## Errata in Climate Change 2022: Mitigation of Climate Change

**Working Group III Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (WGIII AR6)**

**Version: 06_03_2023**


<table>
<thead>
<tr>
<th>Document (Chapter, Annex, Supp. Material)</th>
<th>Page (Based on the final pdf FGD version)</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPM</td>
<td>47</td>
<td>Insert minus sign before “45” ie: (e.g., -45-100 USD/tCO2...</td>
</tr>
<tr>
<td>SPM</td>
<td>Figure 8</td>
<td>Symbol showing the links between response option: “Highly energy efficient building envelope” links with “SDG 17” should be a “+”</td>
</tr>
<tr>
<td>SPM</td>
<td>55</td>
<td>D2.2: replace “Land-related mitigation options with potential co-benefits for adaptation include agroforestry, cover crops, intercropping, and perennial plants, thus restoring natural vegetation and rehabilitating degraded land.” with “Land-related mitigation options with potential co-benefits for adaptation include agroforestry, cover crops, intercropping, perennial plants, restoring natural vegetation and rehabilitating degraded land.”</td>
</tr>
<tr>
<td>SPM</td>
<td>8</td>
<td>“35% live in countries...” to be changed to: “Around 35% live in countries...”</td>
</tr>
<tr>
<td>SPM</td>
<td>38</td>
<td>Replace “In both categories of scenarios, the transport sector likely does not reach zero CO2 emissions by 2100 so negative emissions are likely needed to counterbalance residual CO2 emissions from the sector (high confidence).” with “In both categories of scenarios, the transport sector is not modelled to reach zero CO2 emissions by 2100 so CDR is expected to be needed to counterbalance residual CO2 emissions from the sector (high confidence).”</td>
</tr>
<tr>
<td>SPM</td>
<td></td>
<td>replace “Models that incorporate the economic damages from climate change find that the global cost of limiting warming to 2°C over the 21st century...” with “Models that incorporate the economic damages from climate change find that the global cost of limiting warming to 2°C (&gt;67%) over the 21st century...”</td>
</tr>
</tbody>
</table>
The 2020–2030 decade is critical for accelerating the learning of know-how, building the technical and institutional capacity, setting the appropriate governance structures, ensuring the flow of finance, and in developing the skills needed to fully capture the mitigation potential of buildings.

The 2020–2030 decade is critical for accelerating the acquisition of know-how, building the technical and institutional capacity, setting the appropriate governance structures, ensuring the flow of finance, and in developing the skills needed to fully capture the mitigation potential of buildings.

Add " ; Solar Radiation Modification (SRM) (Cross-Working Group Box 4 in Chapter 14)." to the end of the footnote, to read:

Namely: Economic Benefits from Avoided Climate Impacts along Long-Term Mitigation Pathways (Cross-Working Group Box 1 in Chapter 3); Urban: Cities and Climate Change (Cross-Working Group Box 2 in Chapter 8); Mitigation and Adaptation via the Bioeconomy (Cross-Working Group Box 3 in Chapter 12; and Solar Radiation Modification (SRM) (Cross-Working Group Box 4 in Chapter 14)."

By 2050, comprehensive demand-side strategies across all sectors could reduce CO2 and non-CO2 GHG emissions globally by 40–70% compared to the 2050 emissions projection of two scenarios consistent with policies announced by national governments until 2020...."

By 2050, comprehensive demand-side strategies could reduce direct and indirect CO2 and non-CO2 GHG emissions in three end-use sectors (buildings, land transport, and food) globally by 40%–70% compared to the 2050 emissions projection of two scenarios consistent with policies announced by national governments until 2020...."

In the same type of pathways assessed in SR1.5, reported GHG emissions reductions in 2030 were 39-51% (interquartile range) relative to 2010.

In this context, ‘unabated fossil fuels’ refers to fossil fuels produced and used without interventions that substantially reduce the amount of GHG emitted throughout the life-cycle; for example, capturing 90% or more from power plants, or 50-80% of fugitive methane emissions from energy supply. {Box 6.5, 11.3]"

In this context, ‘unabated fossil fuels’ refers to fossil fuels produced and used without interventions that substantially reduce the amount of GHG emitted throughout the life-cycle; for example, capturing 90% or more CO2 from power plants, or 50-80% of fugitive methane emissions from energy supply. {Box 6.5, 11.3]"

Drawing error: in the 2100 panel of SPM4 - for current policies the p75 should be 74.16, not 70

Drawing error: discrepancy in the lines between panel a and b in 2030

In the legend: "Filled: peak warming (over the 21st century" - change to "Filled: highest projected warming over the 21st century"

Replace “+5.9 (±4.1)” with “+5.7 (±4.0)”. Replace “7.2” in the line of sight with “Table 2.1”

Replace Enhanced plant growth, reduced erosion, enhanced soil carbon, reduced pH, soil water retention.” with “Enhanced plant growth, reduced erosion, enhanced soil carbon, reduced soil acidity, enhanced soil water retention.”

Figure TS.7 Legend: Replaced legend with SPM.3 Legend.
Canada, and the United States of America. Uncertainties in emissions levels and changes over time prevents a precise assessment of reductions in some cases. The per-capita emissions of developed countries remain high, particularly in Australia, Canada, and the United States of America. Uncertainties in emissions levels and changes over time prevents a precise assessment of reductions in some cases. The per-capita emissions of developed countries remain high, particularly in Australia, Canada, and the United States of America.

The combined emissions reductions of these 24 countries were outweighed by rapid emissions growth elsewhere, particularly among developing countries that have grown from a much lower base of per-capita emissions. Of these, six are Western and Northern European countries that started reducing in the 1970s, six are former Eastern Bloc countries with consistent reductions since the 1990s, and 12 more have reduced since the mid-2000s. At least 24 countries have reduced both territorial carbon dioxide (CO2) and GHG emissions and consumption-based CO2 emissions in absolute terms for at least 10 years, including consumption-based CO2 emissions. Of these, six are Western and Northern European countries that started reducing in the 1970s, six are former Eastern Bloc countries with consistent reductions since the 1990s, and 12 more have reduced since the mid-2000s. A growing number of countries have reduced both territorial carbon dioxide (CO2) and GHG emissions and consumption-based CO2 emissions in absolute terms for at least 10 years, including consumption-based CO2 emissions. These include mainly European countries, some of which have reduced production-based GHG emissions by a factor of two or more since peaking. Some countries have achieved several years of rapid sustained CO2 reduction rates of 4% yr⁻¹. (TS.5) (2.2')

Some have done so at rapid sustained CO2 reduction rates of 4% yr⁻¹. (TS.3) (2.2')

Given the multiple sources and lack of harmonised methodologies, the data can only be indicative of the size and pattern of investment gaps. The gap between most recent flows and required investments is only a single indicator. A more comprehensive (and qualitative) assessment is required in order to understand the magnitude of the challenge of scaling up investment in sectors and regions. The analysis also does not consider the effects of misaligned flows. (15.3, 15.4, 15.5, Table 15.2, Table 15.3, Table 15.4)
A growing number of countries have achieved GHG emission reductions over periods longer than 10 years – a few at rates that are broadly consistent with the global rates described in climate change mitigation scenarios that limit warming to 2°C (>67%) (high confidence). At least 24 countries have reduced CO2 and GHG emissions for longer than 10 years...

Pathways limiting warming to 2°C (>67%) or 1.5°C (>50%) and below exhibit substantial reductions in emissions from all sectors (high confidence). Pathways that limit warming to 1.5°C (>50%) with no or limited overshoot entail CO2 emissions reductions between 2019 and 2050 of around 77% (31–96%) for energy demand, around 115% (90–167%) for energy supply, and around 148% (94–387%) for AFOLU. In pathways limiting warming to 2°C (>67%), projected CO2 emissions are reduced between 2019 and 2050 by around 49% for energy demand, 97% for energy supply, and 136% for AFOLU (medium confidence). {3.4}

Removing fossil fuel subsidies could reduce emissions by 1-10% by 2030 while improving public revenue and macroeconomic performance (robust evidence; medium agreement). {13.6}

Removing fossil fuel subsidies would reduce emissions, improve public revenue and macroeconomic performance, and yield other environmental and sustainable development benefits; subsidy removal may have adverse distributional impacts especially on the most economically vulnerable groups which, in some cases can be mitigated by measures such as redistributing revenue saved, all of which depend on national circumstances (high confidence); fossil fuel subsidy removal is projected by various studies (using alternative methodologies) to reduce global CO2 emissions by 1–4%, and GHG emissions by up to 10% by 2030, varying across regions (medium confidence). {6.3, 13.6}
Add line of sight to SR1.5:

"[SR1.5 Figure SPM.3b]"

Scenario category names updated to be consistent with the SPM (broad guidelines followed as below) in all instances in chapter where this change aids comprehension

Category>Old>Approved
C1>limit warming to 1.5°C with no or limited overshoot>limit warming to 1.5°C (>50%) with no or limited overshoot
C2>limit warming to 1.5°C with high overshoot>return warming to 1.5°C (>50%) after a high overshoot
C3>Likely below 2°C>limit warming to 2°C (>67%)
C4>Below 2°C>limit warming to 2°C (>50%)
C5>Below 2.5°C>limit warming to 2.5°C (>50%)
C6>Below 3°C>limit warming to 3°C (>50%)
C7>Below 4°C>limit warming to 4°C (>50%)
C8>Above 4°C>exceed warming of 4°C (>50%)
C1, C2 and C3>Likely limit to 2°C or lower>limit warming to 2°C (>67%) or lower

...while countries in Asia and developing Pacific...’ to ‘...while countries in Asia and Pacific...’

change 13.4% to 13.3%

Request to add "(Ward et al., 2016; Hickel and Kallis, 2020; Haberl, et al., 2020)"

Request to add "(Jiang, et al., 2021)", to read:
"(Xu and Ang, 2013; Kanitkar et al., 2015; Su and Ang, 2016; Jiang, et al., 2021)"


"Ranking of high-emitting sectors by direct emissions highlights the importance of CO2 emissions from LULUCF (6.6 GtCO2-eq; but with low confidence in magnitude and trend), road transport (6.1 GtCO2-eq), metals (3.1 GtCO2-eq), and other industry (4.4 GtCO2-eq) subsectors."

"Ranking of high-emitting sub-sectors by direct emissions highlights the importance of CO2 emissions from LULUCF (6.6 GtCO2-eq; but with low confidence in magnitude and trend), road transport (6.1 GtCO2-eq), metals (3.1 GtCO2-eq), and other industry (4.4 GtCO2-eq)."

request to remove in-text citation (Le Quéré et al. 2018) from the following sentence:

Developing countries tend to be net emission exporters with higher PBEs than their CBPs (Peters et al. 2011a; Le Quéré et al. 2018).

replace

"The global benefits of pathways likely limiting warming to 2°C outweigh global mitigation costs over the 21st century,..." with

"The global benefits of limiting warming to 2°C outweigh global mitigation costs over the 21st century,..."

likely' to be deleted from below:"However, emerging evidence suggests that, even without accounting for co-benefits of mitigation on other sustainable development dimensions (see section 3.6.3 for elements on co-benefits), global benefits of pathways likely to limit warming to 2°C outweigh global mitigation costs over the 21st century."

Replace: "total gross negative" from the bottom-right panel of figure 3.15 with "total gross removals"

Figure 3.43 Changes in the colours to be aligned with Figure T5.32; changes in the symbols and colours for the IMPs (Panel C) to be aligned with Figure T5.32.
Below replacement of text to match approved changed in SPM Box

The IMPs consist of pathways with: gradual strengthening of current policies (GS), extensive use of net negative emissions (Neg), renewables (Ren), low demand (LD), and shifting pathways (SP). Each of these pathways can be implemented with different levels of ambition.

With

The IMPs differ in terms of their focus, for example, placing greater emphasis on renewables (IMP-Ren), deployment of carbon dioxide removal that results in net negative global GHG emissions (IMP-Neg), and efficient resource use and shifts in consumption patterns, leading to low demand for resources, while ensuring a high level of services (IMP-LD). Other IMPs illustrate the implications of a less rapid introduction of mitigation measures followed by a subsequent gradual strengthening (IMP-GS), and how shifting global pathways towards sustainable development, including by reducing inequality, can lead to mitigation (IMP-SP)

Replace ‘This is illustrated in Figure 3.13, which plots the cumulative CO2 emissions against the projected outcome for global mean temperature, both until a temperature peak and full century.’ With

This is illustrated in Figure 3.13, which plots the cumulative CO2 emissions against the projected outcome for global mean temperature, both until peak temperature and through to end of century (or 2100).’

Replace ‘By contrast, achieving equity without international markets would result in a large discrepancy in regional carbon prices, up to a factor (Bauer et al. 2020).’ with

‘By contrast, achieving equity without international markets would result in a large discrepancy in regional carbon prices, up to a factor of 100 (Bauer et al. 2020).’

SDG 15 updated from ‘ecosystem protection and water system’ to ‘life on land’ per official SDG name (https://sdgs.un.org/#goal_section)

Update ‘Other factors currently limiting the capacity to steer transitions at the necessary speed include the electoral-market orientation of politicians (Willis 2017), the status-quo orientation of senior public officials (Geden 2016), path dependencies created by ‘instrument constituencies’ (Béland and Howlett 2016), or the benefits of deliberate inconsistencies between talk, decisions and actions in climate policy (Rickards et al. 2014).’ to

‘Other factors currently limiting the capacity to steer transitions at the necessary speed include the electoral-market orientation of politicians (Willis 2017), the status-quo orientation of senior public officials (Geden 2016), path dependencies created by ‘instrument constituencies’ (Béland and Howlett 2016), or the impacts of deliberate inconsistencies between talk, decisions and actions in climate policy (Rickards et al. 2014).’

Fig 3.5 addition to caption: ‘The Ren2.0 and Neg2.0 scenarios are alternative scenarios to the IMPs. These pathways are based on renewables and extensive use of negative emissions, respectively, but leading to temperature levels comparable to the C3 category and have sometimes been used for comparison.’

Change from:

“The SSPs have now been quantified in terms of energy, land-use change, and emission pathways (Riahi et al. 2017)”

to

“The SSPs have now been quantified in terms of energy, land-use, and emission pathways (Riahi et al. 2017)”

Changed to:

“The scenarios originated from over 15 different model intercomparison projects, with very few scenarios originating from individual studies”

_CHANGED TO:_

“The scenarios originated from over 15 different model intercomparison projects, with around one fifth originating from individual studies”
Numbers throughout paragraph changed to reflect updated numbers in Annex III, as follows:

"In addition to the temperature classification, each scenario is assigned to one of the following policy categories: (P0) diagnostic scenarios – 100 of 1686 vetted scenarios; (P1) scenarios with no globally coordinated policy and either (P1a) no climate mitigation efforts – 119, (P1b) current national mitigation efforts – 59, (P1c) Nationally Determined Contributions (NDCs) – 110, or (P1d) other non-standard assumptions – 104; (P2) globally coordinated climate policies with immediate (i.e., before 2030) action – 73, (P2a) without any transfer of emission permits – 435, (P2b) with transfers – 70; or (P2c) with additional policy assumptions – 55; (P3) globally coordinated climate policies with delayed (i.e., from 2030 onwards or after 2030) action, preceded by (P3a) no mitigation commitment or current national policies – 7, (P3b) NDCs – 376, (P3c) NDCs and additional policies..."

Changed to:

"In addition to the temperature classification, each scenario is assigned to one of the following policy categories: (P0) diagnostic scenarios – 99 of 1686 vetted scenarios; (P1) scenarios with no globally coordinated policy (500) and either (P1a) no climate mitigation efforts – 124, (P1b) current national mitigation efforts – 59, (P1c) Nationally Determined Contributions (NDCs) – 160, or (P1d) other non-standard assumptions – 153; (P2) globally coordinated climate policies with immediate (i.e., before 2030) action (634) and either (P2a) without any transfer of emission permits – 435, (P2b) with transfers – 70; or (P2c) with additional policy assumptions – 55; (P3) globally coordinated climate policies with delayed (i.e., from 2030 onwards or after 2030) action, preceded by (P3a) no mitigation commitment or current national policies – 7, (P3b) NDCs – 426, (P3c) NDCs and additional policies..."

---

**Figure 3.7**, title to change from:

The residual fossil fuel and industry emissions, net land-use change, carbon dioxide removal (CDR), and non-CO2 emissions (using AR6 GWP-100) for each of the seven illustrative pathways (IPs).

To:

"The residual fossil fuel and industry emissions, carbon dioxide removal (CDR) {LUC, DACCS, BECCS}, and non-CO2 emissions (using AR6 GWP-100) for each of the seven illustrative pathways (IPs)."

---

Box 3.4, cumulative CO2 emissions until net zero estimated by AR6 WGIII

"The numbers can be found in Table 3.2 (330–710 GtCO2 for C1; 540–930 for C2; and 640–1160 for C3)."

changed to:

"The numbers can be found in Table 3.2 (330–710 GtCO2 for C1; 530–930 for C2; and 640–1160 for C3)."

---

Pathways following emissions levels projected from the implementation of NDCs announced prior to COP26 until 2030 would have to reach net zero CO2 around 10 years earlier.

Changed to:

Pathways following emissions levels projected from the implementation of NDCs announced prior to COP26 until 2030 would have to reach net zero CO2 around 5 years earlier.

Same change made in corresponding footnote.

---

A small fraction of pathways in the AR6 scenarios database that likely limit warming to 2°C (9%) or are as likely as not to limit warming to 2°C (14%)...

Changed to:

A small fraction of pathways in the AR6 scenarios database that limit warming to 2°C (7% for C3 and 14% for C4)...

---

Pathways that follow emission levels projected from the implementation of NDCs announced prior to COP26 until 2030 and that still likely limit warming to 2°C reach net zero CO2 emissions during 2065–2070 (2060–...)

compared with 2075–2080 (2060–...)

Changed to:

Pathways that follow emission levels projected from the implementation of NDCs announced prior to COP26 until 2030 and that still limit warming to 2°C (+67%) reach net zero CO2 emissions during 2065–2070 (2055–2090)

compared with 2070-2075 (2055–...)

---

CCB3. "Global net zero GHG emissions measured in terms of GWP-100 are reached between 2095 and 2100 (2050–...)

Changed to:

"Global net zero GHG emissions measured in terms of GWP-100 are reached between 2095 and 2100 (2050–...)

---

Page 7
Footnote changed from:
"'NDCs announced prior to COP26' refers to the most recent Nationally Determined Contributions submitted to the UNFCCC as well as those publicly announced with sufficient detail on targets, but not yet submitted, up to 11 October 2021, and reflected in studies published up to 11 October 2021."

To:
"NDCs announced prior to COP26 refer to the most recent nationally determined contributions submitted to the UNFCCC up to the literature cut-off date of this report, 11 October 2021, and revised NDCs announced by China, Japan and the Republic of Korea prior to October 2021 but only submitted thereafter."

Cost-effective mitigation pathways assuming immediate actions to limit warming to 2°C (>67%) are associated with net global GHG emissions of 32–55 GtCO2-eq yr−1 by 2030...

Changed to:
"Cost-effective mitigation pathways assuming immediate actions to limit warming to 2°C (>67%) are associated with net global GHG emissions of 30-49 GtCO2-eq yr−1 by 2030..."

New footnote added at first use of ‘immediate action’, lifted from the SPM.

Footnote reads: "Immediate action in modelled global pathways refers to the adoption between 2020 and at latest before 2025 of climate policies intended to limit global warming to a given level. Modelled pathways that limit warming to 2°C (>67%) based on immediate action are summarised in category C3a in Table SPM.2. All assessed modelled global pathways that limit warming to 1.5°C (>50%) with no or limited overshoot assume immediate action as defined here (Category C1 in Table SPM.2)."

"To limit warming to 2°C (>67%) after following the NDCs to 2030, the pace of global GHG emission reductions would need to accelerate quite rapidly from 2030 onward: to an average of 1.4–2.0 GtCO2-eq yr−1 between 2030 and 2050, which is similar to global CO2 emission reductions in 2020..."

Changed to:
"To limit warming to 2°C (>67%) after following the NDCs to 2030, the pace of global GHG emission reductions would need to accelerate quite rapidly from 2030 onward: to an average of 1.4–2.0 GtCO2-eq yr−1 between 2030 and 2050, which is around two thirds of the global CO2 emission reductions in 2020..."

Modelled pathways that are consistent with NDCs announced prior to COP26 until 2030 and assume no increase in ambition thereafter have lower emissions, leading to a median global warming of 2.8°C [2.1-3.4°C] by 2100.

changed to:
Modelled pathways that are consistent with NDCs announced prior to COP26 until 2030 and assume no increase in ambition thereafter have higher emissions, leading to a median global warming of 2.8°C [2.1-3.4°C] by 2100.

Table 3.1 Col 1 heading updated from 'Description' to 'Category' to match SPM table 2 and col 2 heading 'Subset' to 'Description' for clarity

Table 3.2, footnote b: addition of 'and table 3.1' as: 'For a description of pathways categories see Box SPM.1 and Table 3.1.'

Update missing confidence statement as

'Different mitigation pathways are associated with different feasibility challenges, though appropriate enabling conditions can reduce these challenges. Feasibility challenges are transient and concentrated in the next two to three decades (high confidence). They are multidimensional, context-dependent and malleable to policy, technological and societal trends. (3.8)' to

'Different mitigation pathways are associated with different feasibility challenges, though appropriate enabling conditions can reduce these challenges (high confidence). Feasibility challenges are transient and concentrated in the next two to three decades (high confidence). They are multidimensional, context-dependent and malleable to policy, technological and societal trends. (3.8)'
Update missing confidence statement as

'Mitigation pathways are associated with significant institutional and economic feasibility challenges rather than technological and geophysical feasibility challenges. The rapid pace of technological development and deployment in mitigation pathways is not incompatible with historical records. Institutional capacity is rather a key limiting factor for a successful transition. Emerging economies appear to have the highest feasibility challenges in the short to medium term. (3.8)'

to

'Mitigation pathways are associated with significant institutional and economic feasibility challenges rather than technological and geophysical feasibility challenges (medium confidence). The rapid pace of technological development and deployment in mitigation pathways is not incompatible with historical records. Institutional capacity is rather a key limiting factor for a successful transition. Emerging economies appear to have the highest feasibility challenges in the short to medium term. (3.8)'

Table 3.1

Last row added 'C1, C2, C3: limit warming to 2°C (>67%) or lower' based on approved changes from SPM

Section 3.2

Title for section 3.2 updated from 'What are Mitigation Pathways Compatible With Long-term Goals?' to 'Which Mitigation Pathways are Compatible With Long-term Goals?'

Reference deletion:

As well as change of corresponding in-text citation:

For Germany, three steps to climate neutrality by 2050 are introduced: First, a 65% reduction of emissions by 2030; second, a complete switch to climate-neutral technologies, leading to a 95% cut in emissions, all relative to 1990 levels by 2050; and third balancing of residual emissions through carbon capture and storage (Görz et al. 2020)

to

For Germany, three steps to climate neutrality by 2050 are introduced: First, a 65% reduction of emissions by 2030; second, a complete switch to climate-neutral technologies, leading to a 95% cut in emissions, all relative to 1990 levels by 2050; and third balancing of residual emissions through carbon capture and storage (Prognos et al. 2020)

2. Replacing in-text citation as below:

from

The European Union member states (EU-28) recently announced 2050 climate neutrality goal is explored by pathways that emphasise complete substitution of fossil fuels with electricity generated by low-carbon sources, particularly renewables; demand reductions through efficiency and conservation, and novel fuels and end-use technologies (Capros et al. 2019; Zappa et al. 22; Louis et al. 2020; Duscha et al. 2019; Prognos Öko-Institut Wuppertal-Institut 2020)

to

The European Union member states (EU-28) recently announced 2050 climate neutrality goal is explored by pathways that emphasise complete substitution of fossil fuels with electricity generated by low-carbon sources, particularly renewables; demand reductions through efficiency and conservation, and novel fuels and end-use technologies (Prognos et al. 2020).

The European Green Deal proposed in 2019 (European Commission 2019), including a UDF100 billion...

To

The European Green Deal proposed in 2019 (European Commission 2019), including a €100 billion...

replace

'Some early framing of development pathways was included in the Third Assessment Report (William R Moomaw et al. 2001)'

with

'Some early framing of development pathways was included in the Third Assessment Report (Banuri et al. 2001)'


UNFCCC, 2015d: Adoption of the Paris Agreement. United Nations Framework Convention on Climate Change (UNFCCC), 32 pp.

Cross chapter Box 4, Emissions gap:

Change from: "GHG emissions of NDCs are broadly consistent with 2030 emission levels of cost-effective long-term pathways staying below 2.5°C."

To:

"GHG emissions of NDCs are broadly consistent with 2030 emission levels of cost-effective long-term pathways staying below 2.5°C, (scenarios category C5, Table 3.2, Chapter 3)."
Table 4.4, Target for Non-CO2 emissions:
"Members to implement policies that will deliver substantial short-lived climate forcers (SLCP) reductions in the near to medium-term (i.e., by 2030) for HFCs and methane"

Changed to:
"Members to implement policies that will deliver substantial short-lived climate pollutants (SLCP) reductions in the near to medium-term (i.e., by 2030) for HFCs and methane"

CCB4 Figure 1, figure to be replaced by updated graphic to reflect updated changes to figure SPM.4.

Changes as follows:
• Drawing error: in the 2100 panel - for current policies the p75 should be 74.16, not 70

Section 4.3.1.2, change from:

"Ecological sustainability challenges include reducing GHG emissions, protecting the ozone, controlling pollutants..."

To:

"Ecological sustainability challenges include reducing GHG emissions, protecting the ozone layer, controlling pollutants..."

Cross chapter Box 4 Figure 1 caption, panel a description:

Limit to 2°C (>67%) with immediate action: Pathways that limit warming to 2°C (>67%) with immediate action after 202027 (C3a, Table SPM.2)

Replace "comparing the situation between 2014 and 2018." With:
"comparing the situation between 2000 and 2018"

Table 5.5 Row "Reduce size of dwellings", change "Size of dwellings getting smaller" with "Size of dwellings getting larger"

The indicative potential of demand-side strategies across all sectors to reduce emissions is 40-70% in end use sectors (industry, buildings, land, transport and food) by 2050 (high confidence)."
<table>
<thead>
<tr>
<th>Page</th>
<th>Line</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>87</td>
<td>In the state of Himachal Pradesh of India, shift from LPG to electricity, with induction stove, has been successful due to…. Changed to: In the state of Himachal Pradesh of India, shift from LPG to electricity among rural households, with induction stove, has been successful due to….</td>
</tr>
<tr>
<td>5</td>
<td>96</td>
<td>Examples of informal-sector mitigation include digital banking in Africa; mobility in India using recycled motors and collective transport; food production, meal provision, and reduction of food waste in Latin America (e.g. soup kitchens in Brazil, community kitchens in Lima, community kitchens in Lima), Changed to: Examples of informal-sector mitigation include digital banking in Africa; mobility in India using collective transport; food production, meal provision, and reduction of food waste in Latin America (e.g. soup kitchens in Brazil, community kitchens in Lima, community kitchens in Lima),</td>
</tr>
<tr>
<td>5</td>
<td>Box 5.1 Figure 1</td>
<td>Box 5.1 Figure 1: Higher resolution version of figure provided to make data points clearer. Clustering overlay removed.</td>
</tr>
<tr>
<td>6</td>
<td>Box 6.11, 104</td>
<td>Change: “limiting warming to 1.5°C” to “likely limiting warming to 2.0°C or below”.</td>
</tr>
<tr>
<td>6</td>
<td>Figure 6.27</td>
<td>Updated fig 6.27: Errors identified in the R6 dataset mean that the figure is redrawn with correct data</td>
</tr>
<tr>
<td>6</td>
<td>Box 11 Figure 1, Box 11 Figure 2, Box 11 Figure 3, Box 11 Figure 4</td>
<td>Replace Box 11 Figure 1, Box 11 Figure 2, Box 11 Figure 3, Box 11 Figure 4 with updated Figures: Box 11 Figure 1, Box 11 Figure 2, Box 11 Figure 3, Box 11 Figure 4.</td>
</tr>
<tr>
<td>6</td>
<td>Figure 6.27</td>
<td>Change “RS” in the figure caption to “RS”</td>
</tr>
<tr>
<td>6</td>
<td>114</td>
<td>Change ‘generally’ to ‘- on an average -’</td>
</tr>
<tr>
<td>6</td>
<td>Figure 6.35</td>
<td>Replace Figure 6.35 with the new version to match the accounting method for all relative change assessments in Section 6.7 as undertaken in Final Draft Version.</td>
</tr>
<tr>
<td>6</td>
<td>117</td>
<td>Change “23-51” to “24-51”</td>
</tr>
<tr>
<td>6</td>
<td>117</td>
<td>change “79% to 99%” to “78% to 99%”</td>
</tr>
<tr>
<td>6</td>
<td>117</td>
<td>Change “66% to 98%” to “65% to 98%”</td>
</tr>
<tr>
<td>6</td>
<td>117</td>
<td>“21% to 61%” to “21% to 62%”</td>
</tr>
<tr>
<td>6</td>
<td>117</td>
<td>Change “-13% to 36%” to “-14% to 36%”</td>
</tr>
<tr>
<td>6</td>
<td>117</td>
<td>Change “43” to “73”, Change “91” to “145”, Change “19% to 54%” to “40% to 78%”</td>
</tr>
<tr>
<td>6</td>
<td>118</td>
<td>Change “46” to “26”, Change “109” to “86”</td>
</tr>
<tr>
<td>6</td>
<td>118</td>
<td>Change “21% 60%” to “14% to 45%”</td>
</tr>
<tr>
<td>6</td>
<td>44</td>
<td>Change from: “That said, recent years have seen a decrease in fossil EROI, especially as underground coal mining has continued in China”. To: “That said, recent years have seen a decrease in fossil EROI, especially as underground coal mining still represents a substantial portion of global production.”</td>
</tr>
</tbody>
</table>
Similarly, many programs have promoted the installation of lower-carbon household options such as heat pumps, district heating, or solar water heaters across Europe, the Asia-Pacific and Africa (Hu et al., 2012; Sovacool and Martiskainen 2020; Ahmed et al. 2021).”

- Sovacool, Benjamin K., Mari Martiskainen, Hot transformations: Governing rapid and deep household heating transitions in China, Denmark, Finland and the United Kingdom, Energy Policy, Volume 139, 2020, 111330

Scenario naming updates made throughout the chapter to ensure consistency, as below:
- C1>limit warming to 1.5°C with no or limited overshoot
- C2>limit warming to 1.5°C with high overshoot
- C3>Likely below 2°C
- C4>Likely below 2°C
- C5>Likely below 2.5°C
- C6>Likely below 3°C
- C7>Likely below 4°C
- C8>Likely above 4°C

- C1, C2 and C3>Likely limit to 2°C or lower

References


Figure 6.1 caption changed from:
Global energy flows within the 2019 global energy system (top panel) and within two illustrative future, net-zero CO2 emissions global energy system (bottom panels). Source: IEA, AR6 Scenarios Database. Flows below 1 EJ are not represented. The illustrative net-zero scenarios correspond to the years in which net energy system CO2 emissions reach zero – 2045 in IMP-Ren and 2060 in IMP-Neg-2.0. Source: data from IMP-Ren: Luderer et al.(2021); IMP-Neg-2.0: Riahi, K. et al. 2021.

To:
Global energy flows within the 2019 global energy system (top panel) and within two illustrative future, net-zero CO2 emissions global energy systems (bottom panels). Source: IEA, AR6 Scenarios Database. Flows below 1 EJ are not represented. Agricultural energy and energy own use are included in industry. Captured methane is included in natural gas supply where appropriate. The illustrative net-zero scenarios correspond to the years in which net energy system CO2 emissions reach zero – 2060 in IMP-Ren and 2070 in IMP-Neg-2.0. Source: data from IMP-Ren: Luderer et al.(2021); IMP-Neg-2.0: Riahi, K. et al. 2021.

Figure 6.1, panels b & c: Figure panels updated as incorrect data had been used.

Fig 6.5: add a sentence to the caption for Figure 6.5:
Primary energy in this figure is based on IEA accounting methods and not direct equivalents for several energy sources. Final energy does not include industry own use and losses.

Demand side mitigation row Change
‘Many options rely on voluntarily change so no governance issues and institutional barriers.’
to
‘Many options rely on voluntary change, consequently there are few governance issues and institutional barriers.’
Table 7.1 footnote f:
"(which would become −7.2 GtCO2 yr−1)"
should read
"(which would become −7.0 GtCO2 yr−1)"

In Australia, savanna burning emissions abatement methodologies have been available since 2012, and abatement has exceeded 4 MtCO2-eq mainly through the management of low intensity early dry season fire (Lynch et al. 2018). Until August 2021, 78 were registered (Australian Government, Clean Energy Regulator, 2021).

CHANGE TO
In Australia, savanna burning emissions abatement methodologies have been available since 2012, and abatement has exceeded 9.3 MtCO2-eq mainly through the management of low intensity early dry season fire. Until September 2021, 78 projects were registered (Australian Government, Clean Energy Regulator, 2021).

Regulatory markets provide the next largest share of carbon removal to date. Data from the Australia Emissions Reduction Fund is an estimate of carbon credits in agriculture, and forestry purchased by the Australian government.

Change to
Regulatory markets provide the next largest share of carbon removal to date. Data from the Australian Emissions Reduction Fund are carbon credits issued in for agricultural, and vegetation and savanna burning projects.

Column 2: Total emissions reduction or offset (Mt CO2-eq): 42.7m
Column 3: Timeframe: 2012-2019 (new footnote: “covering 7 financial years, 1 July to 30 June”)
Column 4: Mt CO2-eq yr: 6.1
Column 5: Financing (USD yr): 53.6

In section 7.3.1.4 “fire regime changes” notes unprecedented wildfires in British Columbia are dated to 2021. This is not correct. The given source [Kirchmeier-Young et al. 2019] mentions 12000 square kilometers burned in BC in 2017. A quick Google search gives the area burned in British Columbia in 2021 as 8700 square kilometers, i.e. less than 2017.

CO2-eq emissions for CH4 are incorrect. Replace "(CH4 = 27..." with "(CH4 = 28..."

Sentence should read "Under a scenario with aggressive but not immediate urban mitigation efforts to limit global warming to 2°C (>67%) (low emissions, SSP1-2.6), urban emissions could reach 17 GtCO2-eq in 2050." This is a change to the approved Trickleback, which reads: "Under a scenario with aggressive but not immediate urban mitigation policies to limit global warming to 2°C (>67%) (low emissions, SSP1-2.6), urban emissions could reach 17 GtCO2-eq in 2050."

Sentence should read "Under a scenario with aggressive but not immediate urban mitigation efforts to limit global warming to 2°C (>67%) (low emissions, SSP1-2.6), urban emissions could reach 17 GtCO2-eq in 2050." This is a change to the approved Trickleback, which reads: "Under a scenario with aggressive but not immediate urban mitigation policies to limit global warming to 2°C (>67%) (low emissions, SSP1-2.6), urban emissions could reach 17 GtCO2-eq in 2050.”

Sentence should read "cities can achieve net-zero emissions only if emissions are reduced within and outside of their administrative boundaries.

This is a change to the approved Trickleback, which reads: "cities can achieve net-zero emissions only if emissions are reduced within and outside of their administrative boundaries through supply chains"
The exclusion of consumption-based emissions and emissions that occur outside of city boundaries as a result of urban activities will lead to significant undercounting, to the effect of undercounting 41% of territorial emissions and 4% of global emissions annually, respectively (Wiedmann et al. 2021). The exclusion of consumption-based emissions and emissions that occur outside of city boundaries, however, will lead to significant undercounting. For example, a study of 79 major cities found that about 41% of consumption-based carbon footprints (1.8 GtCO2-eq of 4.4 GtCO2-eq) occurred outside of city boundaries. Hence, using a territorial approach would significantly undercount urban carbon footprints. Targeting the goods and services that are produced for consumption by urban households, encompassing the full supply chain and upstream production, are essential to realize the full mitigation potential of urban areas (Wiedmann et al. 2021).

Only then can the urban form constraints on locational and mobility options be effective at reducing transport-based emissions. Sector analysis indicates that gasoline transportation and electricity generation contributed to the majority of the April May 2020 decline (Gurney et al. 2021b). Nassar et al. (2020) report that over the past 30 years the US has become increasingly reliant in imports to meet domestic demand for minerals, including REEs.

Maintenance costs were assumed to be USD0.63 per km for ICEV buses and USD0.38 per km... 

For four sub-sectors in industry with high emissions Table 11.5 shows results from Material Economics (2019) for the EU. The combination of circularity, material and energy efficiency, fossil and waste fuels mix, electrification, hydrogen, CCS and biomass use varies from scenario to scenario with none of these options ignored, but tradeoffs are required. 

Table 11.1, last column heading to be changed from "GtCO2-e" to "MtCO2-e" 

Table 11.3, replace EUROs with USD and add footnote. USD39-79 t-1 and USD46 MWh-1 [footnote] Footnote: Converted from EUR2018 34–68 t–1 and EUR2018 40 MWh–1

Table 11.1, GHG intensity of EAFs, change from ">=0" to ">=0.05"

Table 11.5, addition of abbreviation. ‘TRL: technology readiness level is a measure of maturity of the CDR method. Scores range from 1 (basic principles defined) to 9 (proven in operational environment).’

Enhanced plant growth, reduced erosion, enhanced soil carbon, reduced pH, soil water retention. " with "Enhanced plant growth, reduced erosion, enhanced soil carbon, reduced soil acidity, enhanced soil water retention."


Table 10.5 footnote ‘n’ added: "Salman et al. (2017); Moreira et al. (2014); Roy et al. (2015); Handler et al. (2016).”

Table 10.1: Column ‘basic human needs’, change “Reduced stress level from driving” to “Reduced driving-induced stress” 

Table 10.5, ADD one line after "end of life plastic" to Table 11.5, titled CCS, with "5-34" for column "Steel", "0-31" for column "Plastics", "0-57" for column "Ammonia", and "29-79" for column "cement" 

Table 10.1, last column heading to be changed from "GtCO2-e “ to "MtCO2-e" 

Table 11.1, GHG intensity of EAFs, change from “>=0” to “>=0.05” 

Cost cut-offs at USD100 tCO2–1 are applied to both electricity production in 2030 as calculated by IAMs and electricity production potentials found in the sectoral analyses. 

Dietary changes are relevant for several SDGs, in addition to SDG 13 (climate action).'

Addition of abbreviation. 'TRL: technology readiness level is a measure of maturity of the CDR method. Scores range from 1 (basic principles defined) to 9 (proven in operational environment).’

Page 14
Update 'The latter are given as box plots of global emissions reductions for each sector (blue and green) at different global carbon cost levels (horizontal axis) for 2030, based on all scenarios likely limiting warming to 2°C or lower (see Chapter 3) in the AR6 scenarios database (IIASA 2021).'

to

'Emission reductions calculated using IAMs are given as box plots of global emissions reductions for each sector (blue and green) at different global carbon cost levels (horizontal axis) for 2030, based on all scenarios likely limiting warming to 2°C or lower (see Chapter 3) in the AR6 scenarios database (IIASA 2021).'

Update 'biodiversity' to 'fundamental alteration of food webs and biodiversity'

Changing the corrigendum for consistency with SPM footnote 53: The current text of corrigendum (p.16 of online corrigenda list):

add footnote after the sentence ending with "percentile range)" - "Cumulative CDR from AFOLU cannot be quantified precisely because models use different reporting methodologies that in some cases combine gross emissions and removals, and use different baselines.

CLAs now propose to update corrigenda to the following:

add footnote after the sentence ending with "percentile range)" - "Cumulative levels of CDR from AFOLU cannot be quantified precisely given that: (i) some pathways assess CDR deployment relative to a baseline; and (ii) different models use different reporting methodologies that in some cases combine gross emissions and removals in AFOLU. Total CDR from AFOLU equals or exceeds the net negative emissions mentioned.

Table 12.3


Change from "Depending on the carbon intensity of the electricity supplied to the vehicles Estimated potential is 0.5 GtCO2-eq, mitigation costs are variable”

to "Estimated potential is 0.5-0.7 GtCO2-eq, depending on the carbon intensity of the electricity supplied to the vehicles. Mitigation costs are variable.”

Table 12.3

Add text to cell under Transport, Heavy duty vehicles - electric vehicles, final column:

"Estimated potential is 0.2 GtCO2-eq. Mitigation costs are variable.”

Delete “in India” from the following sentence:

"For example, hydropower and ground-based solar parks in India have involved enclosure of lands designated as degraded, displacing pastoral use by vulnerable communities, constituting forms of spatial injustice (Yenneti et al. 2016).”

Change to corrigenda to align with SPM footnote 54 (not recorded as a trickleback).

Recorded corrigenda reads:

"Total CDR from AFOLU equals or exceeds the net negative emissions mentioned.” In Ch12, p40 line 15 (after the sentence ending with "percentile range)

Corrigenda previously proposed: add footnote after the sentence ending with "percentile range)" - "Cumulative CDR from AFOLU cannot be quantified precisely because models use different reporting methodologies that in some cases combine gross emissions and removals, and use different baselines.”

New proposal:

Footnote: "Cumulative CDR from AFOLU cannot be quantified precisely because models use different reporting methodologies that in some cases combine gross emissions and removals, and use different baselines. Total CDR from AFOLU equals or exceeds the net negative emissions stated.”

Figure 12.7 / TS.19

Figure is missing some elements in Chapter, which are shown in the TS (grey boxes missing). Replace Figure 12.7 with Figure TS.19.

Request to add the following authors as Contributing Authors of Chapter 12 (all contributed to Table 12.2):

Inês M.L. Azevedo (Portugal/the United States of America)
Stephanie Roe (the Philippines/The United States of America)
Aleksandra Novikova (Germany)
Sudarmanto Budi Nugroho (Indonesia)

"Soil Carbon Sequestration in croplands and grasslands” Column3

Correction requested: Insert minus sign before “45” ie: -45-100

Row Carbon capture, utilization and storage (CCU and CCS), 6th column

"0.15” should be replaced by (formatting same as for buildings sector):

0.15  (0.08-0.36)

Replace: "Blue carbon management in coastal wetlands” with "Blue carbon management in coastal ecosystems”
Cross-Working Group Box 3 | Mitigation and Adaptation via the Bioeconomy

**Old text:** A balanced approach to management of biomass resources could take departure in the carbon cycle from a value-preservation perspective and the possible routes that can be taken for biomass and carbon, considering a carbon budget defined by the Paris Agreement, principles for sustainable land use and natural ecosystem protection.

**New text:** A balanced approach to management of biomass resources could start from the perspective of value preservation within the carbon cycle, with possible routes for biomass use based on the carbon budget defined by the Paris Agreement, principles for sustainable land use and natural ecosystem protection.

*p. 73 of PDF proof*

Replace 'smart agriculture' with 'climate-smart' as below:

Integrated planning and cross-sectoral alignment of climate change policies are particularly evident in developing countries’ NDCs pledged under the Paris Agreement, where key priority sectors such as agriculture and energy are closely aligned between the proposed mitigation and adaptation actions in the context of sustainable development and the SDGs. An example is the integration between climate-smart agriculture and low-carbon energy (robust evidence, high agreement) (Antwi-Agyei et al. 2018; England et al. 2018).

Table 12.3, column "Cost categories 100-200", row "Protection of natural ecosystems…"

"0.22 (0.09 - 0.45)"

To move two rows down, under "Improved forest management, fire management", and corrected to:

"0.22 (0.09 - 0.45)"

Change from:

"For example, hydropower and ground-based solar parks have involved enclosure of lands designated as degraded, displacing pastoral use by vulnerable communities, constituting forms of spatial injustice (Yenneti et al. 2016)."

To:

"For example, Yenneti et al. (2016) have argued that hydropower and ground-based solar parks in India, which have involved enclosure of lands designated as degraded, displacing pastoral use by vulnerable communities, have constituted forms of spatial injustice."

The 2020 data point for the global share of emissions covered by national climate change legislation should read 52% instead of 53%. Correspondingly, the 47% data point should now read as 48%. This also applies to the TS figure.

Cross-Chapter Box 9, top right cell under 'barriers' replace: "Pushback from equity-focused social movements against 'premium' fares, cycling ban"

with:

"Accommodating and addressing legitimate concerns from social movements about the exclusionary effects of 'premium' fares, cycling bans on busy roads"

Section 13.3 title to be updated from 'Structural Factors that Shape Condition Climate Governance' to 'Structural Factors that Shape Climate Governance’

Change "Further, as of October 2020, more than 826 cities and 103 regional governments had made specific pledges to decarbonise, whether in a specific sector (e.g., buildings, electricity, or transport) or through their entire economies, pledging to reduce their overall emissions by at least 80% or greater (NewClimate Institute and Data Driven EnviroLab 2020)." to:

"Further, as of October 2020, more than 826 cities and 103 regional governments had made specific pledges to decarbonise, whether in a specific sector (e.g., buildings, electricity, or transport) or through their entire economies, pledging to reduce their overall emissions by at least 80% (NewClimate Institute and Data Driven EnviroLab 2020)."

Cross Chapter Box 3 | Mitigation and Adaptation via the Bioeconomy

Change 'Examples include emission trading systems within the USA, such as the Regional Greenhouse Gas Initiative (RGGI) and Western Climate Initiative’ to 'Examples include emission trading systems within North America, such as the Regional Greenhouse Gas Initiative (RGGI) and Western Climate Initiative (which also includes two Canadian provinces)’
Removing fossil fuel subsidies would reduce emissions, improve public revenue and macroeconomic performance, and yield other environmental and sustainable development benefits. Subsidy removal may have adverse distributional impacts which can be mitigated by measures such as re-distributing revenue saved (high confidence). Fossil fuel subsidy removal is projected by various studies to reduce global CO2 emissions by 1–4%, and GHG emissions by up to 10% by 2030, varying across regions (medium confidence). *(13.6)*

To be replaced with:

"Removing fossil fuel subsidies would reduce emissions, improve public revenue and macroeconomic performance, and yield other environmental and sustainable development benefits; subsidy removal may have adverse distributional impacts especially on the most economically vulnerable groups which, in some cases can be mitigated by measures such as redistributing revenue saved, all of which depend on national circumstances (high confidence); fossil fuel subsidy removal is projected by various studies (using alternative methodologies) to reduce global CO2 emissions by 1–4%, and GHG emissions by up to 10% by 2030, varying across regions (medium confidence). *(6.3, 13.6)*"

Replace "As the estimates in Table 4.3 demonstrate..." with "As Figure 14.2 illustrates graphically,..."

Replace "publics" with "public-sector organisations"

"Chapter 2 of this report lists 24 countries that have sustained absolute emissions reductions for at least a decade, of which 20 are countries that had Kyoto targets for the first commitment period."

With "Chapter 2 of this report lists at least 18 countries that have sustained absolute emissions reductions for at least a decade, nearly all of which are countries that had Kyoto targets for the first commitment period."

Replace "cost-effective long-term mitigation pathways for limiting warming to 1.5°C with low (<0.1°C) overshoot (50% chance), respectively for limiting warming to 2°C (66% chance)" to "pathways that limit warming to 1.5°C (>50%) with no or limited overshoot, and those to limit warming to 2°C (>67%)."

Box 14.1:

Change text from:

"This aim is explicitly linked to enhancing implementation of the UNFCCC, including its objective in Article 2 of stabilising greenhouse gas emissions...

To:

"This aim is explicitly linked to enhancing implementation of the UNFCCC, including its objective in Article 2 of stabilising greenhouse gas concentrations...

Total Needs: See Table 15.4. Regional breakdown of needs: For Electricity based on IAM output for Non-Biomass renewable (mean C1:C3) plus incremental investment needs for T&D and Storage (mean C1:C3 less mean C5:C7) (see Table 15.2, 15.3, except C6 and C7).

--> Total needs: See Table 15.4. Regional breakdown of needs: For Electricity based on IAM output for Non-Biomass renewable and Storage (mean C1:C3) plus incremental investment needs for T&D (mean C1:C3 less mean C5:C7) (see Table 15.2, 15.3).

increasing the challenges to mobilise substantial volumes of additional financing for many developing

the financial sector that are discourage private sector financing. They comprise short-termism (e.g. UNEP Inquiry 2016b), high perceived risks for mitigation relevant technologies and/or regions (information gap through incomplete/ asymmetric information (e.g. Kempa and Moslener 2017; Clark et al. 2018), lack of carbon pricing effects (e.g. Best and Burke 2018), home bias (results in limited balancing for regional mismatches between current capital and needs distribution, (e.g. Boissinot et al. 2016), and perceived high opportunity and transaction costs (results from limited visibility of future pipelines and policy interventions; SME financing tickets and the missing middle, (e.g. Grubler et al. 2016)."

challenge to mobilise finance

Sectoral considerations. The renewable energy sector attracted the highest level of financing

Current financing of land-based mitigation options is less than 1 billion USD yr-1 representing only 2.5%

involvement) a significant scale-up of commercial financing to the sector can hardly be expected in

of future international public finance to maintain operations as key challenges

Capacity of countries being often stated as challenge for an accelerated deployment of finance

well-structured patient interventions and finance could play an important role (Saldanha 2006; Hope 2011) accepting other barriers than financing playing a role as well. One reason why international public climate finance is not sufficiently directed to such needs might be the complexity in measuring intangible, direct outcomes like improved institutional capacity (Clark et al. 2018)

Early stage / Venture capital financing / Pilot project financing

Access to early stage financing remains critical with performance in in recent years being weak

their financing will continue coming from the public sector noted by

basket finance for large projects/program or sector wide approaches or multilateral finance under
Keenan and Bradt (2020), but transfer to taxpayers the onus of damage compensation and the financing costs of renewable energy (IRENA 2020b) which has been underestimated in many modelling efforts.

UNEP (2020) Adaptation Gap Report estimates adaptation costs of $40-100 billion USD in 2030 and $280-500 billion USD in 2050 (UNEP 2021). Over 100 countries included adaptation components in their intended NDCs (UNDCs) and approximately 25% of these referenced national adaptation plans (NAPs) (GOI 2017/2018).

Change from “The financial and economic circumstances are the opposite for virtually all developing countries, even...” to: “The financial and economic circumstances are more challenging in many developing countries, even...”

rail infrastructure range from 0.1 billion USD in Senegal to 1.6 billion USD in Nigeria. Osama et al. (2021) highlights a 4.7 billion USD financing gap for African countries in the transport sector. In Latin America Oxford Economics (2017) identifies Brazil as frontrunner of required rail investments with 8.3 billion USD, followed by Peru with 2.3 billion USD. Totally, developed countries mounting up to almost 120 billion USD yr-1 (n=15, mean=7.97bn USD) for rail infrastructure financing needs with . Developing countries (excl. LDCs and excl. China) mounting up to almost 50 billion USD yr-1 (n=27, mean=1.78bn USD, excl. China). Oxford Economics (2017) reports rail infrastructure financing needs for China of more than 200 billion USD yr-1 between 2016 and 2040.

rail infrastructure range from 0.1 billion USD in Senegal to 1.6 billion USD in Nigeria. Osama et al. (2021) highlights a 4.7 billion USD financing gap for African countries in the transport sector. In Latin America Oxford Economics (2017) identifies Brazil as frontrunner of required rail investments with 8.3 billion USD, followed by Peru with 2.3 billion USD. Totally, developed countries mounting up to almost 120 billion USD yr-1 (n=15, mean=7.97bn USD) for rail infrastructure financing needs with . Developing countries (excl. LDCs and excl. China) mounting up to almost 50 billion USD yr-1 (n=27, mean=1.78bn USD, excl. China). Oxford Economics (2017) reports rail infrastructure financing needs for China of more than 200 billion USD yr-1 between 2016 and 2040.

rail infrastructure range from 0.1 billion USD in Senegal to 1.6 billion USD in Nigeria. Osama et al. (2021) highlights a 4.7 billion USD financing gap for African countries in the transport sector. In Latin America Oxford Economics (2017) identifies Brazil as frontrunner of required rail investments with 8.3 billion USD, followed by Peru with 2.3 billion USD. Totally, developed countries mounting up to almost 120 billion USD yr-1 (n=15, mean=7.97bn USD) for rail infrastructure financing needs with . Developing countries (excl. LDCs and excl. China) mounting up to almost 50 billion USD yr-1 (n=27, mean=1.78bn USD, excl. China). Oxford Economics (2017) reports rail infrastructure financing needs for China of more than 200 billion USD yr-1 between 2016 and 2040.

projects, IEA estimates a need of 90 billion USD of public sector finance before 2030 having around

reaching a high-bound estimate of 681 billion USD in 2016 (UNFCCC 2018a).

Comparing annual average total investments in global fuel supply and the power sector of approximately 1.61 trillion USD yr-1 in 2019 (IEA 2020a) to the investment in the Stated Policies Scenario (approximately 1.84 trillion USD yr-1) and the Sustainable Development Scenario (approximately 1.91 trillion USD yr-1). Comparing annual average total investments in global fuel supply and the power sector of approximately 1.5 trillion USD2015 yr-1 in 2019 (IEA 2020a) to the investment in the Stated Policies Scenario (approximately 1.7 trillion USD2015 yr-1) and the Sustainable Development Scenario (approximately 1.8 trillion USD2015 yr-1).

While CPI publishes investment levels of 44 billion in 2019 and 26 billion in 2020 for energy efficiency, counting majorly international flows, IEA results come in at a much higher level of more than annually 250bn USD between 2017 and 2020 (IEA 2021c).

While CPI publishes investment levels of 41 billion USD2015 in 2019 and 24 billion USD2015 in 2020 for energy efficiency, counting majorly international flows, IEA results come in at a much higher level of around annually 250 billion USD2015 between 2017 and 2020 (IEA 2021c).

GDP in constant 2015 USD trillion USD2015. -> GDP in trillion USD2015

Entities such as the UK Anti-Corruption Helpdesk are exploring how to mitigate potential corruption with regard to climate risk insurance. This should be corrected to: the UK Anti-Corruption Helpdesk.

addition of missing FCDO study details: in text citation Scott 2017 added as below:

The FCDO study (Scott 2017) examines the uptake of ARC and its impact on reducing vulnerability to disasters. It notes that there is scarce literature on disaster risk insurance mechanisms in terms of impacts. In its current sample of 20 countries as of November 2017, 40% are projected to experience food security crisis (IPC Level 3) but are not signatories to the ARC, which may signal that ARC is not attractive to all food insecure countries and that there is no overwhelming appetite for ARC among poorer countries.

Reference also added in Bibliography:

scenario category names updated to be consistent with the SPM (broad guidelines followed as below) in all instances in chapter where this change aids comprehension

Category: Old > Approved
C1 > limit warming to 1.5°C with no or limited overshoot > limit warming to 1.5°C (>50%) with no or limited overshoot
C2 > limit warming to 1.5°C with high overshoot > return warming to 1.5°C (>50%) after a high overshoot
C3 > Likely below 2°C > limit warming to 2°C (>67%)
C4 > Below 2°C > limit warming to 2°C (>50%)
C5 > Below 2.5°C > limit warming to 2.5°C (>50%)
C6 > Below 3°C > limit warming to 3°C (>50%)
C7 > Below 4°C > limit warming to 4°C (>50%)
C8 > Above 4°C > exceed warming of 4°C (=50%)
C1, C2 and C3 > Likely limit to 2°C or lower > limit warming to 2°C (>67%) or lower

addition of missing FCDO study details:

in text citation Scott 2017 added as below -
The FCDO study (Scott 2017) examines the uptake of ARC and its impact on reducing vulnerability to disasters. It notes that there is scarce literature on disaster risk insurance mechanisms in terms of impacts. In its current sample of 20 countries as of November 2017, 4 four are projected to experience food security crisis (IPC Level 3) but are not signatories to the ARC, which may signal that ARC is not attractive to all food insecure countries and that there is no overwhelming appetite for ARC among poorer countries.

Reference also added in Bibliography:

replace "two scenarios" by "two sets of scenarios" to read "technologies, and does not differ much between the two sets of scenarios (Box 16.1, Figure 1a)"

Delete sentence:
"(Fan et al. 2019b) specifically, SDGs 2 (food security), SDG 6 (clean water and sanitation), SDG 7 (affordable and clean energy), SDG 11 (sustainable cities and communities) and SDG 12 (responsible production and consumption) are considered essential to the WEFN (Bleischwitz et al. 2018)."

Delete sentence:
"The energy system will include microgrids, renewable with demand-side controls aligned with local conditions."

Supplementary Material:
Sheet "Chapter 6"
Sectoral mitigation Option: Bioenergy
Column SDG 6: Replace the sign + with ±

Supplementary Material:
Sheet "Chapter 6"
Sectoral mitigation Option: Bioenergy
Column SDG 14: Replace the cell content with "± treatment of nutrient-rich wastewater (which produces biogas as a co-benefit) is highly relevant for SDG14.1 - reduce marine pollution. At the same time, effluents from biofuel production can also cause negative impacts on marine ecosystems when effluent treatment is not meeting high standards (high confidence)"

Supplementary Material:
Sheet "Chapter 6"
Sectoral mitigation Option: Bioenergy
Column "Line of sight [section numbers, tables, figures, box]": Replace "Section 6.4.2.6" with "Section 6.4.2.6, Section 12.5"

Supplementary Material:
Sheet "Chapter 11"
Sectoral mitigation Option: Circular Economy
Column SDG 14: Add the text "+studies reported direct relationship between CE and SDG14 (High confidence)"

Supplementary Material:
Sheet "Chapter 11"
Sectoral mitigation Option: Electrification
Column SDG 2: Replace the existing text with
"+ Improved food security
- Fuel switching to options such as biomass and bioenergy can have negative impact on food prices (Medium confidence) *
| 17-SM | Supplementary Material:  
Sheet "Chapter 11"  
Sectoral mitigation Option: Electrification  
Column SDG 15: Add the text "-negative impact on SDG 15 [fuel switching to options such as biomass and bioenergy](High confidence)" |
| 17-SM | Supplementary Material:  
Sheet "Chapter 11"  
Sectoral mitigation Option: CCS and carbon capture and utilisation (CCU)  
Column SDG 6: Add the text "-Deployment of CCS and CCU would require increased water consumption (High confidence)" |
| 17-SM | Supplementary Material:  
Sheet "Chapter 11"  
Sectoral mitigation Option: CCS and carbon capture and utilisation (CCU)  
Column SDG 7: Replace the existing text with "+ Decarbonization of energy production through utilization of CO2 (High confidence)  
-Deployment of CCS and CCU would require high energy demand (High confidence)"
| 17-SM | Supplementary Material:  
Sheet "Chapter 11"  
Sectoral mitigation Option: CCS and carbon capture and utilisation (CCU)  
Column SDG 11: Add the text "+Deployment of CCS and CCU would contribute to enhancing the sustainability of cities (High confidence)"
| 17-SM | Supplementary Material:  
Sheet "Chapter 11"  
Sectoral mitigation Option: CCS and carbon capture and utilisation (CCU)  
Column SDG 15: Add the text "-Deployment of CCS and CCU would require additional land-use, (High confidence)"
| 17-SM | Supplementary Material:  
Sheet "Chapter 7"  
Change in name of Sectoral mitigation Option:Replace "Afforestation, reforestation, restoration" with "Ecosystem restoration, reforestation, afforestation"
| 17-SM | Supplementary Material:  
Sheet "Chapter 7"  
Sectoral mitigation Option: Ecosystem restoration, reforestation, afforestation  
Column SDG 2: Replace the text with "may lead to competition for land when done at large scales. reforestation and forest restoration can have co-benefits for food security. (medium confidence)"
| 17-SM | Supplementary Material:  
Sheet "Chapter 7"  
Sectoral mitigation Option: Ecosystem restoration, reforestation, afforestation  
Column SDG 6: Replace the text with "'s better landscape water balance. Afforestation (on naturally unforested land) can compound climate-related risks to water security (medium confidence)"
| 17-SM | Supplementary Material:  
Sheet "Chapter 7"  
Sectoral mitigation Option: Ecosystem restoration, reforestation, afforestation  
Column SDG 8: Replace the text with "'s better landscape water balance. Afforestation (on naturally unforested land) can compound climate-related risks to water security (medium confidence)"
| 17-SM | Change in name of Sectoral mitigation Option:Replace "Reduce CH4 and N2O emissions from agriculture" with "Reduce CH4 and N2O emissions in agriculture"
| 17-SM | Change in name of Sectoral mitigation Option:Replace "Forest and fire management" with "Forest management, Fire management"
| 17-SM | Supplementary Material:  
Sheet "Chapter 6"  
Sectoral mitigation Option: Bioenergy  
Column SDG 7: Replace the sign + with ± |
|---|---|
| 17-SM | Supplementary Material:  
Sheet "Chapter 6"  
Sectoral mitigation Option: Bioenergy  
Column "Chapter Source": Add : Box 6.1 |
| 17-SM | Supplementary Material:  
Sheet "Chapter 6"  
Sectoral mitigation Option: Nuclear  
Column "Chapter Source": Add : Figure 6.18 |
| 17-SM | Supplementary Material:  
Sheet "Chapter 6"  
Sectoral mitigation Option: Bioenergy  
Column SDG 15: Add ± (high confidence) |
| 17-SM | Supplementary Material:  
Sheet "Chapter 6"  
Sectoral mitigation Option: Nuclear  
Column SDG 15: Add "Low impacts to biodiversity but high impact in case of an accident. (High confidence)" |
| 17-SM | Supplementary Material:  
Sheet "Chapter 6"  
Sectoral mitigation Option: Bioenergy  
Column SDG 14: Add "Low impacts to ecosystems (acidification, eutrophication, ecotoxicity, ozone depletion, POCP). Long term solutions for high-level radioactive waste are under development. (High Confidence)" |
| 17-SM | Supplementary Material:  
Sheet "Chapter 6"  
Sectoral mitigation Option: CCS  
Column SDG 1: Delete the text |
| 17-SM | Supplementary Material:  
Sheet: Chater 6  
Option: Nuclear power  
Column: SDG 7 : Change to "synergies and trade-offs" with "medium confidence" |
| 17-SM | Supplementary Material:  
Sheet: Chater 6  
Option: Nuclear power  
Column: SDG 8 to "synergies" with "medium confidence" |
| 17-SM | Supplementary Material:  
Sheet: Chater 10  
Options: All  
SDG 16 and 17: Remove all linkages |
| 17-SM | Supplementary Material  
Sheet: Chapter 10  
Option: Electric light duty vehicles  
Column: SDG 3: Change to “both synergies and trade-offs” with “high confidence” |
| 17-SM | Supplementary Material  
Sheet: Chapter 10  
Option: Biofuel  
Column: SDG 14: Change to “both synergies and trade-offs” with “high confidence” |
| 17-SM | Supplementary Material  
Sheet: Chapter 7  
Option: “reduced conversion of natural ecosystem”: Change to ‘reduced conversion of forests and other ecosystems’ |
| 17-SM | Supplementary Material  
Sheet: Chapter 10  
Option: Biofuel  
Column: SDG 15: Change to “both synergies and trade-offs” with “high confidence” |
| 17-SM | Supplementary Material  
Sheet: Chapter 6  
Option: Wind  
Option: Solar  
Option CCS  
Chapter sources corrected (added 6.7.7) |
| 17-SM | Supplementary Material  
Sheet: Chapter 6  
Option: Bioenergy  
Column SDG 2: Changed to “both synergies and tradeoffs” |
| 17-SM | Supplementary Material  
Sheet: Chapter 7  
Option: Changed the name of the option ‘soil carbon management’ to ‘Carbon sequestration in agriculture (soil carbon management in cropland and grasslands, agroforestry, biochar)’ |
| 17-SM | Supplementary Material  
Sheet: Chapter 7  
Option: Changed the name of the option ‘forest management, fire management’ to ‘improved sustainable forest management’ |
| 17-SM | Supplementary Material  
Sheet: Chapter 11  
Option: Changed the name of the option ‘circular economy’ to ‘circular material flows’ |
| 17-SM | Supplementary Material  
Sheet: Chapter 11  
Option: Energy efficiency  
Column- SDG 3: Changed to “synergies” with “medium confidence” |
| 17-SM | Supplementary Material  
Sheet: Chapter 11  
Option: circular material flows  
Column- SDG 3: Changed to “synergies” with “medium confidence” |
| 17-SM | Supplementary Material  
Sheet: Chapter 11  
Option: ‘electrification’  
Column- SDG 8: Changed to “synergies” with “high confidence” |
| 17-SM | Supplementary Material  
Sheet: Chapter 11  
Option: Electrification  
Column-Chapter sources” corrected (added 6.7.7) |
| 17-SM | Supplementary Material  
Sheet: Chapter 7  
Option: Changed the name of the option ‘shift to sustainable healthy diets’ to ‘shift to balanced, sustainable healthy diets’ |
Updated definition:

Aerosol = A suspension of airborne solid or liquid particles, with typical particle size in the range of a few nanometres to several tens of micrometres and atmospheric lifetimes of up to several days in the troposphere and up to years in the stratosphere. The term aerosol, which includes both the particles and the suspending gas, is often used in this report in its plural form to mean ‘aerosol particles’. Aerosols may be of either natural or anthropogenic origin in the troposphere; stratospheric aerosols mostly stem from volcanic eruptions. Aerosols can cause an effective radiative forcing directly through scattering and absorbing radiation (aerosol–radiation interaction), and indirectly by acting as cloud condensation nuclei or ice nucleating particles that affect the properties of clouds (aerosol–cloud interaction), and upon deposition on snow- or ice-covered surfaces. Atmospheric aerosols may be either emitted as primary particulate matter or formed within the atmosphere from gaseous precursors (secondary production). Aerosols may be composed of sea salt, organic carbon, black carbon (BC), mineral species (mainly desert dust), sulphate, nitrate and ammonium or their mixtures. See also Particulate matter (PM) and Short-lived climate forcers (SLCFs).

Updated definition:

Particulate matter (PM) = Atmospheric aerosols involved in air pollution issues. Of greatest concern for health are particles of aerodynamic diameter less than or equal to 10 micrometers, usually designated as PM10 and particles of diameter less than or equal to 2.5 micrometers, usually designated as PM2.5.
### Annex I

**Definition for ‘Aerosol’, replace:**

“A suspension of airborne solid or liquid particles, with typical diameters between a few nanometres and a few micrometres and atmospheric lifetimes of up to several days in the troposphere and up to years in the stratosphere. The term aerosol, which includes both the particles and the suspending gas, is often used in this report in its plural form to mean ‘aerosol particles’. Aerosols may be of either natural or anthropogenic origin in the troposphere; stratospheric aerosols mostly stem from volcanic eruptions. Aerosols can cause an effective radiative forcing directly through scattering and absorbing radiation (aerosol–radiation interaction), and indirectly by acting as cloud condensation nuclei or ice nucleating particles which affect the properties of clouds (aerosol–cloud interactions), and upon deposition on snow- or ice-covered surfaces. Atmospheric aerosols may be either emitted as primary particulate matter (PM), and form within the atmosphere from gaseous precursors (secondary production). Main classes of aerosol chemical composition are sea salt, organic carbon, black carbon (BC), mineral species (mainly desert dust), sulphate, nitrate, and ammonium. See also Short-lived climate forcers (SLCFs).”

with

“A suspension of airborne solid or liquid particles, with typical particle size in the range of a few nanometres to several tens of micrometres and atmospheric lifetimes of up to several days in the troposphere and up to years in the stratosphere. The term aerosol, which includes both the particles and the suspending gas, is often used in this report in its plural form to mean ‘aerosol particles’. Aerosols may be of either natural or anthropogenic origin in the troposphere; stratospheric aerosols mostly stem from volcanic eruptions. Aerosols can cause an effective radiative forcing directly through scattering and absorbing radiation (aerosol–radiation interaction), and indirectly by acting as cloud condensation nuclei or ice nucleating particles that affect the properties of clouds (aerosol–cloud interaction), and upon deposition on snow- or ice-covered surfaces. Atmospheric aerosols may be either emitted as primary particulate matter or formed within the atmosphere from gaseous precursors (secondary production). Aerosols may be composed of sea salt, organic carbon, black carbon (BC), mineral species (mainly desert dust), sulphate, nitrate and ammonium or their mixtures. See also Short-lived climate forcers (SLCFs)”

### Annex I

**Addition of the word “policy” to the Sufficiency definition, as follows:**

**Sufficiency** A set of **policy** measures and daily practices that avoid demand for energy, materials, land, and water while delivering human well-being for all within planetary boundaries.

### Annex III

56 **Delete ‘that could not be crossed’ from the following sentence:**

In early model intercomparisons, climate targets were often specified as a CO2-equivalent concentration level **that could not be crossed**, for example, 450ppm CO2-eq or 550ppm CO2-eq (Clarke et al. 2009).”

To read:

“In early model intercomparisons, climate targets were often specified as a CO2-equivalent concentration level, for example, 450ppm CO2-eq or 550ppm CO2-eq (Clarke et al. 2009).”

### Annex III

65 **Remove unused model from the following sentence:**

“MAGICC (v7) was used for the main scenario classification, with both FaIR (v1.6.2) and CICERO-SCM (v2019vCH4) being used to provide additional uncertainty ranges...”

To read:

“MAGICC (v7) was used for the main scenario classification, with FaIR (v1.6.2) being used to provide additional uncertainty ranges...”

### Annex III

76 **Changes to numbers of scenarios in the following sentence:**

“Of the total **2425** global scenarios submitted, **1594** could be assessed in terms of their associated climate response, and 1202 of those passed the vetting process.”

To read:

“Of the total **2266** global scenarios submitted, **1574** could be assessed in terms of their associated climate response, and 1202 of those passed the vetting process.”

### Annex III

**Table 9, Energy column, IMP-Neg:**

changed from:

“CDR, transport H2/Electric based on negative emissions”

To:

“Heavy reliance on CDR in power sector and industry; CDR used to compensate fossil fuel emissions”
Annex III

Change to final column “Total with climate categorisation” numbers as follows:

AIM/CGE+Hub: from 55 (162) to 55 (155)
DNE21+: from -46 to -36
GCAM: from 45 (136) to 45 (73)
GCAM-PR: 3(21) to 3 (7)
GEM-E3: from 41 (52) to 41 (41)
IMAGE: from 142 (153) to 142 (151)
MESSAGE: from -10 to -9
POLES: from 114 (18) to 114 (137)
TIAM-ECN: from 45 (58) to 45 (45)
IAM WORLD: from -11 to -9
Total: from 1202 (1698) to 1202 (1574)

Annex III

10 (PDF)

change

“In total, 931 scenarios were submitted to the AR6 scenario database, out of which only two scenarios provided detailed data allowing for an assessment of climate change impacts based on the SER framework considered in the building chapter.”

To

“In total, 931 scenarios were submitted to the AR6 scenario database, out of which only two scenarios provided detailed data allowing for an assessment of emissions reductions based on the SER framework considered in the building chapter.”

Annex III

Fig 2

Update caption

‘GHG mitigation potentials of scenarios considered in the illustrative mitigation pathways considered in Chapter 3.’

to

‘GHG emissions reductions in the building sector (direct emissions) in scenarios considered as illustrative mitigation pathways in Chapter 3.’

Annex III

footnote 7

Update

‘Each SSPx-y combination was calculated by multiple IAMs. The specific scenarios developed by the marker models for the associated SSPs (SSP1: IMAGE; SSP2: MESSAGEGLOBIOM; SSP3: AIM; SSP4: GCAM; SSP5: REMIND-MAgPIE) were selected as Tier 1/Tier 2 scenarios for use in CMIP6. Tier 2 variants include SSP7-3.0 with low emissions of short-lived climate forcers and SSP5-3.4 with high overshoot from following SSP5-8.5 until 2040.’

to

‘Each SSPx-y combination was calculated by multiple IAMs. The specific scenarios developed by the marker models for the associated SSPs (SSP1: IMAGE; SSP2: MESSAGEGLOBIOM; SSP3: AIM; SSP4: GCAM; SSP5: REMIND-MAgPIE) were selected as Tier 1/Tier 2 scenarios for use in CMIP6. Tier 2 variants include SSP7-3.0 with high emissions of short-lived climate forcers and SSP5-3.4 with high overshoot from following SSP5-8.5 until 2040.’

Annex III

Table 14

Scenario category descriptions updated per changes in Chapter 3 Table 3.1 (updates done to match SPM)

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**Correction**

**Climate Change 2022, Mitigation of Climate Change, Full Report**

Chapter 6; Page 630

*Replace:* PV costs (Figure 6.8) have fallen for various reasons: lower silicon costs, automation, lower margins, automation, higher efficiency, and a variety of incremental improvements (Fu et al. 2018);

*With:* PV costs (Figure 6.8) have fallen for various reasons: lower silicon costs, automation, lower margins, higher efficiency, and a variety of incremental improvements (Fu et al. 2018);
This growth outpaced the reduction in the use of energy per unit of GDP (−2% yr−1, globally) as well as improvements in the carbon intensity of energy (−0.3% yr−1). (2.4.1, Figure 2.19)

With:
This growth outpaced the reduction in the use of energy per unit of GDP (−2% yr−1, globally) as well as improvements in the carbon intensity of energy (−0.3% yr−1). (2.4.1, Figure 2.16)

With:

Tanaka et al. (2020)
With
Tanaka et al. (2021)