage	Philippe Waldteufel	CNRS	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
85859	78	20	78	21	Suggest using 'speed optimisation' as an example here instead of slow steaming.	Accepted. Taken into account	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
15513	78	24	78	24	I question the usefulness of the figure on the right. Too many series makes interpretation impossible.	Accepted but beyond the scope of changes to text at this stage	Ryan Falconer	Auckland Council, New Zealand	Australia
23257	78	24	78	24	For Figure 10.21 : Adding in the table legend an explanation of the very important difference between the left and right-hand diagram would be important and add clarity.	Accepted but beyond the scope of changes to text at this stage	Government of France	Ministère de la Transition écologique et solidaire	France
8321	79	1	92	41	The description of transport in IAM scenarios provides a nice link to other chapters. Therefore, I find it quite unfortunate that this sub-section is placed at the end of the chapter. Moving it in the front would helo to contextualize the discussion of mitigation options in different transport modes etc.	Noted. We acknowledge that there are different pros and cons with the current chapter design, but we will regardless work to improve the interface with other sections in this revision.	Michael Jakob	MCC Berlin	Germany
70221	79	1	92	41	A discussion of the difference of IAMs and urban models is provided, while a discussion of the differences of IAMs and LCA models is needed as well (see e.g. https://www.sciencedirect.com/science/article/pii/S1361920919300513). In addition, it should be mentioned that IAMs do not consider LCA coefficients in optimal climate change mitigation pathways of the transport sector. To my best knowledge, only one study exists to date, which consideres the presence of life cycle emissions in the cost-optimal climate change mitigation pathway of the US vehicle fleet (DOI: 10.13140/RG.2.2.18061.87528, chapter 5, pp. 70-84). It is shown that life cycle emissions significantly affect optimal outcomes.	Accepted. We have added a sentence pointing to opportunities for better linkages bewteen LCA and IAMS in that which was section 10.7.7 in the SOD.	Paul Wolfram	Yale University	United States of America
79213	79	1	95	19	I've been quite critical of the outdated assumptions about auto and (more severely) truck and plane efficiency, but I'm unclear how corrections will get carried into section 10.7 (analyzing the outdated model assumptions in 10.7.6, leading to outdated findings in 91:25–32 ad 93:14–21), the up-front summary, and course higher-level summary chapters early in the WG3 and main reports. I trust these information flows are all attended to. For example, FAQ10.2 at 114:30–38 is simply wrong in today's market, though the FAQs are admirably clear.	Later versions clarified this.	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
75831	79	2	79	35	This classification/taxonomy is in general for ESMs rather than transport models only. Perhaps the taxonomy introduced by [6] (Table 1) is useful. It shows that it is not black and white and there are multiple models in the transition space from energy models to transport models. Not clear in this section what the added value of including national models is (i.e. the results are too specific and the section should focus on global trends) [6] https://doi.org/10.1080/15568318.2018.1466220	Noted. We presume the reviwer is reffering to IAMs not ESMs. In any case, the suggestet paper is very informative in exploring and organizeng the axis between energy and transport models. As the IAMs in principle covers multiple sectors, we believe that the proposed taxonomy is too narrowly defined. But indeed the paper presents good work. The authors understanding is that National and Regional models and results offers an important complement to global models. As regoinal variability in mitigation strategies can be significant.	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
79343	79	2	79	34	Although I am not familiar with these transport energy sectoral models, but my review of other models (specifically the CIMS-Urban model) and discussion with specialists indicates that these models tend to be biased in several ways that underestimate the effects and benefits of transportation demand management strategies. As modelling experts Garikapati, Young and Hou (2019) explain, "Recent technological advancements in mobility are creating many options for connecting citizens with employment, goods, and services, particularly in urban areas where modes such as bike and car shares, electric scooters, ridesourcing, and ridesharing are proliferating at a rapid pace. Analysis and tools for overall transportation planning are dominated by urban regional travel demand models whose roots in highway operations poorly reflect the system dynamics in denser areas where parking costs, convenience, and availability—not to mention sustainability concerns and quality of life—are driving people to an ever-greater spectrum of mobility services." Similarly, a major review concluded that, “Currently, most operational regional models in California have limited ability to represent the effects of transit, land use, and auto pricing strategies” (Rodier 2009). Tian, et al. (2015) also found that conventional models significantly exaggerate vehicle trip generation from mixed-use development. Specifically, current models tend to: * Significantly underestimate the impacts of active travel (walking, bicycling and their varients) and public trnasit improvement and encouragement strategies. Many models assume that total annual travel-kilometers are fixed, so each kilometer of reduced driving requires a mile of increased walking, bicycling or transit travel. In fact, active and public transport improvements often leverage large reductions in total travel-kms, so an additional walk/bike/tranit km reduce more than one vehicle-km. * Vehicle travel predictions are often based on old traffic models that do not account for local land use mix (within TAZs), walking and bicycling conditions, or other Smart Growth factors. * They includes a limited set of TDM and Smart Growth policies, and often overlook some of the most effective and beneficial. For example, they generally overlook parking policy reforms that include efficient parking pricing, commute trip reduction and	Noted. Different parts of the scientific literature cover different aspects of the transport sector transiton with different depth and detail. We strive to provide transparecy in this regard with respect to qualifying the outcomes of the literature reviewed in different sections in this chapter. This section covers a segment of the literature focusing on integraded, sectoral and regional models and the outcomes of these. In section 10.7.7 we summrize key insights but also qualify their scope, strenghts and weaknessess.	TODD LITMAN	Victoria Transport Policy Institute	Canada
29387	79	5	0	0	I would use ";" to separate the item of the list	Accepted. Thanks for your comment. We have fixed this.	Maria Pregnolato	University of Bristol	United Kingdom (of Great Britain and Northern Ireland)
29389	79	6	0	0	there is a dot between Yeb and et al	Accepted. Thanks for your comment. We have fixed this.	Maria Pregnolato	University of Bristol	United Kingdom (of Great Britain and Northern Ireland)
56965	79	12	79	13	Sentence unclear: Transport chapter was informed by the AR6 model excercises?	Accepted. The sentence in question is updated.	Government of United States of America	U.S. Department of State	United States of America

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
56967	80	5	80	6	Can the scenarios that are in line with achieving the target of the Paris Agreement be identified?	Noted. This is a very good question. Note that the Paris Agreement sets its goal to "limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels." Given this global, overall emission target, we extract the results from the IAMs grouped in bins by different temperature targets. The transport only models, including both GTEMs and NTEMs can not guarantee reaching these target per se, but aiming for the "fair share action" principles. We believe our explanation should be sufficiently clear. Nevertheless, we have improved the clarity.	Government of United States of America	U.S. Department of State	United States of America
15515	80	6	80	7	Suggest these are done as a series of one or two to a page to assist with analysis.	Noted. Thanks. Figure has been revised	Ryan Falconer	Auckland Council, New Zealand	Australia
28867	80	6	80	7	The heading text in Figure 10.22 is very small, making it hard to understand which groups of countries each chart refers to.	Noted. Thanks. Figure has been revised	Eoin Devane	United Kingdom Climate Change Committee	United Kingdom (of Great Britain and Northern Ireland)
47945	80	6	80	6	Figure 10.22: this figure is extremely insightful. One element that I struggle with: how do emissions reductions in transportation compare with other sectors? Does transport do more/less/the same as other sectors? And what about different parts of transportaiotn (e.f., on-road, aviation, etc.). There seem to be a huge amount of data behind this figure and potential to derive more valuable insights (on top of the great ones already there, kudos for putting this together).	Accepted. This is a great question, regarding the percept of transport reduction compared with the overall emission reduction in these different temperature targets.	Matteo Muratori	NREL	United States of America
56969	80	6	80	7	Labels on axis and for legends are too small on Figure 10.22 to read when printed.	Noted. Thanks. Figure has been revised	Government of United States of America	U.S. Department of State	United States of America
29391	80	29	0	0	I think it should be "suggests"	There is no line 29 on Page 80. Unfortunately we cannot identify what the comment references to. But we will do multiple careful editorial check to make sure that our sentences are clear and without any ambiguity.	Maria Pregnolato	University of Bristol	United Kingdom (of Great Britain and Northern Ireland)
56971	81	6	81	27	Are the references to 2020 emissions levels modeled or measured?	Accepted. Great clarification question. In theory, the modelled level should be the same as what's measured historically. In reality they may not be the same due to data quality issue (e.g. different modeling teams use different sources to characterise historical levels). In addition, in order to be consistent, the results in future years (2030, 2050, 2100) are compared against their own estimates of historical values. We added "the estimated" in the text to make it more clear.	Government of United States of America	U.S. Department of State	United States of America
75833	81	7	82	13	Probably this needs to be put into context. 43% GHG reduction in a 1.5 C scenario probably because aviation, shipping and trucks have limited alternative fuel choices in most IAM (and even in some transport models) and the models just implement energy efficiency measures as much as possible and the rest of the mitigation is left to negative emissions elsewhere in the system since there is no CO2 price that pays for further reduction in transport due to the lack of options in the models. If that is the case, this needs to be clearly stated as a limitation of the underlying methodology and it does not mean that the transport sector should have such a lenient target	Accepted. Great suggestion. A short paragraph has been inserted to reflect this comment.	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
82831	81	43	81	43	After "vary from 65% to 95%." Add: "Full decarbonization of land-transport could even be achieved for the freight transport sector in France. (Briand et al, 2019)". Reference: Yann Briand, Johannes Svensson, Martin Koning, François Combes, Gwennaël Lamy, Prabodh Pourouchottamin, Jean-Michel Cayla, Julien Lefevre (2019). Deep decarbonization pathways of freight transport in France, Descriptive Report, IDDRI.	Noted. Thank your for the suggestion. However, the suggested change does not fit with the paragraph here since it specifically focuses on a specific subsector with a particular country focus. This could be addressed in the freight sector review (Chapter 10.4.3)	Yann BRIAND	Iddri, Sciences Po	France
82829	82	2	82	2	To add afther the last sentence of the paragraph: "Latest results in developing countries, like in six latin american and carribean countries (Reference), reveal that deep decarbonization for the transport sector is achievable too with per capita transport emissions varying between 0 and 0.24 tCO2eq/cap." Reference: Bataille et al (2020). Net-zero deep decarbonization pathways in Latin America: Challenges and opportunities. Energy Strategy Reviews. https://doi.org/10.1016/j.esr.2020.100510"	Accepted. Thank you for the suggestion. We have added several new net-zero emission studies in the review and the specific reference is now included in the review.	Yann BRIAND	Iddri, Sciences Po	France
78909	82	16	82	16	good consumptions' ?? Should it be goods or freight?	Accepted. Replaced the "goods" word to "freight".	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
53745	83	1	83	3	The sentences here need references.	Reject. incorrect page and line number reference	ZHENG XINZHU	China University of Petroleum (Beijing)	China
28869	83	6	84	1	The charts in Figure 10.23 are of different widths, which makes them more difficult to compare by eye. Also, the headings for the third row of charts are on a different page to the charts they represent.	Accepted. Revised the figure	Eoin Devane	United Kingdom Climate Change Committee	United Kingdom (of Great Britain and Northern Ireland)
56973	84	1	84	4	Suggest adding labels or legend text to indicate which Figure 10.23 panel is R5 Regions (left?) and which is World (right?).	Accepted. Revised the figure	Government of United States of America	U.S. Department of State	United States of America
75835	84	5	85	26	Perhaps put all of this information on activity in perspective (expanding a bit the last sentence) by mentioning that this is a classical approach: 1. Based on GDP; 2. Following historical trends. This does not consider the disruptive effect that BEV + AI + Mobility as a service could have where it could increase significantly the pkm but it could still decrease significantly the GHG emissions (by BEV + renewable electricity in manufacturing + low-carbon production of materials). These aspects are mentioned earlier in the chapter but it seems to be disconnected from this section where the classical IAM analysis is done and this type of model has years, if not decades, of lag with reality	Agree with your observation. Added a sentence to higlight this "The proliferation of shared and on demand mobility solutions are leading to rebound effects for travel demand (Coulombel et al., 2019; Chen & Kockelman, 2016) and this is a new challenge for modelling."	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
12577	84	21	84	22	"The ITF, however, suggests that ambitious decarbonisation policies could reduce global demand for passenger transport by 2050, compared to the business-as usual scenario. This demand reduction, in turn, could reduce emissions from passenger transport by 70% compared to the BAU scenario". The way the second sentence is phrased suggests that the 70% drop in emissions is from demand reduction alone (rather than also including the effect of lower carbon intensities and different mode shares in the high ambition scenario). In our ITF Outlook 2019 results, the pkm are 20% lower in the high ambition scenario than in the BAU scenario.	Accepted. We have revised the sentence and removed the value of % emission reduction in the ambitious scenario due to the reduction in the passenger transport demand	Matteo Craglia	International Transport Forum	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
84157	84	27	18	30	Would it not be helpful to reader to point out how work in the coming 5 years could address this limitation. Elsewhere in the report, changes in how land use serve the community could remove 25% of the demand for passenger transport, models should be looking to explore integrated outcomes where there is such a interdependancy (and where the 25% figure is actually uncertain and maybe higher).	We have highlighted the limitation of IAM models based on the literature and demand reduction in urban transport demand through land use changes are presented in the chapter number 5 in section 5.6	Kym Lennox	climate change equity	Australia
56975	84	29	84	30	Sentence incomplete: "... as mitigation efforts would likely increase travel costs *and(?)* could lower transport demand ..."	Accepted. Revised the sentence	Government of United States of America	U.S. Department of State	United States of America
79345	85	5	85	20	It would be helpful to be more specific about the omissions and biases in the different models. Many transport emission models greatly underestimate the potential energy savings, emission reductions and co-benefits from an integrated set of TDM and Smart Growth policies, as discussed above. It is important that policy makers and practioners understand the direction of these biases and take them into account when developing emission reduction plans: current models tend to exaggerate the benefits of fuel shifting (such as electrification) and undervalue the impacts and benefits of TDM and Smart Growth policies.	We have tried to highlight all the major limitations especially within IAMs in modelling demand transitions however we did not encounter more literature than what we cover on this. We have added in this draft about challenges being posed from the emerge of shared and on demand mobility which can lead to rebound effects.	TODD LITMAN	Victoria Transport Policy Institute	Canada
56977	85	23	85	26	Suggest adding one or two sentences highlighting mitigation potential of transportation demand changes from Chapter 5, relative to the BAU or other scenarios presented in the chapter (e.g., 2.9x-3.3x increase in road passenger travel presented on page 85).	Accepted. Added a sentence to present the mitigtion potential of different mitigation strategies(social-behavioural , infrastrature and technology) provided in Table SM5.1	Government of United States of America	U.S. Department of State	United States of America
11301	85	27	85	39	I suggest adding this sentence, or similar, perhaps at line 35. "The ITF suggests that reallocating existing road space from private cars to public transit, walking and cycling can produce very significant mode shifts and 'traffic evaporation' (2021)." ITF (2021), Reversing Car Dependency: Summary and Conclusions, ITF Roundtable Reports, No. 181, OECD Publishing, Paris. www.itf-oecd.org/avoiding-car-dependency	Accepted. Thank you. We have added an abbreviated version of this suggestion, highlighting the role urban form can play in driving modal shifts at the location you specified.	Eric Doherty	Ecopath Planning	Canada
79347	85	30	85	32	This statement is incomplete and biased because it ignores policy biases that favor automobile travel over more affordable and resource-efficient modes: "private cars have displaced public transit, particularly in OECD countries, as consumers' value of time and the aspirations for comfort, status symbols, and convenience have increased with GDP growth". Please change it to, "During the last century, private automobile has increased due to a combination of increased incomes and automobile-oriented policies that degrade other modes". See: Jeffrey R. Brown, Eric A. Morris and Brian D. Taylor (2009), "Paved with Good Intentions: Fiscal Politics, Freeways, and the 20th Century American City," Access 35 (www.uctc.net), Fall, pp. 30-37; at www.uctc.net/access/35/access35.shtml. Timothy Garceau, et al. (2013), "Evaluating Selected Costs of Automobile-Oriented Transportation Systems from a Sustainability Perspective," Research in Transportation Business & Management, Vol. 7, pp. 43-53; www.sciencedirect.com/science/article/pii/S2210539513000059. Susan Handy (2020). What California Gains from Reducing Car Dependence. National Center for Sustainable Transportation (https://ncst.ucdavis.edu); at https://escholarship.org/uc/item/0hk0h610. Giulio Mattioli, et al. (2020), "The Political Economy of Car Dependence: A Systems of Provision Approach," Energy Research & Social Science, Vo. 66 (https://doi.org/10.1016/j.erss.2020.101486); at www.sciencedirect.com/science/article/pii/S2214629620300633. Todd Litman (2014), Analysis of Public Policies that Unintentionally Encourage and Subsidize Sprawl, in partnership with the LSE Cities program (http://lsecities.net) for the New Climate Economy (http://newclimateeconomy.net); at http://bit.ly/1EvGtIN. Gregory H. Shill (2020), "Should Law Subsidize Driving?" University 0f Iowa Legal Studies Research Paper No. 2019-03, New York University Law Review, (http://dx.doi.org/10.2139/ssrn.3345366).	Accepted. Thank you for the suggestion. We have added a modified version of your suggestion, which now indicates that policy has also driven the shift to private transit. We have also added a citation to Mattioli et al., which provides the most direct support for this statement.	TODD LITMAN	Victoria Transport Policy Institute	Canada
17143	85	33	85	34	A recent study with evidence from several cities around the world finds that even in cities like Amsterdam and Stockholm, public transport is slower than car driving except in very particular contexts and situations (city core, rush hour): Liao, Y., Gil, J., Pereira, R. H., Yeh, S., & Verendel, V. (2020). Disparities in travel times between car and transit: Spatiotemporal patterns in cities. Scientific reports, 10(1), 1-12.	Accepted. Thank you for the suggestion. We have added this citation and added the study's insights to this section.	Giulio Mattioli	TU Dortmund University	Germany
75837	85	44	86	5	It would be great if the reasons for the trends can be briefly mentioned instead of just mentioning the extent of the activity increase for each one. One in particular that seems counterintuitive is the trend in passenger transport in railway. I would expect stricter GHG scenarios lead to higher cost of private transport nudging the change to more efficient modes of transport	Noted. Thanks	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
56979	86	19	86	21	Incomplete sentence: "... through 2100 in the available ..." Does "little growth or even reductions" refer to "across scenarios by 2100" or to 1.5°C scenarios?	Accepted. The correct interpretation is "across scenarios through 2100". Thank you for pointing out this error.	Government of United States of America	U.S. Department of State	United States of America
28871	86	21	86	21	"through 2100 in the available" seems to be missing a word at the end of the sentence.	Accepted. The correct interpretation is "across scenarios through 2100". Thank you for pointing out this error.	Eoin Devane	United Kingdom Climate Change Committee	United Kingdom (of Great Britain and Northern Ireland)
56981	87	1	87	2	Do "weaker climate targets" refer to C3-5 and C6-7? Is there an explanation for why freight international shipping is highest under C1-2, more stable under C6-7, and lowest under C3-5?	Accepted. Yes - we have added a clarification that weaker climate targets means moving from C1-2 to C6-7.	Government of United States of America	U.S. Department of State	United States of America
52509	87	20	87	20	Is it supposed to say - "enhanced shared mobility?" The word "shared" seems to be missing	Rejected. Enhanced mobility here refers to a diverse set of actions, including improving shared mobility and shifting to non-vehicle travel modes.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
53695	87	31	91	48	This is a MAJOR concern which could be due to a misunderstanding. My understanding of this section after reading it is that it explores the spread of parameter assumptions in the scenarios, not the impact that changes in the assumptions actually have on the outcomes. For instance, if few of the scenarios in the database have been constructed with assumptions that all transports are electric, we will see this in the plots as electric drive having a low market share. Put differently, I read it as that it is a study of how evaluated input parameters were distributed, not of what effect a variation in the different input variables has on the model output (temperature). If this understanding is correct, there are several causal claims made in the text that are not supported by the methodology. If the methodology actually allows for drawing causal conclusions (i.e. that an even share of biofuels and EVs is the best path towards <1.5 deg C), then I think the methodology needs to be explained in more detail. It could be that I just don't understand sufficiencly well what variables are inputs and outputs in the IAMs and GTEMs, but if so, I think this should be explained better in the text.	Rejected. Thank you for the question. While we appreciate the desire for more information on IAMs and GTEMs here, there is not sufficient space in our section to cover these details. Instead, IAM and GTEM model descriptions are provided in a centralized location to avoid redundant descriptions - please see 10.7.1. As for your question re: causality, the IAMs and GTEM results in Figure 10.24 and not showing model inputs (or parameters). Rather, these models take more basic inputs, then determine transport mode shares that, in conjunction with other energy and economy shifts, meet a given temperature target (e.g., 1.5 C).	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
28873	87	41	87	41	"passenger transport's energy intensity drops to between 10%-30%" should I think say "by between 10%-30%", as the final figures are around 70-90% of reference values.	Accepted. Yes, thanks for poiting that out.	Eoin Devane	United Kingdom Climate Change Committee	United Kingdom (of Great Britain and Northern Ireland)
53697	87	41	87	41	"drops to between" -> "drops by between"	Accepted. Yes, thanks for pointing that out.	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
52511	87	45	87	45	Is it supposed to say: "1.9%-2.1%?"	Accepted. Yes, thanks for pointing that out.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
53699	88	1	88	1	This is a very interesting figure, but the fact that the medians are not monotonically increasing within each subplot makes the entire thing look suspect. Within the C1-C5 range, a quick and steady decrease in energy intensity of both passenger and freight transport appears to increase global warming! (C5 < C1 & C2 in all but one plot)	Noted. So there is indeed some variation. Forexample there is a different composition of models and also experiments within the different bins. As such the trends are not as mononitic as one could expect e.g from multiple runs from the same model looking at different temperatures targets and all else constant.	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
27811	88	19	88	20	Sentence to be edited.	Accepted. Yes, thanks for pointing that out.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
53701	89	1	89	2	This is an interesting conclusion, but based on what is explained here (I have not looked at the original paper) I don't see how the methodology allows for such a conclusion to be drawn. Please verify, and/or explain.	Accepted. These are insights inferred by the results and modelling approach. Simply speaking, the models will choose to decarbonize where cheapest first. So if a sector is decarbonizing slower than the other sectrors, it is beccause the options at hand (for the model) in that sector, is more costly than those in the other sectors.	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53703	89	28	89	32	Maybe also mention that a challenge here is the long lifespan of vehicles. Replacing the rolling fleet of ICE polluters will likely take 15-25 years from the day only electric vehicles are manufactured.	Noted. We will take the suggestion into consideration.	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
56983	89	31	89	32	Earlier parts of Section 10.7 state that segments of the transport sector are hard-to-decarbonize, that the transport sector may take a less steep reductions trajectory than the cross-sectoral average (page 10-82, lines 3-4) and still be consistent with the 2°C target, and that there are lower cost mitigation options outside the transport sector. Here, the text states that the "LCA literature suggests technologies exist today that would already match and exceed the median energy and carbon intensity values that might be needed by 2050 for stringent mitigation scenarios". Suggest introducing the point that suitable technologies to decarbonize transportation do exist earlier in Section 10.7.	Noted. So from an editorial perspective we present the LCA results in 10.4. Then we introduce and explore the results from the models in 10.7. Then, indeed at the back end of 10.7 we seek to bridge between these two parts of the literature. Now, the main reason that these lower emission options are not as prevailing in the models, relates to the cost paramaterization. So simply speraking, the models find other ways of reducing the emissions in a more cost effective manner. So it is not that the models does not have these options. We will revise the text as to get that artifact better across to the reader.	Government of United States of America	U.S. Department of State	United States of America
78767	89	33	91	48	Ram et al. (http://energywatchgroup.org/wp-content/uploads/EWG_LUT_100RE_All_Sectors_Global_Report_2019.pdf ; also part of the AR6 scenario database) have shown that a zero CO2 emission trajectory until 2050 is possible for the entire transport sector, based on full and technology transitions as detailed in Khalili et al. (https://www.mdpi.com/1996-1073/12/20/3870). This transition has also proven to be cost attractive.	Noted. Thank you for your submissions. We confirm, as can be seen in fig 10.23 SOD that we do Indeed have scenarios that show that net zero emissions are possible.	Christian Breyer	LUT University	Finland
28875	90	1	90	2	As with comment 4 above, the heading text in Figure 10.26 is very small, making it difficult to see what each set of charts refers to.	Noted. We will work to improve the readability of the figures.	Eoin Devane	United Kingdom Climate Change Committee	United Kingdom (of Great Britain and Northern Ireland)
53705	90	1	90	1	I found this figure unnecessarily difficult to read. For instance, the text is very small and the policy and reference columns have no data, while the rest are crammed together.	Noted. We will work to improve the readability of the figures.	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
53707	90	1	90	1	The fact that the medians within each group don't sum to 1 makes me think that it's easy to misread this figure. put differently, no world can exists where all the values are at their medians.	The median value simply represents the 50th percentile of the data, there is no physical reason as to why summing the medians within a group would sum to 1. In fact, within a set of values, if they were all the same value then the median value would by definition be the same for all values in that set.	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
56985	90	1	90	2	The Figure 10.26 title is too small to read and can't see the blue shapes in the legend or figure.	Noted. We will work to improve the readability of the figures.	Government of United States of America	U.S. Department of State	United States of America
75839	90	2	90	2	It would be great to see this disaggregated by mode since (passenger) cars are completely different from e.g. aviation. Perhaps since aviation and shipping were discussed before, this could have: 1. Total; 2. Cars; 3. Trucks. The relevance of (2) is to see how much in line it is with the battery costs trends (i.e. at what point do sales reach 100%) and with the ICE phase-out announcements. The relevance of (3) is that as stated earlier in the chapter, there is no easy and clear answer for trucks so it would be interesting to see where the average (and 25-75th percentile) of the models is	We agree, however our capabilities in this regard are constrained by the resolution of the data submitted to the AR6 scenario database.	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
52537	90	8	91	46	The discussion is limiting Land Transportation decarbonization in fuel switching to EVs, FCV and Biofuels	The section in question presents the outcomes from a segment of the literature and does by no means cover all mitigation options for the transport sector. We have tried make this clear in the introduction as well as the outro of this section. Furthermore, the coverage of technologies reflects the body of technologies most studied within the research literature.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
75841	90	23	90	23	Could it be that the low hydrogen share across models is just because most models either: 1. Do not consider the full range of hydrogen pathways (including synthetic fuels and ammonia) across all the transport modes; or 2. The assumptions for fuel cells, hydrogen production, refueling/bunkering are outdated or not so ambitious (in line with deployment expected for a net zero emissions world which is a more recent trend). I think the answer is yes, if so, perhaps good to reflect in the text	Thanks for your comment. A key point you raise is that some of these outcomes e.g levels of H2 in the fuel mix, are not in-line with what you would expect for a net zero emissions (for the transport sector). If you look at section 10.7.2 you may note that the overall emissions of the transport sector might not be at net zero even if the global emission levels are net zero. As such the fuel mix results presented also reflects this. We would be cautious in suggesting that the H2 parametirization is outdated.	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
27813	90		90		Figure 10.26 to have the horizontal axes corrected.	Thanks - we will work to improve the readability of the figure in question.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
78911	91	33	91	33	does 'non-passenger transport' mean freight transport - if so this is an odd expression	Thanks we will revise this.	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
78913	91	39	91	42	while I wouldn't disagree with the overall conclusion in this sentence, it would be more convincing if there had been a fuller assessment in the chapter of the potential of 'logistics improvement' and 'high-efficiency technologies' (particularly IT-related) to cut freight emissions.	Thanks for the comment. Our intention is to cover this in the synthesis in section 10.8	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
79789	92	1	92	41	The modelling literature is missing two recent papers that do not follow the dominant models but these are new approaches for modelling the EV penetration using different prognostic tools (https://doi.org/10.1063/1.5117039) and the evaluation of the electricity demand and GHG emissions that these scenarios will have (https://doi.org/10.1016/j.egyr.2020.09.025). As this is a review in literature on modelling it should be included in this subsection 10.7.7 Insights from the modelling literature	Section 10.8 summarizes the preceeding section 10.1-7. We have noted the suggested papers.	Constantinos Psomopoulos	University of West Attica, Department of Electrical and Electronics Engineering	Greece
53709	92	21	92	22	"as the mitigation potential ..." <-- Not entirely. Electric vehicles are more energy efficient also. Carbon capture is far more feasible in power plants than in vehicles, so it's likely better in the long run to run on electricity in either case. Due to low efficiency, hydrogen produced with electricity is however a far worse emitter than ICE, *unless* the source of electricity is mostly fossil-free.	The broader paragraph principally points to the need to take into account both fuel/electricity prodution in addition to any tailpipe emissions. The sentence in question highlights this wrt electric vehicles, though the same is true for hydrogen production. The paragraph is moderately updated to improve readability.	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
6157	92	23	92	30	Following articles indicate the needs for subnational research in transport emission estimation to consider the urban conditions on the tranpsort situations including trip length, mode choice, and congestion. - Matsuhashi, K.; Ariga, T. Estimation of passenger car CO2 emissions with urban population density scenarios for low carbon transportation in Japan. IATSS Res. 2016, 39, 117–120. - Kii M. Reductions in CO2 Emissions from Passenger Cars under Demography and Technology Scenarios in Japan by 2050. Sustainability. 2020; 12(17):6919. https://doi.org/10.3390/su12176919	Noted, though the variation in outputs and the coverage of studies/models that would be required for sub-national regional resolution is far outside the scope of the review we are conducting.	Masanobu Kii	Kagawa university	Japan
56987	92	26	92	29	Sentence references "AI, autonomy and big data" (along with heavy duty fuels and digital communication replacing travel) as unexpected technological innovations with a cross-reference to Section 10.2. Suggest providing an example or more detail on how AI, autonomy and big data can decarbonize the transport sector.	Later versions clarified this.	Government of United States of America	U.S. Department of State	United States of America
75843	92	27	92	28	It is good that the limitations are explicit and clear but it does not seem reasonable to exclude innovations such as AI, autonomy and big data. Those are known and those will come (especially when a time horizon to 2050 or 2100 is used). These should be part of the modeling as opposed to, for example, a breakthrough in energy density and cost of batteries that would allow to shift all the trucks to electricity without major cost increases. The latter would be counting on something that is not yet clear now while the AI/autonomy example is something that is clear now and it is more advanced	Noted. We would like to point to that we are not excluding these, we are merely explaining the coverage in the reviewed literature. It is likely that more studies of these topics will happen in the future and add substantial variation in many of the outputs of interest.	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
10455	92	31	92	31	After line 31, could you please add the following text?: "Vehicles able to be charged autonomously while parked and/or in-motion is an innovative technology where the type of charging infrastructure will be particularly relevant (Rothman, 2020; Soller, 2019)". Gregor Soller. Beton unter strom. VISION mobility, October 2019. 86-87. https://static1.squarespace.com/static/5a12bbb7bff200f859bcb08c/t/5dbb40456f8b1269bc23f4a3/1572552851335/2019_10_Vision+Mobility_INTERVIEW_Mauricio+Esguerra.pdf Tiran Rothman. Complementary equity research reports on Electreon Wireless Ltd. 2019 Annual Update. May 25, 2020. Frost & Sullivan. 3211 Scott Blvd #203, Santa Clara, CA 95054. https://ww3.frost.com/files/3315/9058/8341/Electreon_annual19_250520_isa.pdf https://www.frostequityresearch.com/	Later versions clarified this.	Aniceto Zaragoza	Oficemen	Spain
11611	92	31	92	31	After line 31, could you please add the following text?: "Vehicles able to be charged autonomously while parked and/or in-motion is an innovative technology where the type of charging infrastructure will be particularly relevant (Rothman, 2020; Soller, 2019)". Gregor Soller. Beton unter strom. VISION mobility, October 2019. 86-87. https://static1.squarespace.com/static/5a12bbb7bff200f859bcb08c/t/5dbb40456f8b1269bc23f4a3/1572552851335/2019_10_Vision+Mobility_INTERVIEW_Mauricio+Esguerra.pdf Tiran Rothman. Complementary equity research reports on Electreon Wireless Ltd. 2019 Annual Update. May 25, 2020. Frost & Sullivan. 3211 Scott Blvd #203, Santa Clara, CA 95054. https://ww3.frost.com/files/3315/9058/8341/Electreon_annual19_250520_isa.pdf https://www.frostequityresearch.com/	Later versions clarified this.	PEDRO MORA PERIS	UNIVERSITY	Spain

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79349	92	31	92	34	This statement is unclear: "Still, the models can find solutions encompassing the transport sector and its interactions with other sectors that are compatible with stringent mitigation targets. This would mean our solution space is wider than that which is explored by the models, so there is still a need to understand better how all options in combination may support our mitigation targets." I suggest changing it to: Most currently-used transport emission models have overlooked or undervalued some emission reduction strategies, particularly those that involve transportation demand management and Smart Growth development policies. By improving resource-efficient and affordable travel options (walking, bicycling, e-bikes, ridesharing, public transit, MaaS, and telework) and creating more compact, multimodal neighbrhoods these tend to provide significant economic, social and environmental co-benefits. This suggests that the range of cost-effective emission reduction solutions is wider than that previous studies suggest. To be comprehensive, transportation emission reduction modelling should account for the following factors: * Embodied emissions from vehicle and fuel production. * Rebound effects (the additional vehicle-kilometers caused by reduced vehicle oprerating costs) and the resulting increases in any external costs (congestion, road and parking infrastrure subsidies, crash risk, non-tailpipe pollution, and sprawl-related costs). * The cost-efficiency, measured per unit of emissions reduced, considering all benefits and costs. * Co-benefits provided by TDM and Smart Growth policies. * Social equity impacts, including fairness benefits of more efficient road, parking and vehicle insurance pricing, and the benefits to disadvantaged groups from improving affordable modes.	The shortcomings discussed in this section are for global integrated assessment models or national-level energy models that span multiple sectors. In fact, many transportation specific models do include detailed nuances of changes in mobility (active travel modes, transit, MaaS, etc). While it would be infeasible to include many of these details into broader multi-sector models, many IAMs attempt to capture these effects in the aggregate through changes in demand/energy/carbon intensity of the sector as a whole. As modeling efforts into mobility details are refined, so too will these be reflected (at some level) in larger scale models. In reference to the specific factors, items 1-3 (embodied emissions, rebound effects, and cost-efficiency) are certainly included in most, if not all, of the large-scale models reviewed within this section. The co-benefits from TDM/Smart Growth are likely to improve in the future as more studies inject these conversations into the transport sector of broader models. Lastly, while social equity impacts is a crucial topic to consider in transitioning to a decarbonized society, these are not strictly considered over the suite of mitigation options to reach climate change targets.	TODD LITMAN	Victoria Transport Policy Institute	Canada
52513	92	36	92	38	"The global models suggest that such deeper decarbonisation in other sectors could be more cost-effective than enforcing a zero-emissions target for the transport sector in isolation." Include this statement in the executive summary for chapter 10	Later versions clarified this.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52515	92	36	92	38	"The global models suggest that such deeper decarbonisation in other sectors could be more cost-effective than enforcing a zero-emissions target for the transport sector in isolation." Include this statement in the SPM	Later versions clarified this.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
53711	92	37	92	38	Can this point be expanded on? I don't understand how this conclusion was arrived at, but it's an important one. I work with decarbonization of road freight, and I increasingly often hear (unsourced) claims that biofuels, e-fuels and hydrogen are likely to be needed more in other sectors like aviation and steel production. As these are expected to be supply-limited over the coming 20 years, to use these in the transport sector would then be detrimental to the overall decarbonization of society. It would then follow that only direct electrification remains as an option for road transport.	Noted. The insight we tried to communicate is though not that these fuels per se are needed elswhere, but rather that other sectors might be cheaper to decarbonize. E.g the energy sector.	Jakob Rogstadius	RISE - Research Institutes of Sweden	Sweden
28591	93	14	93	24	I think the assessment should be more open to a role for direct electrification of a number of road freight vehicles, starting from light commercial and vehicles used for urban deliveries. See https://www.itf-oecd.org/how-urban-delivery-vehicles-can-boost-electric-mobility	Accepted. Text added.	Pierpaolo Cazzola	International Transport Forum	France
56989	93	14	93	24	Opportunities exist in heavy vehicle systems to increase their contribution to reducing transport climate impacts. Research is needed to support these advancements that carry significant potential to greatly reduce transport climate impacts. These may be considered high risk/big return investments domestically and internationally.	Accepted. Text added.	Government of United States of America	U.S. Department of State	United States of America
69847	93	19	93	19	Aviation is looking towards synthetic hydrocarbon drop-in fuels based on DAC with renewables-based H2 -but shipping is not, first because it does not need the specific energy of hydrocarbons (ships can easily accomodate a heavier fuels, planes cannot, the fuel weight is already up to 45% of maximum take-off weight), and second... because aviation does, and ship owners do not want to compete with airlines and air passengers for scarce resources. Ammonia is not a perfect "drop-in" but still sufficiently close to be, as it can burn in existing marine diesel engines (which are ~50% efficient).	Accepted. Text has been oriented to this approach in the new version.	Cédric PHILIBERT	Institut Français des Relations Internationales	France
24693	93	20	93	21	Hydrogen produced via electrolysis: both renewable and nuclear power can be used in this process (see reference already used in the chapter: Bicer, Y., and Dincer, I. (2017). Life cycle assessment of nuclear-based hydrogen and ammonia production options: A comparative evaluation. International Journal of Hydrogen Energy, 42(33), 21559–21570. https://doi.org/https://doi.org/10.1016/j.ijhydene.2017.02.002). So we recommend replacing "based on combining carbon extraction from the atmosphere with hydrogen produced from renewables" with "based on combining carbon extraction from the atmosphere with hydrogen produced from low-carbon electricity"	Understood but no changes as nuclear is not seen as feasible in rest of AR6 assessments due to time and cost contraints. Following approach adopted by the rest of the report.	Ann Jessica Johnson	FORATOM (European Atomic Forum)	Belgium
5523	93	21	93	21	replace Renewables" by "low carbon sources"	No change due to report approach.	Michel SIMON	Retraité/ Pdt d'association	France
1323	93	25	93	36	This is a very difficult paragraph to read. Especially the first sentence is too long and therefore very difficult to interpret. Another problem is that demand and efficiency are combined in one topic. Demand can either decrease, and thereby contribute to the GHG reduction goal or increase which make it harder to reach the goal. In the end of the paragraph there is speaking about demand reduction, which is maybe better to include also in the heading. However, autonomous vehicles may increase transport demand, and also shared mobility may replace walking trips thereby also increasing demand for motorised transport.	Accepted. Paragraph has been edit and text added. Demand and Efficiency are retained however.	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
70347	93	25			I miss classical demand management policies: Pls discuss role of fiscal policies (higher taxes/prices) for fuels, vehicles, etc. In urban areas: Access management/restrictions, parking and space mangement/restrictions. Mode choice and shift policies? Shared mobility (not only shared economy)? Technical efficiency? Logistical & operational efficiency? Occupancy?....where are all these standing notions of transportation planning/management?	Accepted. Some modifications to show these are just recent additions to transporatation management	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
79351	93	25	93	35	This is an awfully long and confusing sentence. I suggest restructruing.	Accepted. Paragraph has been edited	TODD LITMAN	Victoria Transport Policy Institute	Canada
70349	93	44			"models suggest".... Is this correct? These are prescriptive or exploratory scenarios aiming to achieve a certain CO2/temperature target. Then "models assume" or "require" might be more appropriate language.	Accepted. Text corrected.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
75845	93	44	93	44	This sentence mentions 68% (for 25th) while the previous page (line 6) mentions 43% (median) and page 81 (line 8) also mentions 43% perhaps either eliminate it here (preferred since it was mentioned a page before) or make it consistent (both are correct since they refer to different percentile but the same number could be used)	Noted. No changed in text as both shows different percentile.	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79353	94	1	94	9	This table lumps together demand management and fuel switching (particularly electrification), although many of their impacts are very different. For example, because vehicle electrification is likely to increase owners' total vehicle travel, unless implemented with TDM and Smart Growth policies, it is likely to increase sprawl-related costs and social inequity, while TDM and Smart Growth policies that improve affordable mobility and housing optioins provides large social equity benefits.	Noted and can see the issue. No changes in table, TDM menitoned in 10.2 and other sections cover this distinction.	TODD LITMAN	Victoria Transport Policy Institute	Canada
1325	94	8	94	10	The text in table 10.7 is not readable.	Noted. Revised	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
15517	94	8	94	9	Table 10.7 needs its own page.	Noted. Revised	Ryan Falconer	Auckland Council, New Zealand	Australia
28877	94	8	94	9	The text in Table 10.7 is very small, to the extent that it is difficult to read even when zoomed in.	Noted. Revised	Eoin Devane	United Kingdom Climate Change Committee	United Kingdom (of Great Britain and Northern Ireland)
50081	94	8	94	9	Too small to read.	Noted. Revised	Masahiro Sugiyama	University of Tokyo	Japan
52517	94	8	94	9	Table 10.7 is hard to read	Noted. Revised	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
56991	94	8	94	9	Table 10.7 is very difficult to read. It needs to be edited and potentially broken into multiple tables.	Noted. Revised	Government of United States of America	U.S. Department of State	United States of America
70351	94	8			Table 10-7 too small print to be legible.	Noted. Revised	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
27815	94		94		Table 10.7 is difficult to read.	Noted. Revised	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
31681	94				Table 10.7: Please spell out LoA, LoC	Accepted. Text corrected.	Shreya Some	Ahmedabad University	India
70353	95	5			I guess "Low Carbon Fuels" instead of simply "Fuels"...	Noted. No changed in text as it refers to low and net zero.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
43139	95	10	95	11	The statement is now obsolete. As per 2021, there are commercially available battery electric heavy duty vehicles 36t GCW (for short-haul), hence TRL 8 (e.g. DAF CF Electric) . Also, there are hydrogen HDVs commercially available in Switzerland, hence TRL 8 (Hyundai Xcient Fuel Cell).	Accepted. Text has been improved.	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
17145	95	12	95	19	The paragraph is unclear	Accepted. Text added.	Giulio Mattioli	TU Dortmund University	Germany
79355	95	13	95	18	This statement is unclear: "They have been addressed consistently for a number of decades but are not by themselves transformative in the transport sector. There is considerable literature supporting demand efficiency on all criteria except institutional issues, where such options are not generally given sufficient priority and on the criteria of socio-cultural acceptability where such changes are generally difficult to achieve politically unless presented with a strong set of change tools." I strongly disagree that demand management is not transformative, and that it is not supported by instituions. In fact, the transportation planning world is undergoing a paradigm shift to more comprehensive and multimodal planning that evaluates performance based on accessibility rather than mobility. Many jurisdictions now have vehicle travel reduciton targets as part of their emission reduciton plans, and to help achieve other economic, social and environmental goals, including social equity. This can be transformative if fully supported. Please discuss this concept and its implications for emission reduction planning. To use a specific example, the discussion of "leapfrogging" and "transformation" seems to assume that thes are purely technical, ignoring policies such as Bus Rapid Transit, streetscaping and road space reallocation to favor resource-efficient modes, and efficient transport pricing. This report should recognize that such policy reforms are as important as technological innovations. See: ACEEE (2019), Sustainable Transportation Planning, American Council for an Energy Efficient Economy (www.aceee.org); at https://database.aceee.org/city/sustainable-transportation-planning. Lists examples of VMT reduction targets in various communities. Shlomo Angel and Alejandro M. Blei (2015), "The Productivity Of American Cities: How Densification, Relocation, and Greater Mobility Sustain the Productive Advantage of Larger U.S. Metropolitan Labor Markets," Cities; at www.sciencedirect.com/science/article/pii/S0264275115300226; summary at http://www.citylab.com/commute/2016/01/commute-times-dont-grow-as-fast-as-cities-do/422457. Jonn Axsen, Patrick Plötz and Michael Wolinetz (2020), "Crafting Strong, Integrated Policy Mixes for Deep CO2 Mitigation in Road Transport," Nature Climate Change (https://doi.org/10.1038/s41558-020-0877-y).	Accepted. It is clear that shifts are occurring but much literature shows that changes of behaviour are difficult and institutional change is slow.	TODD LITMAN	Victoria Transport Policy Institute	Canada
70355	95	14	95	18	I can hardly understand. Please formulate in 3-4 sentences, and provide (cross-)references.	Noted.some changes made	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
52519	95	15	95	18	"There is considerable literature supporting demand efficiency on all criteria except institutional issues, where such options are not generally given sufficient priority and on the criteria of socio-cultural acceptability where such changes are generally difficult to achieve politically unless presented with a strong set of change tools" Include this statement in the executive summary for chapter 10	Noted. ES is still under review.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52521	95	15	95	18	"There is considerable literature supporting demand efficiency on all criteria except institutional issues, where such options are not generally given sufficient priority and on the criteria of socio-cultural acceptability where such changes are generally difficult to achieve politically unless presented with a strong set of change tools" Include this statement in the SPM	Noted. SPM is still under review	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
70357	95	41			TTS is still in development & preparatory phase? Then it seems premature to assess whether and how beneficial for the climate. No discussion of what is substituted or avoided by this tram (motorbikes or bicycles, for instance), but this is crucial for its net impact.	Accepted. Text added.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79237	95				Suggest all the boxes in the feasibility section are place in corresponding sections throughout the main chapter e.g. Box 10.2 electromobility under 10.2 Systemic change; Box 10.3 critical minerals in section 10.3.1 Battery technologies; etc. This will communicate the opportunities and barriers in a more coherent way; and then summarize those opportunities/limitations in 10.8 Feasibility.	Accepted. Both Boxes will edited intp 10.2 and 10.3 if space is available.	Martino Tran	UBC	Canada
31683	96	14			"They have adopted SDG goals and are establishing partnerships"- will be SDG as the G is goals	Editorial. Text added.	Shreya Some	Ahmedabad University	India
29393	97	0	0	0	The table in the box has the Word "symbols" to show spaces	Will be revised	Maria Pregnolato	University of Bristol	United Kingdom (of Great Britain and Northern Ireland)
52523	97	1	97	1	Table 1 in box 10.2 has editing issues	Will be revised	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
56993	98	19	100	22	Life cycle assessment of electrification is weak to date. Utilization of ISO 14040 and/or 14044 to better understand the true impact of electrificiation on the overall environment is needed. The U.S. is 100% dependent on rare earth elements needed for lithium ion development, and has not addressed end of life environmental challenges with electrification of the transportation system. To be good stewards of the environment, stakeholders need to fully comprehend the impacts of lithium battery development and the retirement of these spent batteries in the hundreds of millions anticipated to reach sustainable transport goals. Limited research is available on the potential of recycling of lithium ion batteries with estimates of worldwide generation of used batteries topping 2 million metric tons per year by 2030.	Accepted. Considerable research appears to be underway on the chemistry and engineering involved but like all circular economy issue the key is how to bring the dispersed products into a coherent and viable amount for processing.	Government of United States of America	U.S. Department of State	United States of America
70359	98	19			This box relates very often the position of Sovacool et al (2020). Authors should find more references or have a more nuanced presentation of a single reference position. This very reference is actually missing the the list.	Accepted.Box revised and reference added.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
79179	98	19	98	38	The rare-earths discussion is underinformed, despite the abundance of authors who hold similar views based on similar and shared errors. Please see “Clean energy and rare earths: Why not to worry,” Bull. atom. Scient., 24 May 2017, http://thebulletin.org/clean-energy-and-rare-earths-why-not-worry10785.	Noted, text added (last sentence). Provided reference is not a peer-reviewed article.	Amory B. Lovins	Rocky Mountain Institute; also Adjunct Professor of Environmental & Civil Engineering, Stanford University	United States of America
81961	98	19	100	22	this assessment should be completed with an outlook on international trade flows: from lithium mining to battery production to battery recycling. These flows won't probably be as dispersed as oil trade flows and shift away / concentrate in other origins/destinations.	Noted. The Box covers the fact that a new geopolitics is emerging	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
28777	98	24			There are references to Sovacool et al, 2020 but I could not find it in the List of References.	Editorial. Fixed	Jonatan J. Gomez Vilchez	European Commission, Joint Research Centre	Italy
70361	98	26	98	29	Two slightly different definitions of "critical" seem redundant and inconsistent.	Noted, Box has been revised.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
70363	98	37	98	38	Logic? Why does high energy demand (for production of clean energy supplies) put pressure on the supplu chain of critical materials? In the first place it puts pressure on energy resources.	Accepted. Box has been revised	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
29395	99	0	0	0	The figure in the box has a caption with a different (and blurred) font	Editorial. Figure removed	Maria Pregnolato	University of Bristol	United Kingdom (of Great Britain and Northern Ireland)
43141	99	1	99	1	This table describes critical materials for EV. As FCEV are also EV, this list should also include Platinum Group Metals and Fuel Cell Stack. You can find a list of EU critical materials here: https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_en	Editorial Figure has been removed.	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
86855	99	6	99	10	Having considered the aspects that are detailed below and that arise from reading the drafts and support material provided, it should be noted: • Governance of the sustainability of mining and processing of many minerals is critical to the global transition to renewable energy technologies and battery systems, in areas generally known for their variable environmental stewardship, remains inadequate and often a source of conflict; • Mining requires a large fleet of large heavy vehicles and also light vehicles.	Noted. The Box and chapter does cover those issues	Government of Argentina	Ministry of Environment and Sustainable development of Argentina	Argentina
78769	99	11	99	24	Lithium criticality has been investigated for highly ambitious demand scenarios by Greim et al. (https://www.nature.com/articles/s41467-020-18402-y), concluding that supply is at the edge but still doable, while very high recycling rates are mandatory. Junne et al. (https://www.sciencedirect.com/science/article/abs/pii/S0360544220316406) have investigated the supply criticality of Lithium, Cobalt, Neodymium and Dysprosium in most demanding highly renewables scenarios and found challenges in supply.	Noted. Reference added	Christian Breyer	LUT University	Finland
79759	99	11	99	24	Some discussion of Li resource constraints is provided but not suficient in my view. Furthermore, other minerals, e.g. Cobalt, need to be discussed as well. Note that recycling rates of these minerals are low or very low (for Li)	Noted. The Box has been revised but always covered more than Lithium	Stefan Bakker	KiM Netherlands Institute for Transport Policy Assessment	Netherlands
85861	99	20	99	21	Suggest adding to this point: ‘Australia has all the Li-ion battery minerals and has a strategy to enable them to be provided ethically and transparently (Commonwealth of Australia, 2019).’ – as follows: ‘The Australian Government’s Technology Investment Roadmap has identified energy storage (including lithium ion batteries) as a priority technology and set economic targets that would enable them to be cost-competitive and deployable at scale.’ https://www.industry.gov.au/sites/default/files/September%202020/document/first-low-emissions-technology-statement-2020.pdf	Noted. The text suggested is not about the subject of the Box. .	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
70163	99	24			Giurco et al, 2019.) Serious concerns remain around the constraints of existing mineral reserves as they relate to our ability to convert our global transportation fleet to renewables. Copper, Lithium and Manganese requirements under scenarios that involve high EV conversion exceed current reserves. Some studies suggests that only under a degrowth scenario (strong reduction in demand) will our existing reserves of minerals be sufficient to allow a conversion to EVs (de Blas et al, 2020). This study shows that only under degrowth scenarios can the decarbonization objectives (based on the IPCC SR1.5 1.5-2C pathways) be met while also avoiding energy restrictions without exceeding mineral reserves. https://www.sciencedirect.com/science/article/pii/S2211467X20300961	Noted. Box is revised and recognises the concerns but the balance is more towards the resources not being a constraint.	Rayner Andersen	Department of Fisheries and Oceans	Canada
27817	99		99		The second title of Figure 1 to be deleted (i.e. Figure 11.3 Overview of key metal requirements and supply chain for LIB and EV).	Accepted. Figure was deleted.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
15279	100	7	100	11	In this paragraph, the statement "China has a near-monopoly on REE processing" does not tally with the facts. It is suggested to change it to "The development of the global REE production and processing chain has created an interdependence among countries and enterprises, and future cooperation among multinational enterprises will be beneficial to the sustainable supply of REE, a key resource in the world".	Noted. Box has been revised to shorten and sentence removed.	Government of China	China Meteorological Administration	China
53743	100	7	100	11	"near-monopoly" is a subjective judgement. It is supported by the references.	Noted. Box has been revised to shorten and sentence removed.	ZHENG XINZHU	China University of Petroleum (Beijing)	China
70365	100	14			Reference to H2020 needs to be more specific to be valid. Else remove.	Noted. Reference added	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
51567	100	24	100	24	Box 10.4 title is misleading. SAFare not Net Zero Emission fuels. They can't fully eliminate non-CO2 effects. Hydrogen-powered aviation. A fact-based study of hydrogen technology, economics, and climate impact by 2050. May 2020. Clean Sky 2 JU and Fuel Cells and Hydrogen 2 JU (Joint Undertakings) https://www.fch.europa.eu/publications/hydrogen-powered-aviation	Noted. This section is still being revised.	eric lombard	Stay Grounded	France
70367	100	24			The headline *Net Zero Aviation" is utterly misleading. It seems that the box refers to a project for the development and use of so-called 'sustainable aviation fuels'. The whole text in this box is extremely biased when it ignores: How much (fossil) carbon is avoided? How much of SLCFs remain? What's the energy efficiency of the promoted SAFs? What are costs?	Noted, This section is still being revised.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
70369	100	26			SAF? Explain in Box, even if explained already elsewhere.	Noted, This section is still being revised.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
70371	100	29	100	44	This sounds like industry promotion. If you decide to keep it in (which seems implausible to me) please refer in a neutral tone (neither as succes nor as failure story) what's been done and what's achieved. Aspirations for future achievements seem misplaced in this review.	Accepted. Box has been revised substantially.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
5525	101	3	101	3	replace Renewables" by "low carbon sources"	Noted. Chapter and all AR6 show nuclear is not time and cost competitive for new plants unless heavily subsidized.	Michel SIMON	Retraité/ Pdt d'association	France
27819	101	9	101	9	The title of Box 10.5 to be revised, making no reference to the Paris Agreement, considering that the stated question is an outstanding issue under UNFCCC negotiations.	Noted. Box has been revised.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
49745	101	9	102	25	Good to outline the issue of international aviation and shipping emissions but it is incorrect to say that the NDCs are not assigned to control these emission sources. Countries can still set mitigation targets and measures focusing on aviation and shipping (even on the outbound international vessels and flights from their territory). The new NDC of Fiij also includes a target on domestic shipping emissions. IMO and ICAO should align towards the Paris Agreement. More on this topic is discussed here: https://www.changing-transport.org/updated-ndcs-transport/	Noted. Box has been revised.	Nikola Medimorec	SLOCAT Partnership on Sustainable, Low Carbon Transport	Republic of Korea
50109	101	9	102	25	The IPCC may wish to review the intent and context of this box story, as it has included policy prescriptive statements around the national attribution of international transport emissions under the Paris Agreement.	Noted. Box has been revised.	Government of Singapore	Ministry of Sustainability and the Environment (MSE)	Singapore
51569	101	9	101	9	Box 10.5 is about "International" aviation and shipping. I propose to change the title to : International Aviation and Shipping: Should they be Part of the Paris Agreement?	Noted. Box has been revised.	eric lombard	Stay Grounded	France
70373	101	9	101	25	This box is extremely important, but it needs to be presented in a less policy prescriptive manner. I recommend changing the title to something like "what role for aviation and shipping low emission pathways?" Then it has to answer the question (to the extent possible), how much can these sectors emit in the future in the future (e.g. in 2050) in consistent global 2°C/ 1.5°C scenarios? The comparison of the IMO & ICAO projections with projections such as those of UNEP Gap is important and instructive. More should be made of this. Discussion about whether international bunkers 'should' be part of the Paris Agreement should be kept to a minimum. A more useful and important focus is whether the ICAO/IMO are an adequate contribution to the Paris temperature goals. Some model scenarios have attempted to include the contribution of bunkers in different scenarios, for example the Global Energy & Climate Outlook of the European Commission JRC: http://dx.doi.org/10.2760/608429 It is also worth mentioning that domestic aviation & shipping are part of national emissions and included in UNFCCC inventories. Therefore, they are in principle included in the NDC of any country that has an economy-wide target.	Noted. Box has been revised.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76169	101	9	102	25	This is a very useful and relevant box. You may check if a link to Ch14 can be given.	Noted. Box has been revised.	Jan Fuglestvedt	CICERO	Norway
79483	101	9	102	25	Box 10.5 is conceptually incorrect. The Paris Agreement covers "anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century" (Article 4) and makes no mention of any exclusion of aviation or maritime emission. Where is the source for questioning "Aviation and Shipping: Should they be Part of the Paris Agreement"?. 102, line 8 should include the full picture that under the KP only Annex I countries should "persue" reductions in ICAO and IMO (Artile 2.2 "The Parties included in Annex I shall pursue...." the Paris Agreement applies to almost all countries. Significant aviation and maritime emissions ARE covered by NDC´s even if international emissions are accounted for seperately. International aviation emissions are already regulated in international law e.g. EU-ETS. NDC´s cover aviation and maritime emissions e.g. Norway and Marshall Islands.	Noted. Box has been revised.	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
85397	101	9	101	9	Comment: This should reflect the reference in ICAO Assembly Resolution A40-19. Whereas the Paris Agreement, which was adopted by the Conference of the Parties to the UNFCCC in December 2015, enhances the implementation of the UNFCCC including its objective, and aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change; Recognizing the global aspirational goals for the international aviation sector of improving fuel efficiency by 2 per cent per annum and keeping the net carbon emissions from 2020 at the same level, as adopted by the ICAO Assembly at its 37th Session in 2010 and reaffirmed at its 38th and 39th Sessions in 2013 and 2016, as well as the work being undertaken to explore a long-term global aspirational goal for international aviation in light of the 2 °C and 1.5 °C temperature goals of the Paris Agreement; Proposed Change: In terms of 'regulation' – ICAO is a specialized UN agency with 193 Member States, producing internationally-agreed polices, standards and recommended practices, which once agreed under ICAO, are adopted in national legislation of individual Member States ICAO is not a regulatory agency, but rather produces standards and recommended practices that are adopted in national/international legislation. If international aviation and shipping emissions were a part of the Paris Agreement, this may remove something of the present ambiguity of responsibilities but is unlikely to fundamentally change emissions reductions unless IMO and ICAO explicitly charged with a target (e.g., "net zero" by some date). In any case, as outlined above, these two agencies do not 'regulate', as such but rely on consensus and international agreement of emission reductions.	Noted. Box has been revised.	Neil Dickson	ICAO	Canada
86693	101	9	102	25	Box 10.5 covers perhaps the most difficult issue in AR6 and in the forthcoming COP26, and this needs empahsising here and in conclusions for policymakers. However I can only comment as an expert on aviation. - It is absolutely necessary to align institutional frameworks with carbon goals, and it is also clear that frameworks and goals have not been in alignment for some years. This includes not only CO2 but all warming impacts. - The challenges are clear- that ICAO 1) has no clear mandate under Paris, and 2) is a forum for international agreement of standards which are adopted nationally. Some of these issues have been discussed recently, not only at the ICAO 40th assembly but in the ICAO 'Aviation CO2 Reduction Stocktaking seminar' (https://www.icao.int/Meetings/Stocktaking2020/Pages/default.aspx). - It seems that unless ICAO is given a mandate to deliver a target equivalent to net zero then nation states (or groups of nation states) have to reclaim the institutional framework. This may fall more on the developed than the developing world. This may be through a resolution to incorporate aviation in national budgets targets or NDCs, and deliver change through policies like support for innovation at a national level on fuels or airframe change, tax (which may be hypothecated into innovation to reduce international competitive challenges), and land-use and planning policy (eg a constraint or moratorium on new airport or airspace capacity). - perhaps it is not an either or. Perhaps there are national as well as international policies, but the international framework (however imperfect) has been seem as a block on national policy, not least becasueof trade and competition issues.	Noted. Box has been revised.	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)
75847	101	13	101	13	NDC is Nationally Determined Contribution (not Nationally Declared Contribution)	Noted. Box has been revised.	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
43143	101	14	101	14	I doubt that anything can be more than 100%. There it says "60% to 220%". Probably that is wrong or it is not properly explained.	Noted. It is possible to increase 2.2 times.	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
51331	101	17	101	20	"Their CO2 emissions are not part of the Paris Agreement but instead they continue to be addressed (as they were under the Kyoto Protocol) by the International Civil Aviation Organisation (ICAO) and the International Marine Organisation (IMO), specialised UN Agencies." Art. 4.1 Paris Agreement (PA) reads "Parties aim... to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases". Since GHG emission of aviation and shipping are clearly anthropogenic they are implicitly included even without being explicitly mentioned. So GHG emissions (not only CO2), or even GHG impacts, i.e. including non-CO2 emissions of aviation and shipping are part of the PA. Moreover, Art. 2.2 of the Kyoto Protocol reads "The Parties ... shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively." Since ICAO/IMO are Party driven processes/bodies as the UNFCCC they do not have any responsibily but just a facilitative role. Parties remain responsible for the emissions of aviation and shipping	Noted. Box has been revised.	Martin Cames	Oeko-Institut	Germany
56995	102	1	102	2	This seems like important information, but it's not explicity stated or discussed in Section 10.6. It's only here in Box 10.5.	Noted. Box has been revised. There are mentions of it in the main text.	Government of United States of America	U.S. Department of State	United States of America
27821	102	3	102	14	Delete "Some commentators have suggested that emissions from international aviation and shipping should be part of the Paris Agreement (Gençsü and Hino, 2015; Lee, 2018; Traut et al., 2018). Gilbert and Bows, (2012) and Wan (2020) argue that the shipping and aviation industries would prefer emissions to be treated under an international regime rather than a national-oriented regime. Under the previous Kyoto Protocol (Article 2.2), limitation or reduction of international emissions of CO2 from aviation and shipping, were to be pursued within ICAO and IMO as the relevant specialised UN Agencies. The omission of a mention of these international emissions in the Paris Agreement creates an ambiguity. Clearly, these emissions are not part of a state's Nationally Declared Contributions to emission reduction pledges, yet the Paris Agreement is a temperature-based one, in which the "balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases" are referred to (Article 4). The legal basis and interpretation of 'greenhouse gas balance' has been discussed by, e.g. Rajamani and Werksman (2018), and Fuglestvedt et al. (2018).", as these refer to an outstanding negotiation issue under UNFCCC.	Noted. Box has been revised.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
51333	102	6	102	8	Similar as comments above: Parties pursue, not ICAO/IMO, and Art. 2.2 refers to Gases not controlled by the Montreal Protocol, i.e. all GHG not just CO2	Noted. Box has been revised.	Martin Cames	Oeko-Institut	Germany

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
51335	102	10	102	12	NDC = Nationally Determined Contribution "Clearly" is wrong, some countries included international aviation (e.g. the EU: https://www.consilium.europa.eu/media/47652/st14222-re01-en20.pdf, p. 13) in their initial NDC; based on the ratcheting up mechanism it is not unlikely that other countries will do so as well; the EU considers including international shipping in addition to aviation into its updated NDC to be submitted prior to COP26.	Noted. Box has been revised.	Martin Cames	Oeko-Institut	Germany
75849	102	15	102	20	The IMO target seems to be in line with what is needed from shipping (43% GHG median reduction for the entire transport and shipping should have a more lenient target but it even has a more stringent one) so the problem is ICAO and that the only measure is CORSIA plus the limited discussion on SAF at the ICAO level (more driven by private and national initiatives). If this is the case, perhaps useful to mention in the text	Noted. Box has been revised.	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
70375	102	17	102	20	These two sentences contradict each other. I suggest keep only the last:"The emissions projections of both these organisations (Fleming and Lepinay, 2018; IMO 2020) show that there will be a conflict between projected emissions and required reductions by around 2050 (UNEP, 2020)".	Noted. Box has been revised.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
27823	102	21	102	25	Delete "If international aviation and shipping emissions were a part of the Paris Agreement, this may remove something of the present ambiguity of responsibilities but is unlikely to fundamentally change emissions reductions unless IMO and ICAO explicitly charged with a target (e.g., “net zero” by some date). In any case, as outlined above, these two agencies do not ‘regulate’, as such but rely on consensus and international agreement of emission reductions.", as these refer to an outstanding negotiation issues under UNFCCC.	Noted, it will be addressed by David	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
49747	102	34	104	30	The title of the box refers to active transport but the content talks about non-motorised transport (NMT), which is a term that oversimplifies walking and cycling and always puts it in contrast to motorised transport. A preferred expression would be to use active transport or just refer to it as walking and cycling.	Accepted. Box will be revised.	Nikola Medimorec	SLOCAT Partnership on Sustainable, Low Carbon Transport	Republic of Korea
79485	102	34	104	30	The title of the box refers to active transport but the content talks about non-motorised transport (NMT), which is a term that oversimplifies walking and cycling and always puts it in contrast to motorised transport. A preferred expression would be to use active transport or just refer to it as walking and cycling.	Accepted. Text corrected.	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain
27825	102	43	102	43	Delete reference to a footnote that is not presented.	Editorial- taken care of	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
335	104	8	104	8	Better specify "air pollution"	Editorial- taken care of	Sandro Fuzzi	ISAC CNR	Italy
27827	104	10	104	10	Delete reference to a footnote that is not presented.	Editorial- taken care of	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
29397	104	10	104	11	References should stay into the same brackets	Editorial- taken care of	Maria Pregnolato	University of Bristol	United Kingdom (of Great Britain and Northern Ireland)
8325	104	31	110	1	I found the discussion of enabling conditions and policy implications hard to grasp, as much remained on a rather abstract level. I think it would be desirable to provide a robust assessment of which policies have produces which effects under which circumstances. In addition, I would appreciate a discussion of how political resistance from consumers as well as vested interests (e.g. auto manufacturers) have been dealt with.	Accepted and revisions continuing	Michael Jakob	MCC Berlin	Germany
81975	104	31	112	10	These three sections deserve more in-depth discussion and would benefit if they were restructured around e.g. a) AS for passenger, b) AS for freight and c) improve (which has largely been discussed in the preceeding sections) for energy carriers, vehicles, infrastructure. Policy options ASI could be distinguished in terms of Regulation and incentives; options outside and inside the transport sector, as well as needs of communication and Capacity.	Accepted and much more ASI added.	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
82825	104	34	104	34	After "(Geels, Sovacool, Schwanen, and Sorrell, 2017)" Add other references: "Waisman et al. 2017 : https://doi.org/10.1038/s41558-019-0442-8" "Julien Lefèvre , Yann Briand , Steve Pye , Jordi Tovilla , Francis Li , Ken Oshiro , Henri Waisman , Jean-Michel Cayla & Runsen Zhang (2020): A pathway design framework for sectoral deep decarbonization: the case of passenger transportation, Climate Policy, DOI: 10.1080/14693062.2020.1804817"	Editorial- taken care of	Yann BRIAND	Iddri, Sciences Po	France
79239	104				Sections 10.8.2 to 10.8.3 could be complimented by a synthesis on the modelled and empirical evidence of policy interventions (demand and supply) on carbon and energy emissions. This seems to be a gap for this chapter e.g. evidence on congestion charging, EV rebates, scrappage fees, fuel standards, road tolls, etc. Part of this underlies the assumptions underpinning the long-term scenarios, and is reported in Table 10.9 but it would be useful to summarize and be explicit about any quantitative evidence on policy interventions especially from empirical case studies.	Noted. This is covered in 10.7 and a quick summary provided in 10.8	Martino Tran	UBC	Canada
70377	105	9			Fig. 10.27. What does ASI mean? Maybe explain in caption?	Noted. Mentioned in 10.8.1	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
81963	105	9	105	10	The framing of ASI in the figure is misleading.1) ASI should not be on the same level as LDV emob and HDV fuels, but presented as an overarching concept. Emob is part of shift and improve, as HDV fuels is improve. 2) ASI should not be designated as "one out of three options" - it contains basically all options, even beyond the sector itself. 3) ASI cannot be regulated for each mode, as A and S are systemic. 4) ASI is a field ranging from immediate action to continuous and longterm concepts, like urban planning and value chain configurations. what exactly should be delivered in 10 years ? 5) how should one read the y-axis market commerciality for the ASI block?	Noted. ASI is all-encompassing but the literature is more in the demand and efficiency area. The other two are largely technological and the figure tries to emphasise that.	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
20153	105	12	105	23	In Norway, light-duty EVs are competitive since they are cheaper to use due to low electricity prices (also with spillover to shipping): Koasidis, K., Karamaneas, A., Nikas, A., Neofytou, H., Hermansen, E. A., Vaillancourt, K., & Doukas, H. (2020). Many miles to Paris: A sectoral innovation system analysis of the transport sector in norway and canada in light of the Paris Agreement. Sustainability, 12(14), 5832.	Noted	Nikas Alexandros	National Technical University of Athens	Greece
79357	105	12	106	2	This section should include discussion of problems and risks. Currently, vehicle electrification is highly subsidized, has high costs per unit of emission reductions, is regressive, and is likely to induce additional vehicle travel and increase external costs unless implemented with TDM and Smart Growth policies that limit vehicle travel and sprawl.	Noted. No reference provided with the statement (for freight). Revisions made.	TODD LITMAN	Victoria Transport Policy Institute	Canada
81567	105	13	105	15	"This is evident in the trend of incumbent automobile manufacturers producing an increasing range of EVs in response to demand." : suggest to add "[...] and in response to policy and regulatory signals."	Accepted. Text added.	Marine Gorner	International Energy Agency (former)	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
20085	105	15	105	16	There are already cases such as Norway where light-duty EVs are competitive since they are cheaper to use due to low electricity prices (Koasidis et al., 2020): -Koasidis, K., Karamaneas, A., Nikas, A., Neofytou, H., Hermansen, E. A., Vaillancourt, K., & Doukas, H. (2020). Many miles to Paris: A sectoral innovation system analysis of the transport sector in norway and canada in light of the Paris Agreement. Sustainability, 12(14), 5832.	Editorial- taken care of	Haris Doukas	National Technical University of Athens, Greece	Greece
23259	105	15	105	16	While this can now be considered as probable, it is not done yet. In particular, very strong subsidies are currently in place to support the EV market uptake. This is a high risk for this scenario: if public stakeholders find themselves unable or unwilling to maintain such subsidies, the market could suffer a lot.	Noted. Text revised	Government of France	Ministère de la Transition écologique et solidaire	France
23261	105	28	106	2	This statement should be conditioned to enabling conditions. Such as it is, it does not seem credible.	Noted. Text revised	Government of France	Ministère de la Transition écologique et solidaire	France
23263	106	11	106	14	It should be noted that the demand for such assets consists of firms: freight carriers. The notion of anxiety towards innovation, etc. is probably not as strong for them than for passenger mobility. Demonstrations will also need to deliver robust evidence of operating and cost efficiency.	Noted.	Government of France	Ministère de la Transition écologique et solidaire	France
43145	106	11	106	15	Electric trucks are no longer being demonstrated, as they can be bought in the market, even for the largest ones (28-38t GVW); although for short-haulage. In the UK market, DAF has started sales in March 2021, and Volvo will have new models in October 2021. For smaller heavy goods vehicles (e.g. GVW 18t) Volta in the UK, and Wrightbus (for buses) sell those to end clients (not as a demo or trial) . The case of FC HGVs is slightly different, as they can only be bought in Switzerland; as far as I am aware. The references used are obsolete, as this is a fast-moving market. If we look at China, electric buses are widely available and found in the '000s.	Noted. Text has been revised.	Abad Velazquez	Transport Research Laboratory	United Kingdom (of Great Britain and Northern Ireland)
70379	106	16	106	18	"...will be a need for education campaigns..." Really? So apodictic? It depends on a number of assumptions that should be made transparent here. IF, e.g. the alternative fuel were MUCH cheaper than fossil fuels, no need for an education campaign, for sure! If the alternatives would offer much added value (like mobile phone over a fixed) then no need for education campaigns!	Noted	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
70381	106	19	106	21	As remarked above, the Swiss box is less than convincing, hence also not a convincing basis for your argument here "...protected space...needed..." Please provide better/more evidence.	Noted. Box revised.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
27829	106	21	106	23	Delete "The need for nations to consider bringing aviation and shipping inside the Paris Agreement is one major tool that has been considered appropriate by some and not by others (see Box 10.5). This option needs to be reviewed.", as this refers to an outstanding negotiation issue under UNFCCC.	Noted. Box revised.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
70383	106	22	106	23	Remove the suggestion that brining aviation & shipping into the Paris Agreement 'needs to be reviewed' (policy prescriptive). As per our comment on Box 10.5, concentrate on trying to establish scientifically what a fair share of the global mitigation effort would be for these sectors. Bringing them into the Paris Agreement does not itself solve the issue of activity &/or emissions from these sectors being too high for consistency with the Paris temperature goal.	Noted. Box revised.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
17147	106	24	106	25	The sentence is not clear. "Demand and efficiency options are not generally applied to an MPL framework" seems overstated. See Chapter 5	Noted. MPL is further reduced as the basis of figure and text	Giulio Mattioli	TU Dortmund University	Germany
11141	106	40	110	1	I generally like this material, but think that it could be better with aligned with descriptions of policy mixes and sequences present in other chapters. Chapter 1 offers a really nice explanation of the transitions dynamics analytic framework, which can map onto the mobility sector really well. For example, the Norwegian example with EVs fits it almost perfectly, and there is reason to believe that the transition to sustainable aviation fuels, as expeplified by the box on Switzerland, could fit equally well. (FYI I'd be happy to discuss/help).	Noted. MPL is further reduced as the basis of figure and text but still useful	Anthony Patt	ETH Zürich	Switzerland
20459	106	41	106	45	A 100% renewable transport must undertake also changes in logisitcs of cargo and the impacts on commuting in the cities and inter-cities, the impact on air tranport and shipping for a zero-carbon transport imply a reduction of the aviation and shipping fleet (Antonio García-Olivares, Jordi Solé, Oleg Osychenko, Transportation in a 100% renewable energy system,Energy Conversion and Management,Volume 158,2018,Pages 266-285,ISSN 0196-8904,https://doi.org/10.1016/j.enconman.2017.12.053, and :García-Olivares, A.; Solé, J.; Samsó, R.; Ballabrera-Poy, J. Sustainable European Transport System in a 100% Renewable Economy. Sustainability 2020, 12, 5091. https://doi.org/10.3390/su12125091)	Accepted. Text added.	Jordi Solé	Universitat Rovira i Virgili	Spain
79359	107	1	110	1	This table is unclear and does not seem to incorprate good examples of TDR policies. It also seems biased in favor of EVs while understating the co-benefits of TDR strategies, partcularly those that improve affordable modes. For example, in the first cell, it ignores the possibility that EVs will increase total vehicle travel. It implies that TDR primarily have negative social equity impacts; in fact, by improving affordable travel modes, creating more compact and accessible communities, more efficiently pricing automobile travel, and reducing automobile external costs, their equity impacts are generally positive, often very positive. In contrast, EV incentives tend to be regressive and by inducing more vehicle traffic and sprawl, tend to increase many external costs. I therefore disagree with this claim: "The SDG benefits in zero carbon light vehicle transport systems are being demonstrated and these can now be quantified as nations mainstream this transition." I suggest totally rewriting this table to be more objective and comprehensive.	Noted. Text has been revised to include issues about cheap solar-EV's	TODD LITMAN	Victoria Transport Policy Institute	Canada
70385	107	5			"...e-train..." Really leapfrogging? I thought they are standard since 60 years? Or what exactly is meant by this?	Noted. Leagfrogging from no train to e-train; rather than no train - steam/coal train - deisel train - e train	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
23265	107	9	107	9	Table 10.8, 4th column and tool n°2 : the reference is missing	Editorial- taken care of	Government of France	Ministère de la Transition écologique et solidaire	France
28879	107	9	107	9	There is a reference missing at the end of row 2 of Table 10.8.	Editorial- taken care of	Eoin Devane	United Kingdom Climate Change Committee	United Kingdom (of Great Britain and Northern Ireland)
51571	107	9	107	9	3. Financing Economic Incentives and Partnership / Heavy Vehicle Fuel Systems for long haul trucks, shipping and aviation : would be useful to refer to Box 10.4 that reports ideas to finance research on SAF in Switzerland	Not clear what is meant here.	eric lombard	Stay Grounded	France

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
51573	107	9	107	9	6. Governance and Institutional Capacity / Heavy Vehicle Fuel Systems for long haul trucks, shipping and aviation : Whatever the mitigation options, they will not be adopted by the industry unless they are profitable, and in this case the emissions might well continue to increase because of the rebound effect. To avoid that, and force the industry to reduce aviation emissions, there are two main options : either set an emissions cap or price those emissions appropriately. The latter will encourage to pick the most appropriate winning technology or operational improvements to deliver best value under those constraints. Wait and see whether targets are reached before taking action is not a good option.	Noted. Broad issues like pricing are covered in the chapter and in the rest of the report. Targets are increasingly seen as major drivers and enablers.	eric lombard	Stay Grounded	France
51577	107	9	107	9	2. Access and Equity / Heavy Vehicle Fuel Systems for long haul trucks, shipping and aviation : a recent article gives more insight into the equity issues of aviation. Results suggest that the share of the world's population travelling by air in 2018 was 11%, with at most 4% taking international flights. Data also supports that a minor share of air travelers is responsible for a large share of warming: The percentile of the most frequent fliers – at most 1% of the world population - likely accounts for more than half of the total emissions from passenger air travel. Individual users of private aircraft can contribute to emissions of up to 7,500 t CO2 per year. Gössling S. et al. (2020). The global scale, distribution and growth of aviation: Implications for climate change. https://doi.org/10.1016/j.gloenvcha.2020.102194 One of Gössling's findings is cited in the SPM (SPM-9, lines 16-17) : B3.4. The consumption patterns of higher income consumers are associated with large carbon footprints. Top emitters dominate emissions in key sectors, for example the top 1% account for 50% of GHG emissions from aviation (high confidence)	Noted. Reference added.	eric lombard	Stay Grounded	France
52525	107	9	110	1	The tools and strategies listed in table 10.8 are hard to follow. To make it easier to understand the suggestions, provide specific context for each suggestion	Noted	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52527	107	9	110	1	Break down the table to paragraphs instead	Noted. No action as table was prefered to prove a structure.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
70387	107	9			Box 10-8, bullet 1. "Education and R&D" Education sounds very paternalistic and clearly is a different category than R&D. Please revise and separate as appropriate.	Noted. Updated title.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
70389	107	9			Box 10-8, bullet 1. "Education and R&D" Is there any room for behavioural change?	Noted. Updated title.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
75851	107	9	107	9	Two key strategies missing seem to be modal shift (aviation to HSR, public transport, etc.) and "smart mobility" (mobility as a service, seamless transition across modes, AI, etc). The strategies could also be aligned with, for instance, the categories in Section 10.2 (e.g. missing the urban/rural aspect and the nexus with other sectors)	Noted. Mentioned # 1 of table 10.8	Herib Blanco	International Renewable Energy Agency (IRENA)	Germany
84993	108		108		BCRs and health: the principles are fine, but health still only makes a small contribution to the case for most major investments, and further work is needed (and is ongoing) to improve this. Even with a focus on health or on the climate emergency and promoting active travel, many Local Authorities in the UK are still focused on delivering road schemes, often linked to housing targets.	Noted. Text added.	Jameel Hayat	AECOM	United Kingdom (of Great Britain and Northern Ireland)
29399	109	0	0	0	Point 7 has a different identation (the layount of the table could be generally improved)	Editorial- taken care of	Maria Pregnolato	University of Bristol	United Kingdom (of Great Britain and Northern Ireland)
79361	110	2	110	7	The single most important transport emission reduction strategy that people can implement individually is to choose a car-free or car-light lifestyle, which requires choosing a home is a walkable urban neighborhood, and choosing to spend their transport time and money on resource-efficient modes. This does not preclude driving when it is truly the most efficient option, considering all benefits and costs, but tends to greatly reduce annual vehicle-kilometers. A second action is to choose electric cars to own or rent when the opportunity occurs.	Noted. This point is what is being said.	TODD LITMAN	Victoria Transport Policy Institute	Canada
81965	110	2	110	2	The title may be perceived as if transport transformation was an individual / personal sacrifice. Suggest: what can policy do?	Noted. Text has been revised but hard to gather this from what was there.	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
56997	110	8	111	117	It would be helpful if information on the scale of GHG reductions possible via induced behavioral change were discussed. As currently described, emissions reductions as a result of behavoir change does not seem significant relative to the scale of the other things described (e.g., for LDVs, shipping, and aviation).	Noted. The literature and modelling in previous sections is suggesting that the most transformative change is when demand is integrated with technology options.	Government of United States of America	U.S. Department of State	United States of America
70391	110	9			"This Chapter has shown there is a growing significance to behaviour change".... So far I've not seen this evidence. Which sections are refered to? Perhaps better to concentrate on identifying relevant overlaps with Chapter 5.	Noted. this point is made several times.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
10015	110	19		29	While this paragraph describes useful means of behavioural change, what happens in Indonesia show a different tendency due to conformity of riding motorbikes behaviour. Behavioural change in Indonesia is a huge task yet very crucial to be addressed.	Noted. The point is made that behaviour change is hard without institutional change and integration with technological change.	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
11303	110	19	110	29	I suggest adding this sentence, or similar, perhaps at line 27 after "Caldera et al, 2021)." "The ITF suggests that reallocating existing road space from private cars to public transit, walking and cycling can produce rapid and very significant behaviour change leading to reduced traffic volumes; this is sometimes described as evaporating or disappearing traffic (2021)." ITF (2021), Reversing Car Dependency: Summary and Conclusions, ITF Roundtable Reports, No. 181, OECD Publishing, Paris. www.itf-oecd.org/avoiding-car-dependency	Noted. Reference has been added. Car dependency is a clear part of the chapter.	Eric Doherty	Ecopath Planning	Canada

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79363	110	19	110	20	I disagree with "a switch to public transport (shown clearly to be the most important mitigation option in passenger transport in Section 10.4)" Public transit has a moderate role in reducing emissions directly; it has a much larger role if high quality transit provides a catalyst for Transit Oriented Development, which in turn leverages reductions in household vehicle ownership and creates compact, mixed, walkable neighborhoods. I suggest that this section discusses and emphasize the role of Transit Oriented Development. See: ICF (2010), Current Practices in Greenhouse Gas Emissions Savings from Transit: A Synthesis of Transit Practice, TCRP 84, TRB (www.trb.org); at http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_syn_84.pdf. Serge Salat and Gerald Ollivier (2017), Transforming the Urban Space through Transit-Oriented Development : The 3V Approach, MDTF Sustainable Urbanization, World Bank (www.worldbank.org).; at https://openknowledge.worldbank.org/handle/10986/26405. World Bank (2018), TOD Implementation Resources and Tools, Global Platform for Sustainable Cities, World Bank (www.worldbank.org); at http://hdl.handle.net/10986/31121.	Noted. This is the approach outlined in the text.	TODD LITMAN	Victoria Transport Policy Institute	Canada
79365	110	22	110	24	I totally agree that efficient parking management has a LARGE role to play in creating more efficient transportation system and more compact, multimodal neighborhoods, so I suggest that it have separage paragraph. Put simply, per capita vehicle ownership and use typically declines 10-30% if motorists are simply required to pay directly for parking, rather than having it subsidized. In addition, excessive parking inceases driving indirectly by inceasing sprawl and degrading urban environments. This suggests that 10-30% of traffic congestion, crashes and pollution emissions are the result of current parking policies, and parking policy reforms are essential for most successful TDM and Smart Growth programs. Note that there is no reference for Richardson 2017. See: Paul A. Barter (2014), “A Parking Policy Typology for Clearer Thinking on Parking Reform,” International Journal of Urban Sciences (http://www.tandfonline.com/loi/rjus20), at http://dx.doi.org/10.1080/12265934.2014.927740. Economist (2017), “Parkageddon: How Not to Create Traffic Jams, Pollution and Urban Sprawl. Don’t Let People Park For Free” The Economist, 8 April 2017 (www.economist.com); at www.economist.com/news/briefing/21720269-dont-let-people-park-free-how-not-create-traffic-jams-pollution-and-urban-sprawl. Petter Christiansen, et al. (2017), “Parking Facilities and the Built Environment: Impacts on Travel Behaviour,” Transportation Research Part A: Policy and Practice, Vol. 95, pp. 198-206, (https://doi.org/10.1016/j.tra.2016.10.025). Ríos Flores, et al. (2014), Practical Guidebook: Parking and Travel Demand Management Policies in Latin America, InterAmerican Development Bank, (www.iadb.org); at http://publications.iadb.org/handle/11319/3577?locale-attribute=en. C.J. Gabbe, Gregory Pierce and Gordon Clowers (2020), “Parking Policy: The Effects of Residential Minimum Parking Requirements in Seattle,” Land Use Policy, Vol. 91 (https://doi.org/10.1016/j.landusepol.2019.1040530); version at https://bit.ly/2W2v59L.	Noted. Added Barter reference.	TODD LITMAN	Victoria Transport Policy Institute	Canada
81967	110	30	110	30	Free public transport does not seem to be a vastly agreed concept, as it does not create more social equity. It should not be presented as the ultimate solution; dynamic pricing should be mentioned, too.	Noted. Not clear that free public transport is suggested as a solution.	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
81969	110	30	110	35	Concepts like "no parking" or only short term parking possibilities in certain urban areas could be added here.	Noted. Text added.	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
70393	110	32			"when the parking space demand is inelastic, demand may not respond directly to the increase in parking price." This is a tautology, so cut the sentence short.	Noted. Text updated.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
10013	110		111		Table 10.9 Why did not you put behavior change to use high-octane fuels (for vehicles), high-cetane fuels (for diesel vehicles), or even alternative fuels (fuel conversion and batteries)?	Noted. No GHG advantages	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
81971	111	6	111	6	speed limits are mentioned the first time here; it doesn't seem appropriate to scratch the topic on the surface and put them on the same level as bike to work campaigns as they have much broader implications and greater importance.	Noted, updated to low traffic neighbourhoods.	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79367	111	10	111	17	Yes, conventional planning greatly undervalues and underinvests in active travel and micro modes (e-scooters and e-bikes), and this is a major obstacle to more efficient and equitable planning. It has large leverage effects, for example, by providing access to public transit (often, the most effective way to increse transit ridership is to improve active mode access to transit stops and stations), and expanding the range of parking spaces that serve a destination, reducing the number of parking spaces needed. It is not just health benefits that are overlooked, improving and increasing active travel also reduces traffic and parking congestion, road and parking infrastructure costs, consumer costs, and sprawl-related costs. Many communities are improving and encouraging active transport for a variety of reasons, including fairness, health and livability. See: Torsha Bhattacharya, Kevin Mills, and Tiffany Mulally (2019), Active Transportation Transforms America: The Case for Increased Public Investment in Walking and Biking Connectivity, Rails-to-Trails Conservancy (www.railstotrails.org); at www.railstotrails.org/media/847675/activetransport_2019-report_finalreduced.pdf. Christian Brand, et al. (2021), "The Climate Change Mitigation Impacts of Active Travel: Evidence from a Longitudinal Panel Study in Seven European Cities," Global Environmental Change, Vo. 67 (https://doi.org/10.1016/j.gloenvcha.2021.102224). DfT (2020), Gear Change: A Bold Vision for Cycling and Walking, UK Dept. for Transport (www.dft.gov.uk); at https://bit.ly/39ZgZ0t. John Gilderbloom, et al. (2015), "The Green Dividend of Urban Biking? Evidence of Improved Community and Sustainable Development," Local Environment: The International Journal of Justice and Sustainability, at www.tandfonline.com/doi/full/10.1080/13549839.2015.1060409. John I. Gilderbloom, William W. Riggs and Wesley L. Meares (2015), Does Walkability Matter? An Examination of Walkability's Impact on Housing Values, Foreclosures and Crime," Cities, Vol. 42, pp. 13–24 (http://dx.doi.org/10.1016/j.cities.2014.08.001);	Noted. Reference and text updated.	TODD LITMAN	Victoria Transport Policy Institute	Canada
46109	111	15	111	17	The given reference (Sharma et al. 2020) only refers to India. It might be useful to consider further studies reflecting also other countries: Sci Total Environ, 2020, doi: 10.1016/j.scitotenv.2020.138878, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7175882/	Noted. Reference updated.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
81973	111	15	111	17	is this sentence correct? "... increased up to Germany"?	Noted. Yes.	Stefanie Sohm	Plateforme Mobilité Durable Maroc	Morocco
70395	111	17			Reference Sharma et al 2020 missing. This is for now already the second missing reference. Please review list of references and provide them where missing, else the statements need to be substantiated in another way.	Noted. Reference updated.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
15519	111	19	111	19	Appears to be little discussion of pricing regimes in terms of emissions curtailment. Would recommend more coverage including discussion regarding equity considerations. It would also be useful to contemplate pricing regimes in the context of use of emissions settings (e.g. low-emissions zones), and raising revenue to facilitate investment in mode shift (e.g. over time, as increasing numbers of EV lead to reduced vehicle fuel tax receipts).	Noted. Pricing is discussed mostly in other chapters and is part of ASI coverage here. The EV tax receipts issue is covered.	Ryan Falconer	Auckland Council, New Zealand	Australia
43835	111	19	111	19	Why are the SDG impacts not given in some rows?	Noted. Will be fixed	Mattia Righi	Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany	Germany
52529	111	19	112	4	Provide a detailed discussion on costs and benefits for each of the proposed intervention	Noted. Costs and potentials in other sections.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52531	111	19	112	4	Provide a measure on political feasibility of implementing each of the suggestions.	Noted. Political feasibility is in Feasibility Table.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52533	111	19	112	4	Provide a discussion on potential public backlash (if any) that could arise from implementing such measures. For example, the protests in France in 2018 that led to the suspension of fuel price hike	Noted. Covered in Feasibility Table.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
56999	111	19	112	4	Suggest moving the legend to the top of Table 10.9. As it is now, a reader cannot easily discern what the colors mean when the chart breaks across pages.	Noted. Will be fixed.	Government of United States of America	U.S. Department of State	United States of America

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
79369	111	19	112	3	This figure is incomplete and confusing. There are many additional TDR policies and programs that are not mentioned here, or unclearly described and categorized. For example, it mentions workplace parking charges, but not parking cash out, or efficient pricing of public parking. It makes no metion of Pay-As-You-Drive pricing, although this is one of the most effective and cost effective strategies that also provides substantial co-benefits and social equity benefits. I suggest developing a comprehensive list of TDR strategies, and a more comprehensive framework for evaluating their impacts and benefits. See: ACEEE (2019), Sustainable Transportation Planning, American Council for an Energy Efficient Economy (www.aceee.org); at https://database.aceee.org/city/sustainable-transportation-planning. Lists examples of VMT reduction targets in various communities. CARB (2010-2015), Impacts of Transportation and Land Use-Related Policies, California Air Resources Board (http://arb.ca.gov/cc/sb375/policies/policies.htm). Co-Benefits of Climate Action (www.changingtheconversation.ca/co-benefits). Michael Grant, et al. (2013), A Performance-Based Approach to Addressing Greenhouse Gas Emissions Through Transportation Planning, Federal Highway Administration (www.fhwa.dot.gov); at http://tinyurl.com/ku7odw4. Allen Greenberg and Jay Evans (2017), Comparing Greenhouse Gas Reductions and Legal Implementation Possibilities for Pay-to-Save Transportation Price-shifting Strategies and EPA's Clean Power Plan, Victoria Transport Policy In. (www.vtpi.org); at www.vtpi.org/G&E_GHG.pdf. ICAT (2020), ICAT Toolbox: Policy Assessment Guidelines, Initiative for Climate Action Transparency (https://climateactiontransparency.org); https://bit.ly/3q8iEXn. Includes Transport Pricing Methodology; at https://bit.ly/3iK5US5.	Noted. The figure has been revised but it cant include every policy in detail.	TODD LITMAN	Victoria Transport Policy Institute	Canada
4227	113	9			The reference Ruotsolainen 2017 is not in the reference list.	Accepted	Ilkka Savolainen	VTT Technical Research Centre of Finland	Finland
70397	113	17			Citation incorrect: I only find an 2015 article with a different title:"Deliberative collaborative governance as a democratic reform to resolve wicked problems and improve trust"….please review	Noted. It is correct. https://www.semanticscholar.org/paper/Deliberative-Collaborative-Governance-as-a-Reform-Weymouth-Hartz-Karp/58fa401cac73b660de5e15a5d92a1002305d01d0	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
77137	113	18	113	20	Remarks on "climate emergency" plans are unwarranted – observations prove that there is no emergency.	Noted. No reference provided - no change required.	Jim O'Brien	Expert Reviewer AR6 SOD WG1	Ireland
17149	113	24	113	26	While there is merit to future climate pledges, there is also a very concrete danger that they are used as a way to argue that more disruptive changes in the present are not needed, i.e. to delay climate action. See: Lamb, W. F., Mattioli, G., Levi, S., Roberts, J. T., Capstick, S., Creutzig, F., ... & Steinberger, J. K. (2020). Discourses of climate delay. Global Sustainability, 3	Noted. Reference and text added.	Giulio Mattioli	TU Dortmund University	Germany
70399	113	29			Plotz et al (2020). Reference missing.	Accepted	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
79371	113	37	113	43	In addition to commiting to Net Zero, transportation finance institutions should also apply comprehensive analysis and least cost planning, which means that potential solutions are evaluated, ranked and funded based on overall cost-efficiency, considering all benefits and costs, with demand management given equal consideration with capacity expansion. This approach tends to support more TDR solutions due to their low costs and many co-benefits. See: Kathy Lindquist and Michel Wendt (2012), Least Cost Planning in Transportation: Synthesis, Washington State DOT (www.wsdot.wa.gov); at https://bit.ly/2EeB45l. STTI (2018), Modernizing Mitigation: A Demand-Centered Approach, Smart State Transportation Initiative (www.ssti.us); at https://bit.ly/2Nri7Ok.	Noted. This para is focused on net zero in general and such strategies as suggested are required for Noted. net zero financing.	TODD LITMAN	Victoria Transport Policy Institute	Canada
79241	113				Suggest including a gap in knowledge section to highlight strategic directions for further research in terms of both data collection and analysis. This is reported throughout the chapter but a summary would be very helpful especially to communicate to policy and decision makers, along with the research community, especially those who are newer to the field. For example, gaps and uncertanties discussed on smart city technologies and AVs, technology learning curves for hydrogen, end-of-life cost data for land transport, improving demand side factors in modelling frameworks, etc.	Later versions clarified this.	Martino Tran	UBC	Canada
9361	114	1	115	14	Can the Chapter 10 FAQs be formulated as continuous texts, just like the other chapters' FAQs please?	Later versions clarified this.	Maike Nicolai	Helmholtz Centre Geesthacht	Germany
9363	114	2	114	27	In addition to turning this FAQ into a continous text, I would also recommend to define a clear focus and either expand on the importance of electromobility or the battery development. In case you focus on batteries, would it make sense to also address any issues around the supply in metals/minerals? For example, are there any concerns around the new mines that will open in response to the growing demand? Are you able to say more clearly how problems around the reuse/recycling can be solved?	Later versions clarified this.	Maike Nicolai	Helmholtz Centre Geesthacht	Germany
17151	114	2	114	27	An important element of response to FAQ 10.1 is that electro-mobility, while necessary, is hardly sufficient to decarbonise the transport sector, and that demand-side measures (i.e. "avoid" and "shift" measures) will be required as well. See e.g.: Alarfaj, A. F., Griffin, W. M., & Samaras, C. (2020). Decarbonizing US passenger vehicle transport under electrification and automation uncertainty has a travel budget. Environmental Research Letters, 15(9), 0940c2. Hill, G., Heidrich, O., Creutzig, F., & Blythe, P. (2019). The role of electric vehicles in near-term mitigation pathways and achieving the UK's carbon budget. Applied Energy, 251, 113111.	Later versions clarified this.	Giulio Mattioli	TU Dortmund University	Germany
79493	114	6	114	6	Add after "removed entirely": "when charged with renewable electricity".	Later versions clarified this.	Mark MAJOR	Partnership on Sustainable Low Carbon Transport	Spain

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
83861	114	6	114	6	Add after "removed entirely": "when charged with renewable electricity".	Later versions clarified this.	Hannah E. Murdock	REN21	France
5527	114	10	114	10	replace Renewables" by "low carbon sources"	Later versions clarified this but phrase not changed.	Michel SIMON	Retraité/ Pdt d'association	France
47939	114	13	114	13	Flexible or managed charging can also provide major values to the power system, without V2G (bi-directionla power flow)	Later versions clarified this.	Matteo Muratori	NREL	United States of America
57001	114	14	114	15	What does "state of the art" mean here?	Later versions clarified this.	Government of United States of America	U.S. Department of State	United States of America
9365	114	28	114	29	I think the "How hard..." question needs to specify compared to what. You could consider asking where the barriers are or what would support decarbonisation of heavy vehicles transport.	Later versions clarified this.	Maike Nicolai	Helmholtz Centre Geesthacht	Germany
9367	114	28	114	44	Why does this FAQ only address difficulties to decarbonise our current way to transport things? Couldn't there be new or alternative transport options that are far less carbon-intensive and help decarbonise the transport sector? Focusing on why something is especially hard might not inspire much change (i.e., the transformation this report highlights in so many instances) in my opinion.	Later versions clarified this.	Maike Nicolai	Helmholtz Centre Geesthacht	Germany
78915	114	28	114	44	It is not true to say 'there are few obvious solutions to decarbonising heavy vehicles other than by increased efficiency' - recent advances in battery technology, have made the battery electrification of trucks a viable proposition particularly for delivery ranges less than 500km and lower density loads. The e-highway trials for trucks in Sweden and Germany have also been successful. Nor is it correct, therefore, to say that heavy trucks need 'drop-in fuels' to use with existing propulsion systems.	Later versions clarified this.	Alan McKinnon	Kuehne Logistics University	United Kingdom (of Great Britain and Northern Ireland)
69849	114	30	114	34	It's not so much the weight of some truck that is at stake (or of their freight), than the range they might be supposed to reach. Electric trucks of all sizes and tonnage have no difficulty reaching ranges of 250 km already, and are being developed for ranges up to 500 km and beyond. However, given the mandatory obligations for drivers' rests (in the EU, 3/4 hours after 4.5 hours drive), is it really useful despite weight, volume and cost to provide trucks with a range of more than 400 km, while a 3/4 fast-recharging time would allow perform another 300 km during the same day? Another option is battery swap, developed in China for light duty vehicles by the carmakers NIO and BAIC. There are 5 times more battery swap stations in China than there are hydrogen refueling stations - and thousand times more public EV charging connectors were installed in December 2020.	Later versions clarified this.	Cédric PHILIBERT	Institut Français des Relations Internationales	France
85507	114	30	114	31	"Unlike light vehicles, there are few obvious solutions to decarbonizing heavy vehicles other than by increased efficiency." This FAQ is simply perpetuating an urban myth. See also my comment on page 4 line 18-30. If anything, the heavier the vehicle, the easier it is to electrify (see Nykvist 2020 who I mention there). In the end the rounded calculation is pretty simple. You need an 800 km range because that covers over 80% of the needs of your fleet. (A driver can work no more than 9 hours and must rest and in a best case scenario the druck drives 90km/h so that gives you a range of 8*90=720km which is close to the max distance we see in our data.) You can charge overnight by the way because most trucks drive from hub to hub and return home at the end of the day these days. This 800 km of range means you need around 1 MWh of battery (don't forget that trucks drive empty part of the time). With current battery tech that means an extra weight of 5t but in 2030 it will be 2-3t if trends hold. You can subtract that the electric drivetrain is 1-2t lighter. Now worst case this 4t extra increases your weight by 10%. Assuming half of your energy goes to rolling resistance it increases your energy use by 5%. That's all. Of course you can also take less cargo but most trips are volume constrained not weight constrained. And the EU gives you 2t extra allowance and most countries give you extra allowances on top of that and these are seldom used. So the idea that heavy trucks cannot be electrified is a myth. It's only kept alive because trucking companies haven't started actually building redesigned battery electric trucks with the latest battery technology. There is a case to be made that long distances pose a problem for electric vehicles but that is a very different issue than weight. And as we saw 800km already allows you to electrify 80% of trucks. So weight is a nonsensical metric and range is a better one. But an even more relevant metric than range is the discrepancy between max range and daily range. Put differently: how often the battery is cycled. Newer batteries can handle 5000 cycles and using as many of these cycles as fast as possible means the battery costs are paid back sooner. But anyway: the statement that light vehicles can be electrified but for heavy vehicles this is somehow intrinsically harder is flat wrong. Please don't include it in the AR6 without proper argumentation.	Later versions clarified this.	Auke Hoekstra	Eindhoven University of Technology	Netherlands
47941	114	33	114	33	I'd argue the biofuel are already commercially available and cost-competitie (in some regions), the real problem is scale up	Later versions clarified this.	Matteo Muratori	NREL	United States of America
47943	114	35	114	35	BEV are also poised as soluttion for long-haul trucks by some: https://eta.lbl.gov/publications/working-paper-005- long-haul-battery.	Later versions clarified this.	Matteo Muratori	NREL	United States of America
69851	114	39	114	44	The response to FAQ 10.2 must distinguish aviation and maritime, that are more likely than not adopting different solutions: pure drop-in fuels, mix of biofuels and e-kerosene for aviation, and mostly ammonia for deep sea shippings. Battery electric ships may also be more viable for short range ships (already deployed in the Scandinavians countries for ferries - up to 80 Norwegian ferries going to be electrified) than for short range planes, as the very low specific energy (aka "gravimetric" density) is much more problematic for planes than for ships. On the electrification of maritime transport see e.g. Liebreich et al. 2021 Opportunities for electric ferries in Latin America, Inter-Aerican Development Bank.	Later versions clarified this.	Cédric PHILIBERT	Institut Français des Relations Internationales	France
51575	114	41	114	43	"Synthetic fuels made by CO2 capture and subsequent refining to a jet fuel or marine fuel can be a very good solution as it is zero carbon, involves much less contrails-based climate impacts and low local air pollution." This statement is not supported for aviation by 10.5.3.3 (Page 10-63) and is not true. Hydrogen-powered aviation. A fact-based study of hydrogen technology, economics, and climate impact by 2050. May 2020. Clean Sky 2 JU and Fuel Cells and Hydrogen 2 JU (Joint Undertakings) https://www.fch.europa.eu/publications/hydrogen-powered-aviation	Later versions clarified this.	eric lombard	Stay Grounded	France
85563	114	41	114	44	It would be prudent to also point out that you need more low carbon energy to produce sythethic fuels than to charge a battery. In a world where low carbon energy is not abundant in the forseeable future, producing synthetic fuels means you will burn more fossil fuels elsewhere. You could for example add a sentence to the end like: "Another drawback of synthetic fuels is that they require about four times more energy than directly charging a battery which means they would slow down decarbonisation of the energy sector unless synthetic fuels somehow managed to speed up the creation of low carbon energy supply."	Later versions clarified this.	Auke Hoekstra	Eindhoven University of Technology	Netherlands
46505	114	43	114	44	FAQ 10.2: Why mention Switzerland specifically? Please either elaborate more in order clarify, or delete this last sentence.	Later versions clarified this.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
9369	115	1	115	14	The question suggests that this FAQ might cover quite a lot of ground and present some tangible recommendations. But it is hard to understand why you focus on only four aspects in the answer, and it does not become clear what "governments, communities and individuals" can do exactly or how actions on these levels depend on each other, how these levels interact. Does the transformation happen top-down or bottom-up or in a combination of both? In this context, I also wonder if there is any evidence about people's willingness to chose more energy-efficient transport options (and what would have to happen to make best use of their motivation).	Later versions clarified this.	Maike Nicolai	Helmholtz Centre Geesthacht	Germany
46507	115	1	115	14	FAQ 10.3: the text does not refer to all groups mentioned in the FAQs title, esp. Individuals. Please add information on options for individuals or rephrase title.	Later versions clarified this.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
11305	115	3	115	4	I suggest adding this sentence, or similar, after the sentence ending on line 4 “Reallocating existing road space from private cars to dedicated space for public transit, walking and cycling seems to be a particularly effective strategy for reducing energy use.” See ITF (2021), Reversing Car Dependency: Summary and Conclusions, ITF Roundtable Reports, No. 181, OECD Publishing, Paris. www.itf-oecd.org/avoiding-car-dependency	Later versions clarified this.	Eric Doherty	Ecopath Planning	Canada
79373	115	3	115	5	All types of communities (not just cities) can significantly reduce per captia vehicle travel through integrated TDR and Smart Growth strategies that include less car dependent infrastructure, Smart Growth policies that create more compact, multimodal neighborhoods, pricing reforms (efficient road and parking pricing, fuel and carbon tax increases, pay as you drive vehicle insurance and taxes), and TDM programs.	Later versions clarified this.	TODD LITMAN	Victoria Transport Policy Institute	Canada
1327	115	5	115	14	Indeed in COVID times electric micro-mobility enables greater locatlised travel but whether this is good from a GHG perspective and leads to more efficiency in transport energy is not certain. As the ITF report (Good to go? Assessing the environmental performance of new mobility in cities) the GHG emissions of electromobility are not always low. Especially the GHG emissions of shared e-scooters are relatively high. It is therefore still questionable if all micromobility reduce energy demand. If walking or cycling trips are replaced this is not the case. Both in Paris and Brussel significant numbers of walking trips were replaced by e-scooters; see for instance Moreau et al., 2020 Dockless E-Scooter: A Green Solution for Mobility? Comparative Case Study between Dockless E-Scooters, Displaced Transport, and Personal E-Scooters. Sustainability / Lefrancq (2019). Shared freefloating micromobility regulations & results of e-scooter users’ survey (summer 2019). ERSCharter Webinar / 6t-bureau de recherche (2019). Uses and users of free-floating electric scooters in France.	Later versions clarified this.	Marlinde Knoope	KiM Netherlands Institute for Transport Policy Analysis	Netherlands
69853	115	5	115	8	While ICT does reduce the need for high energy travel, it is unclear if electric micro-mobility does too, or mostly replaces walking and cycling.	Later versions clarified this.	Cédric PHILIBERT	Institut Français des Relations Internationales	France
79375	115	9	115	11	"More traditional programs for reducing unnecessary high-energy travel through behaviour change programs, taxes on fuel, parking and vehicles, subsidies on alternatives, continue to be evaluated with mixed results due to the dominance of time savings in most transport issues." This statement does not really reflect the economics. In fact, people who live automobile-dependent lifestyles tend to spend more total time on travel, particularly if measured based on "effective speed" (travel distance divided by time spent travelling plus time spent earning money to pay travel expenses) because automoibile-dependent sprawl increases total travel distances. Yes, in such conditions individuals feel that driving is faster, but its an economic trap: a situation that forces individuals to compete in ways that are overall inefficient. I suggest changing it to: "Demand management strategies, such as improvements to resource-efficient modes, efficient pricing, and Smart Growth development policies have proven effective at reducing vehicle travel and emissions, but have not been widly implemented. Institutional reforms are needed for these strategies to be implemented to the degree that they are justified for their oveall benefits. See: "Paul J. Tranter (2004), Effective Speeds: Car Costs are Slowing Us Down, University of New South Wales, for the Australian Greenhouse Office (www.climatechange.gov.au); at https://bit.ly/36g5oa9.	Later versions clarified this.	TODD LITMAN	Victoria Transport Policy Institute	Canada

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
84789	115	9	115	11	"More traditional programs for reducing unnecessary high-energy travel through behaviour change programs, taxes on fuel, parking and vehicles, subsidies on alternatives, continue to be evaluated with mixed results due to the dominance of time savings in most transport issues." This statement does not really reflect the economics. In fact, people who live automobile-dependent lifestyles tend to spend more total time on travel, particularly if measured based on "effective speed" (travel distance divided by time spent travelling plus time spent earning money to pay travel expenses) because automoibile-dependent sprawl increases total travel distances. Yes, in such conditions individuals feel that driving is faster, but its an economic trap: a situation that forces individuals to compete in ways that are overall inefficient. I suggest changing it to: "Demand management strategies, such as improvements to resource-efficient modes, efficient pricing, and Smart Growth development policies have proven effective at reducing vehicle travel and emissions, but have not been widly implemented. Institutional reforms are needed for these strategies to be implemented to the degree that they are justified for their oveall benefits. See: David Metz (2008), "The Myth of Travel Time Saving," Transport Reviews, Vol. 28, No. 3, pp. 321- 336; at http://pdfserve.informaworld.com/149983__910667966.pdf. Christopher Standen (2018), The Value of Slow Travel: An Econometric Method for Valuing the User Benefits of Active Transport Infrastructure, PhD Thesis, University of Sydney (https://ses.library.usyd.edu.au); at https://bit.ly/2EkA0Ym. Paul J. Tranter (2004), Effective Speeds: Car Costs are Slowing Us Down, University of New South Wales, for the Australian Greenhouse Office (www.climatechange.gov.au); at https://bit.ly/36g5oa9. Paul Joseph Tranter (2010), "Speed Kills: The Complex Links Between Transport, Lack of Time and Urban Health," Journal of Urban Health, Vol. 87, No. 2, doi:10.1007/s11524-009-9433-9; at www.springerlink.com/content/v5206257222v6h8v.	Later versions clarified this.	TODD LITMAN	Victoria Transport Policy Institute	Canada
57003	128	7	128	7	The source should correctly read as follows: Fleming, G.G., and de Lepinay, I. (2019). Environmental trends in aviation to 2050. Available at: www.icao.int/environmental-protection/Documents/EnvironmentalReports/2019/ENVReport2019_pg17-23.pdf	Accepted	Government of United States of America	U.S. Department of State	United States of America
85589	135	6	135	8	First author name is missing.	Rejected because it is automatically generated by Mendeley.	San Win	Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation	Myanmar
51527	135	42	135	42	Kandaramath Hari, T., Yaakob, Z., and Binitha, N. N. (2015). Refered to as Hari et al. 2015 in page 10-63, line 42. Should be classified to the letter H.	Accepted	eric lombard	Stay Grounded	France
85591	136	10	136	11	First author name is missing.	Rejected because it is automatically generated by Mendeley.	San Win	Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation	Myanmar
85593	137	1	137	1	First author name is missing.	Rejected because it is automatically generated by Mendeley.	San Win	Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation	Myanmar
61145	148	39	148	40	This citation should be: "Sclar R., C. Gorguinpour, S. Castellanos, X. Li. 2019. "Barriers to Adopting Electric Buses". Report. Washington, DC: World Resources Institute. ISBN: 978-1-56973-960-0. Available online at https://www.wri.org/publication/barriers-adopting-electric-buses"	Accepted	Su Song	Young Crane Consulting	China
84149	160	29	160	31	In terms of mitigation alternatives and policy formation, existing vehicle fleet should have a zero value except where maintenance is being considered. The IPCC should also include a table to show that due to local issues of countries the Life cycle GHG emissions are not the same (high carbon electricity as the most obvious). The VC value shoudl also reference Scope 3 emissions and incorporate the energy consumption in disposal and recyclying of the components.	Noted. These issues are discussed in 10.4	Kym Lennox	climate change equity	Australia
2465	165	3	165	4	Table SM.1. on the feasibility assessment could include further references on the acceptability of electromobility. One recent contribution, stuyding factors that lead consumers to accept and adopt electric vehicles, relying on a relatively high share of actual adopters of Battery Electric (BEV) and Plug-in Hybrid Electric Vehicles (PHEV) in their sample, is Orlov, Anton and Steffen Kallbekken, 2019. The impact of consumer attitudes towards energy efficiency on car choice: Survey results from Norway. Journal of Cleaner Production 214, 816-822.	Noted. Reference added.	Steffen Kallbekken	CICERO	Norway
10017					Please see our previous comment on Chapter 2 page 64 regarding the case of Southeast Asia countries, car dependency has been growing together with higher motorbike use. (In the case of Southe ast Asia countries, car dependency has been growing together with higher motorbike use. Not only for private use, it has also been growing due to online transport applications such as uber and gojek. Such online transport becomea a competitor of public or mass transit for intercity travel.)	Noted. This trend is described in 10.2 and 10.8	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
27809					The presented scenarios on transformation pathways for the aviation and maritime sectors to consider the 11 Illustrative Pathways elaborated in earlier Chapters of the WG III contribution, and show results for C1:C7.	Noted. Unsure of the meaning here. 10.7 covers scenarios and how they relate to 11 pathways.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
39057					There are only two mentions of potential stranded assets in this entire chapter, and both are references to the stranded asset potential of the auto industry. If we consider transportation more broadly, there are a whole bunch of transportation sectors where asset value risk is quite high--marine transport, cruise lines, railroads and public transportation, air travel and freight. Agian, the point I made above stands--it not just an issue of directing financial flows in a certain (and presumably better) direction--there's a lot of baggage that needs to be dealt with.	Noted. Broad aspects of stranded assets are dealt with in other chapters.	Robert Buhr	Green Planet Consulting Ltd.	United Kingdom (of Great Britain and Northern Ireland)

Comment ID	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
57005					Battery disposal is not addressed. Ensure that disposal policies are equitable and do not inequitably impact low-income communities or communities of color.	Noted. Battery recycling dealt with in Box.	Government of United States of America	U.S. Department of State	United States of America
57007					Will charging stations be equitably distributed throughout communities? Under-served communities have the longest commuting time; charging infrastructures must be equitably distributed.	Noted. Equitable charging is expanded	Government of United States of America	U.S. Department of State	United States of America
57009					The report suggests incentivizing the use of public transporatation over personal vehicles; this discussion must also include ensuring that public transportation is fully accessible for persons with disabilities, and that public transportation is equitably available to all communities.	Noted. Addressing all other aspects of equitable transport is difficult in the space allowed.	Government of United States of America	U.S. Department of State	United States of America
57011					The topic of transportation of hazardous materials and energy products by pipeline does not appear to be addressed; check to see if addressed in other chapters. Also, check if the costs and specific hazards associated with movement/transportation of lithium batteries and materials are covered in other chapters.	Noted. Pipelines are addressed in ch 6. LiB costs and safety are addressed in this chapter.	Government of United States of America	U.S. Department of State	United States of America
57013					Be consistent in how lithium ion batteries are identified and referred to throughout the chapter. Terms used include: Li-ion batteries, LIB, LIB-based, LI batteries.	Noted. Editorial	Government of United States of America	U.S. Department of State	United States of America
57015					The chapter starts making the point that transport sector GHG trends in the report are through 2018. However, periodically throughout the chapter, including in the Introduction, there is brief mention/suggestion of COVID-19 impacts on emission outcomes. It would be helpful in the introduction to briefly discuss how the chapter is treating COVID-19 in the context of the 2000-2018 focus of the emissions trends. Does the report just recognize that travel during 2020-2021 will be a temporary deviation from the trend? Do authors suspect there could be longer term implications? As it is currently written, it's not clear to a reader how the authors view/treat/have considered COVID travel other than to note that travel (and thus emissions) have slowed some in the last few months.	Noted. This issue was handled in X-cut Box on Covid. Also mentioned in ch 10 briefly.	Government of United States of America	U.S. Department of State	United States of America
57017					The sections of this chapter that discuss technology readiness of Li-ion technology and its associated charging infrastructure is a good assessment for light duty vehicles. However, it seems to ignore that this technology is at a different TRL with regards to medium and heavy duty onroad vehicles, marine vessels, locomotives, and aircraft. This oversight is most significant in the area of MD/HD onroad vehicles, where battery electric technology actually is available today and can be assessed. While great strides have been made in the electrification of MD/HD freight vehicles, that technology remains at a lower TRL than the equivalent technology for LDVs. The same is true for charging infrastructure. While a global charging protocol for MD/HD is being developed, it is years behind the equivalent processes for LDV. The overall effect of this oversight is to overstate the level of technological readiness of Li-ion batteries and charging for MD/HD freight applications. Statements made later in this chapter for hydrogen fuel cells in the MD/HD space should be applied equally to Li-ion batteries, as both are of similar TRL in the context of freight vehicles, especially heavy duty freight vehicles.	Noted. It is not an oversight but is heavily discussed in the technology chapters and in 10.8.	Government of United States of America	U.S. Department of State	United States of America
57019					A lot more could be said regarding military transit/traffic and the security implications as well as those for emissions.	Noted. Cybersecurity is described.	Government of United States of America	U.S. Department of State	United States of America
57021					This literature should be included as a way to enhance the discussion on artificial intelligence and machine learning approaches to tackle various aspects of climate change: https://arxiv.org/pdf/1906.05433.pdf. Either the article's insights should all be positioned within Chapter 10, or the insights should be divided across the chapters based on the different areas addressed.	Noted. The Box on smart technologies explains this now.	Government of United States of America	U.S. Department of State	United States of America
86703					The Transport chapter is good but more emphasis needs to be put on the need to get the institutional framework right for aviation and shipping, This is one of the hardest and most important issues for AR6 and COP26.	Noted. The Box on this remains with a strong focus on governance of aviation and shipping.	Mark Hinnells	Ricardo Energy and Environment	United Kingdom (of Great Britain and Northern Ireland)