

1 **Chapter 4 Supplementary Material**

2 **Table SM4.1 Overview of methods used for projected emissions of NDCs and/or current policies (adapted from (Kuramochi et al. 2020; den Elzen et**
 3 **al. 2019)).**

Study	Policy cut-off ^a	Regions	Sectors	Emissions ^{b/} GWP (if applicable)	Scenarios ^c	Policies	Methods ^d	References
Climate Action Tracker	11/2018	Global (38 countries in detail)	Energy, AFOLU	Kyoto/AR4	CP, NDC	All policies	Literature review (official, national, international sources), supplemented by additional bottom-up analysis	(Climate Action Tracker 2019) method: https://climateactiontracker.org/methodology/
PBL Netherlands Environmental Assessment Agency	11/2018	Global (G20 countries with policy detail, NDCs for 78 countries, covering 91% of 2012 GHG emissions)	Energy, AFOLU	Kyoto/AR4	CP, NDC	Expert-selected policies based on comprehensive policy inventory	CP: literature review (official, national, international sources), global IAM (IMAGE), ILM (GLOBIOM/G4M), NDC: FAIR model	(Kuramochi and et al. 2019) online tool: www.pbl.nl/indc
ADVANCE	4/2017*	Global	Energy, AFOLU	Kyoto/AR4	NDC	NDC: GHG targets	Set of global IAMs (AIM/CGE, IMAGE, IMACLIM, GCAM, GEM-E3, MESSAGE-GLOBIOM, POLES, REMIND, WITCH-GLOBIOM)	(Luderer et al. 2018; Vrontisi et al. 2018) online database : https://db1.ene.iaa.ac.at/ADVANCE/CEDB/

CD-LINKS global	12/2016	Global, with regional detail	Energy, AFOLU	Kyoto/AR4	CP, NDC	CP: comprehensive policies; NDC: GHG targets, additional policies	Set of global IAMs (AIM/CGE, IMAGE, GEM-E3, MESSAGEix-GLOBIOM, POLES, REMIND-MagPIE, WITCH-GLOBIOM)	(McCollum et al. 2018; Roelfsema et al. 2020) online database: https://db1.ene.iaa.ac.at/CDLINK/SDB/
JRC GECO 2019	03/2020	Global G20 countries with policy detail	Energy, AFOLU	Kyoto/SAR	CP, NDC	Expert- selected policies based on comprehensive policy inventory	CP: literature review (official, national, international sources), global IAM (POLES), ILM (GLOBIOM/G4M)	(Keramidas et al. 2020)
NDC & INDC Factsheets	11/2016	Global (195 countries)	Energy, AFOLU	Kyoto/AR4	NDC	NDC: Emissions pathways	literature review, IPCC scenario database	(Meinshausen and Alexander 2017) http://climatecollege.unimelb.edu.au/ndc-indc-factsheets
Kuramochi et al. 2020	11/2020	Non-G20 countries: Chile, Colombia, Democratic Republic of the Congo (DRC), Iran,	Energy, AFOLU	Kyoto/AR4	CP, NDC	CP: comprehensive policies; NDC: GHG targets, additional policies	Literature review (official, national, international sources), supplemented by additional bottom-up analysis	(Kuramochi et al. 2021, 2019)

									Kazakhstan, Morocco, the Philippines, Thailand, and Ukraine
Keesler et al. 2019	11/2019	National (Argentina)	Energy, AFOLU	Kyoto/AR4	CP, NDC	CP: comprehensive policies; NDC: GHG target	National ESM	(Keesler et al. 2019)	
Climateworks Australia	2018	National (Australia)	Energy, AFOLU	Kyoto/AR4	CP, NDC	CP: comprehensive policies; NDC: GHG target	National ESM	(ClimateWorks Australia 2018)	
Commonwealth of Australia 2019	2019	National (Australia)	Energy, AFOLU	Kyoto/AR4	CP, NDC	CP: comprehensive policies; NDC: GHG target	National ESM	(Commonwealth of Australia 2019)	
Rochedo et al. 2018; Koberle et al. 2020	12/2016	National (Brazil)	Energy, AFOLU	Kyoto/AR4	CP, NDC	CP: comprehensive policies, NDC: GHG target	National ESM (BLUES)	(Rochedo et al. 2018; Köberle et al. 2020)	
Fu et al. 2017, 2018	11/2017	National (China)	Energy	CO ₂ /NA	CP, NDC	NDC	National ESM (China)	(Fu et al. 2017; Fu 2018)	

Li et al. 2019	12/2018	National (China)	Energy	CO ₂ /NA	CP, NDC	NDC: Emission peak by 2030, others?	National ESM (China TIMES)	(Li et al. 2019) Method: (Shi et al. 2016)
Yang et al. 2018	1/2017	National (China)	Energy	CO ₂ /NA	NDC	NDC: Emission peak emission intensity	National ESM (China MAPLE) MACCs	(Yang et al. 2018)
China Renewable Energy Outlook	4/2017*	National (China)	Energy	CO ₂ /NA	CP	CP: stated policies and extrapolation of current policies	National ESM (CNREC scenario modeling tools)	(ERI/CNREC 2017)
European Commission 2018	11/2018	Regional (EU)	Energy, AFOLU	Kyoto/AR4	CP, NDC	CP: comprehensive policies; NDC: GHG target	Modeling tools for EU analysis (PRIMES, GAINS, GLOBIOM/G4M, CAPRI, GEM-E3, E3ME)	(European Commission 2018) method: https://ec.europa.eu/clima/policies/strategies/analyses/models_en
Vrontisi et al. 2019	12/2016	Region 1 (EU)	Energy	Kyoto/AR4	CP, NDC	CP: comprehensive policies; NDC: GHG target	Regional ESM and CGE model (PRIMES, GEM-E3)	(Vrontisi et al. 2019)

Dusbash et al. 2018	2011-2015	National (India)	Energy	CO ₂ /NA	CP, NDC	CP: comprehensive policies; NDC: GHG target	Set of 15 national ESM studies with a base-year of current policies pre-2015 and 2015	(Dubash et al. 2018)
Vishwanathan et al. 2018	12/2016	National (India)	Energy	CO ₂ /NA	CP, NDC	CP: comprehensive policies; NDC	National ESM (AIM/Enduse 3.0)	(Vishwanathan et al. 2018; Vishwanathan and Garg 2020)
Mathur et al. 2019	12/2016	National (India)	Energy	CO ₂ /NA	CP, NDC	CP: comprehensive policies, NDC	National ESM (India MARKAL)	(Mathur and Shekhar 2020)
Oshiro et al. 2019	12/2016	National (Japan)	Energy, AFOLU	Kyoto/AR4	CP, NDC	CP, NDC	National ESM (AIM/Enduse, DNE21+)	(Oshiro et al. 2019)
JMIP/EMF3 5	3/2018	National (Japan)	Energy, AFOLU	CO ₂ /NA, Kyoto gases/AR4	NDC	NDC: GHG target	National ESMs (AIM/Enduse-Japan, AIM/Hub-Japan, DNE21-Japan, IEEJ-Japan)	(Sugiyama et al. 2021)
Safonov et al. 2020	12/2016	National (Russia)	Energy	CO ₂ /NA	CP, NDC	CP: comprehensive policies, NDC	National energy systems models (Russia-TIMES)	(Safonov et al. 2020)
Rhodium Group	11/2019	National (USA)	Energy	Kyoto/AR4	CP, NDC	CP: comprehensive policies; NDC: GHG target	National ESM (USA)	(Pitt et al. 2019)

EIA Annual Energy Outlook 2019	6/2018*	National (USA)	Energy	CO ₂ /NA	CP	CP: current laws and regulations	National ESM (NEMS)	(EIA 2019)
ENGAGE global	07/2019	Global, with regional detail	Energy, AFOLU	Kyoto/AR4	CP, NDC	CP: comprehensive policies; NDC: GHG targets, additional policies	Set of global IAMs (AIM/CGE, COFFEE, IMAGE, GEM-E3, MESSAGEix-GLOBIOM, POLES, REMIND-MAGPIE, TIAM-ECM, WITCH)	(Riahi et al. 2021; Bertram et al. 2021a; Drouet et al. 2021; Hasegawa et al. 2021)
ENGAGE national Asia	03/2020	National (China, India, Japan, Korea, Thailand)	Energy, AFOLU	Kyoto/AR4	NDC	NDC: GHG targets	Set of national IAMs (AIM/Hub China, India, Japan, Korea, Thailand, Vietnam)	(Fujimori et al. 2021)
COMMIT	7/2019	Global with regional detail, National (Australia, Brazil, Canada, EU, India, Japan, Korea, Russia, USA)	Energy, AFOLU	CO ₂ /NA, Kyoto/AR4	CP, NDC	CP: comprehensive policies; NDC: GHG targets, additional policies	Set of global and national ESMs/IAMs (global: AIM/CGE, COFFEE, IMAGE, MESSAGEix-GLOBIOM, POLES, PROMETHEUS, REMIND-MAGPIE, TIAM-Grantham, WITCH; national: AIM/CGE-Korea, AIM/Enduse-Japan, BLUES-Brazil, GCAM-USA, PRIMES, TIMES-Australia)	(van Soest et al. 2021)

REMIND 2.1	06/2020*	Global with regional detail	Energy, AFOLU	Kyoto/AR4	CP, NDC for SSP1/2/5	CP: stylized policies; NDC: GHG targets, stylized policies	Global IAM (REMIND)	(Baumstark et al. 2021)
PEP1p5	08/2017*	Global with regional detail	Energy, AFOLU	Kyoto/AR4	CP, NDC	CP comprehensive policies; NDC: GHG targets, additional policies	Global IAM (REMIND- MAGPIE)	(Kriegler et al. 2018)
CEMICS	05/2017	Global with regional detail	Energy, AFOLU	Kyoto/AR4	CP, NDC	NDC: GHG targets	Global IAM (REMIND)	(Strefler et al. 2018)
van der Zwaan et al. 2018	11/2016*	National (Ethiopia)	Energy, AFOLU	CO ₂ /NA	CP		National IAM embedded in global IAM (TIAM-ECN ETH)	(van der Zwaan et al. 2018)
Dalla Longa and van der Zwaan 2017	05/2016*	National (Kenya)	Energy, AFOLU	CO ₂ /NA	CP, NDC		National IAM embedded in global IAM (TIAM-ECN KEN)	(Dalla Longa and van der Zwaan 2017)
Nogueira et al. 2020	05/2019*	National (Madagascar)	Energy, AFOLU	CO ₂ /NA	CP, NDC		National IAM embedded in global IAM (TIAM-ECN MDG)	(Nogueira et al. 2020)
Fortes et al. 2019		National (Portugal)	Energy	CO ₂ , CH ₄ , N ₂ O/NA	NDC		National ESM (TIMES- Portugal)	(Fortes et al. 2019)

Climate Equity Reference Calculator		Multi-national (91 countries and regions)	Energy, AFOLU	Kyoto/SAR	NDC		Literature review (NDC targets, emission inventories, exogenous emission pathways), spreadsheet calculation	(Holz et al. 2018)
EMF36		Global with regional detail	Energy, AFOLU	CO ₂ /NA	NDC		Set of global CGEs (C-GEM, CGE-MOD, DART, EC-MSMR, EDF-GEPA, ENVISAGE, ICES-EMF, SNOW, TEA, WEGDYN)	(Böhringer et al. 2021)
Wei et al. 2018		National (China)	Energy	CO ₂ /NA	NDC (3 variants)		National IAM embedded in global IAM (C3IAM)	(Wei et al. 2018)
NGFS	12/2020	Global with regional detail	Energy, AFOLU	Kyoto/AR4	CP/NDC	CP: comprehensive policies; NDC: GHG targets, additional policies	Set of global IAMs (GCAM, MESSAGEix-GLOBIOM, REMIND-MAgPIE)	(Bertram et al. 2021b)
Paris Reinforce		Global with regional detail, EU	Energy, (AFOLU)	CO ₂ /NA, Kyoto/AR4	CP/NDC	CP: comprehensive policies; NDC: GHG targets, additional policies	Set of global IAMs (E3ME, GCAM-PR, GEMINI-E3, ICES-XPS, MUSE, NEMESIS) and regional IAM (E4SMA-EU-TIMES)	(Sognaes et al. 2021; Nikas et al. 2021)
van de Ven et al. 2021		Global	Energy, AFOLU	Kyoto/AR4	NDC	NDC: GHG targets,	National IAM embedded in global IAM (GCAM-USA)	(van de Ven et al. 2021)

						additional policies		
Le Treut et al. 2020		National (Argentina)	Energy	CO ₂ /NA	NDC	NDC: GHG targets, additional policies	National IAM (IMACLIM-ARG)	(Le Treut et al. 2021)
Panos et al. 2021	2018	National (Switzerland)	Energy	CO ₂ /NA	CP	CP: comprehensive policies	National ESM (Swiss TIMES Energy Systems Model)	(Panos et al. 2021)
Rogelj et al. 2017		Global	Energy, AFOLU	Kyoto/AR4	NDC	NDC: GHG targets, additional policies	Global IAM (MESSAGE-GLOBIOM)	(Rogelj et al. 2017)
Benveniste et al. 2018		Global	Energy, AFOLU	Kyoto/SAR	NDC	NDC: GHG targets, additional policies	Monte Carlo analysis of GHG emissions	(Benveniste et al. 2018)

1 Notes: ^a in case policy cut-off date is not explicitly specified in the publication or accompanying information, the study submission date minus six months is used as proxy; ^b
2 CO₂ = CO₂ only, Kyoto = Kyoto GHGs, SAR = IPCC Second Assessment Report, AR4 = IPCC Fourth Assessment Report; ^c CP = Current Policies, NDC = Nationally
3 Determined Contribution; ^d IAM = Integrated Assessment Model, ESM = Energy Systems Model, ILM = Integrated Land Model, CGE = Computable General Equilibrium
4 Model

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1 **Table SM4.2 Comparison of post-COVID and pre-COVID 2030 emissions projections. The comparison is**
 2 **based on current policy scenario projections for all GHG emissions, unless otherwise noted. All results**
 3 **rounded to .5%-point precision.**

	Emissions ^a / Sectors ^b	Min	Max	References
Climate Action Tracker	Kyoto/all	-4%	-7%	(Climate Action Tracker 2020)
IEA World Energy Outlook 2020 ^c	CO ₂ /energy	-4%	-10%	(IEA 2020)
UNEP Emissions Gap Report 2020	Kyoto/all	-3%	-7.5%	(UNEP 2020)
Dafnomilis et al. 2020	Kyoto/all	-4%	-7.5%	(Dafnomilis et al. 2020)
Dafnomilis et al. 2021 ^d	Kyoto/all	-6%	-7.5%	(Dafnomilis et al. 2021)
Kikstra et al. 2021 ^e	Kyoto/all	-1.5%	-8.5%	(Kikstra et al. 2021)
ENGAGE ^f	Kyoto/all	-3%	-6.5%	(Riahi et al. 2021)
Pollitt et al. 2021 ^g	CO ₂ /all	3.5%	-3.5%	(Pollitt et al. 2021)

4 Notes: ^a CO₂ = CO₂ only, Kyoto = Kyoto GHGs ^b all = all sectors including AFOLU emissions, energy = energy
 5 related emissions ^c Stated Policies Scenario, scenario “incorporates our assessment of all the policy ambitions and
 6 targets that have been legislated for or announced by governments around the world” (IEA 2020), and “assumes
 7 that significant risks to public health are brought under control over the course of 2021, allowing for a steady
 8 recovery in economic activity”. ^d (Dafnomilis et al. 2021) range includes estimates from three models E3ME,
 9 GEM-E3, and IMAGE. ^e (Kikstra et al. 2021) range based on four different recovery scenarios. ^f (Riahi et al. 2021)
 10 range includes estimates from four models GEM E3, MESSAGEix-GLOBIOM, POLES, REMIND-MAgPIE
 11 based on sensitivity analysis. ^g (Pollitt et al. 2021) Green Recovery Plan scenario not included in range.

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