



ELEVATE modelling protocol for Task 2.3
*Development of global and national climate
policy pathways*

May 2024

1. Introduction

This protocol provides the scenario framework for the national and global-level model runs under ELEVATE Task 2.3. This task is part of WP2, which aims to evaluate existing policies and NDCs, identifying lessons, barriers and milestones for future climate policies, NDCs and low-emission strategies. This protocol integrates national and global pathways into a coherent set of low-carbon strategies, allowing the assessment of national strategies and good practice policies¹, and their consistency with global pathways to 1.5/2°C warming levels, feasibility factors, and entry points related to technological innovation, behavioural changes and political economy. Additionally, specific insights will be provided on sectors that are highly relevant for specific countries.

A large part of the scenarios in this task overlaps with scenarios developed for ENGAGE Task 4.5. The Current Policies, NDC and NDC-LTS (Glasgow) scenarios developed in ENGAGE will be updated. The main additions in this task compared to ENGAGE Task 4.5 are the following:

- Pathways will be based on updated socioeconomic pathways (WP6);
- Design of pathways will be improved based on interaction with national stakeholders and policymakers (on transferability of good practice policies);
- We will compare scenario results with relevant sectoral indicators and benchmarks from WP3 (sectoral entry points) to monitor countries' progress;
- We will provide insights on sectors that are highly relevant for specific countries (AFOLU in Brazil, coal-fired power plants in Poland);
- We develop a scenario representing LTS without first considering NDC targets;
- T2.1 (up-to-date assessment of climate policies across countries and exploration of policy packages to drive transformative changes) results will be used to develop a good practice policies scenario that takes into account regional characteristics;
- T2.2 (ex-poste evaluation of NDC formulation process and implementation in the light of feasibility) findings feed into Task 2.3 to better consider country-

¹ This scenario will be added in an update of this protocol

specific constraints, drivers, and barriers to policy implementation in scenario analyses.

The expected outputs will provide up-to-date information for the formulation of climate policy strategies and national planning for the post-2030 period. This scenario exercise will feed into Deliverable 2.3 - "Report on national and global current policies and mid-century strategies", due by December 2024 (M28). It also feeds into WP6, where this protocol and resulting scenarios are combined with results from WP3 (sectoral entry points), WP4 (international cooperation mechanisms) and WP5 (just transitions) to develop transition scenarios from current trends to pathways consistent with the net-zero targets.

2. Scenario framework

General specifications

Population and GDP projections follow the new SSP2-type scenarios (<https://data.ece.iiasa.ac.at/ssp>). For GDP, please use the OECD ENV-Growth 2023 version. It is optional to additionally follow the new SSP1 and SSP3 scenarios. If scenarios following SSP1 and SSP3 are included, they should also be included when scenarios are updated.

Furthermore, in all scenarios, primary energy from fossil fuels without CCS should only decline (and not increase) after emissions reach net zero CO₂.

1.5°/2°C scenarios

Climate action starts in 2025 and continues up to 2100 or the last year possible for the model. Before 2025, the scenario follows the current policies scenario. After global GHG emissions became negative, they should not become positive again. Additionally, primary energy from fossil fuels without CCS should be less than 20% of the primary energy supply (excl. non energy use of fossils) in 2100.

For **global models**, the 1.5°C/2°C global scenarios should follow the budgets² below:

- **2°C:** CO₂ emissions budget of 1,150 GtCO₂ from 2020 onwards (peak as well as full century budget);

² Based on IPCC AR6 WGI Chapter 5 for the budget from 2020 onwards.

- **1.5°C:** first priority a CO₂ emissions peak budget of 650 GtCO₂ (from 2020 to the time of net zero emissions), next try to reach a full century budget of 400 GtCO₂ (from 2020–2100).

Models that cannot achieve these budgets aim for the lowest budgets feasible. Non-CO₂ emissions reduce by effect of the carbon tax level that is necessary to reduce the CO₂ emissions.

For **national models**, these scenarios will follow the carbon budgets as presented in Table 1. The carbon budgets are calculated based on recent results from the IMAGE model. A model that cannot achieve these budgets should aim for the lowest budgets feasible. They can choose to exclude LULUCF from the scenario when this fits better with the capabilities of their model.

Table 1: National CO₂ budgets for 2020-end year period based on recent results from the IMAGE model

National Team	End year	CO ₂ Budget 2020 - end year in GtCO ₂			
		Full century budget 1.5°C	Full century budget 1.5°C (excl. LULUCF)	Full century budget 2°C	Full century budget 2°C (excl. LULUCF)
Brazil	2060	-0.85	-6.8	10	6.9
India	2070	32	30	88	86
Poland	2070	3.9	3.8	6.3	6.2
Saudi Arabia	2100	7.6	7.6	19	19
China	2060	149	155	280	284
Pakistan	2100	1.3	2.8	11.4	11.4
Vietnam	2050	4.6	2.3	8.3	6.0
Indonesia	2050	12.4	1.3	23	12.5

Current policies

Current policies are defined as currently implemented policies adopted by governments (through legislation) or non-binding targets backed by effective policy instruments. Ambitions and pledges are not included.

The Current Policies scenario describes energy, climate and economic projections for the period until 2030 or 2040, depending on the region³. Modelling teams will update the Current Policies scenario based on the latest policies update, as listed in the current policy protocol spreadsheet which updates the climate policies until July 2023. They will report which policies were implemented in tab 'Target implementation check' in the same spreadsheet. If a policy was not implemented, they should also indicate why it was not possible to implement it. Please feel free to implement policies in your models in alternate ways, depending on the capabilities of each model, as long as the targets are met – meaning no significant over- or under-shooting of targets.

Post-2030 extension (for current policies and NDCs)

After the last major policy ended, the ambition levels of countries and regions should remain constant throughout the rest of the time frame. This is implemented in two ways:

- For each region, determine the “equivalent” carbon price (which lead to current policy emission levels compared to the SSP2 baseline scenario) in 2030/2040 and keeping this carbon price constant until 2100 or the last year possible for the model;
- Optional: Determine the “equivalent” carbon price in 2030/2040 and increase it over time at the same rate as the discount rate in the model or a value of the modelers preference up to 3%.

NDC

The NDC scenario aims to represent the short-term goals of each country or region by implementing the targets for 2030 as defined in their NDC submission. All modelling teams must update their ENGAGE NDC-2030+ scenario. If a region has a conditional NDC, this is the NDC that should be implemented. Appendix I contains the NDC targets for major emitting countries and regions. Targets for other countries and regions and absolute emission levels for all countries and regions calculated from these targets can be found in the enclosed excel-file 'ELEVATE T2.3 Scenario Protocol NDC and LTS information.xlsx'. After 2030, the same extension methods as for the Current Policies scenario should be applied.

³ For most regions, major policies end by 2030. The exceptions are the EU and Korea, for which major policies end (and the extension method should start) by 2040.

NDC-LTS (net-zero)

The NDC-LTS scenario will consider the NDC pledges and the long-term strategy pledges (net-zero targets). Many countries have defined a net-zero pledge that determines the target year in which emissions must be net-zero. They have also indicated if the net-zero pledge refers to carbon dioxide (CO₂) or greenhouse gas (GHG) emissions. When emission coverage is not specified, we follow most relevant published literature or expert assessment. Appendix II contains the LTS targets for major emitting countries and regions. Targets for other countries and regions can be found in the enclosed excel-file 'ELEVATE T2.3 Scenario Protocol NDC and LTS information.xlsx'.

National modelling teams should consider the net-zero target year regarding their modelling time frame (e.g., if the model's time frame goes up to 2050 and the net-zero target year is 2070, consider expanding to 2070 or, alternatively, linearly interpolating to 2050). After the net-zero year, emissions for a country should stay around net-zero.

Global modelling teams should consider all net-zero pledges, aggregating them to their specific model regions. If countries within a model region have different net-zero targets, the region's strategy is calculated based on those countries' contribution to the total GHG emissions of the region by a calculated (weighted) target year. These strategies should be implemented as a reduction compared to the NDC scenario (extended with the constant carbon tax) by an indicated target year. Table 2 contains an example, Annex C presents different GCAM regions as an additional example. The enclosed excel file ('ELEVATE T2.3 Scenario Protocol NDC and LTS information.xlsx', tab 'NET-ZERO calculation') can help with calculating the targets for other regions. The emissions should be kept at least at the same level between the target year and 2100.

Table 2: Example of a regional LTS

GCAM Region	Countries	Target year	Share of GHG emissions covered by net-zero targets
Eastern Africa	Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Mauritius, Reunion, Rwanda, Sudan, Somalia, Uganda	2050	56%

Infeasible outcomes can be reported mentioning the region and year in which the target is infeasible. Modelling teams can relax the time period of the target year in order to reach feasible results.

LTS (net-zero)

The LTS scenario is similar the NDC-LTS scenario, but we assume that countries are on a cost-optimal pathway towards their net-zero targets without the need to meet their NDC pledges in 2030.

Overview of scenarios

Table 3: Overview of scenarios

	Scenario name	National teams	Global teams
0	1.5/2°C	ELV-SSP#-15C-N ELV-SSP#-2C-N	ELV-SSP#-650P-400F ELV-SSP#-1150F
1a	Current Policies with constant carbon price after 2030/2040	ELV-SSP#-CP-D0-N	ELV-SSP#-CP-D0
1b	Current Policies with increasing carbon price after 2030/2040 (at a rate up to 3%) (optional)	ELV-SSP#-CP-D#-N	ELV-SSP#-CP-D#
2a	NDC with constant carbon price after 2030/2040	ELV-SSP#-NDC- D0-N	ELV-SSP#-NDC- D0
2b	NDC with increasing carbon price after 2030/2040 (at a rate up to 3%) (optional)	ELV-SSP#-NDC- D#-N	ELV-SSP#-NDC-D#
3	NDC-LTS	ELV-SSP#-NDC-LTS-N	ELV-SSP#-NDC-LTS
4	LTS	ELV-SSP#-LTS-N	ELV-SSP#-LTS
Notes: SSP# = SSP1, SSP2 or SSP3 (# = 1, 2 or 3) D# = increasing in carbon price # (0 (for constant c-price case) or up to 3%, modellers choice) N = national modelling scenarios			

Annex A

Table A: NDC targets for 2030 for selected countries/regions. When a region has an unconditional and a conditional NDC target, only the conditional one is included

Region	NDC target for 2030	Updated since ENGAGE
Argentina	GHG emissions 349 MtCO ₂ e	Yes
Australia	GHG emissions 43% below 2005 levels	Yes
Brazil	GHG emissions 48% below 2005 levels	Yes
Canada	GHG emissions 40-45% below 2005 levels	
China	<ul style="list-style-type: none"> - Reduction in CO₂ emissions intensity (emissions per unit of GDP) by 60% to 65%, compared to 2005 levels (excl. LULUCF) - Peaking CO₂ emissions before 2030 - Increase in the share of non-fossil fuel in primary energy to around 25% - New renewable wind and solar installed capacity target of 1,200 GW - Increase in forest stock volume by 6 billion m³, relative to 2005 levels 	
EU-27	GHG emissions 55% below 1990 levels	
India	<ul style="list-style-type: none"> - GHG emissions intensity 45% below 2005 levels (excl. LULUCF) - Increase in the share of non-fossil energy in total power capacity to around 50% by 2030 - Increase the carbon sink volume with 2.5 to 3 GtCO₂e through additional forest and tree cover by 2030 	Yes
Indonesia	GHG emissions 43.2% below BAU	Yes
Japan	GHG emissions 46% below 2013 levels	
Republic of Korea	GHG emissions 40% below 2018 levels	
Mexico	GHG emissions 40% below BAU	Yes
Russian Federation	GHG emissions 70% below 1990 levels	
Saudi Arabia	GHG emissions of 715 – 958 MtCO ₂ e ⁴	Yes
South Africa	GHG emissions of 350-420 MtCO ₂ e	
Thailand	GHG emissions 40% below BAU	Yes
Turkiye	GHG emissions 41% below BAU	
USA	GHG emissions 50-52% below 2005 levels	
Viet Nam	GHG emissions 43.5% below BAU	Yes

Source: <https://themasites.pbl.nl/o/climate-ndc-policies-tool/#ndc>

⁴ Target estimated as in https://www.pbl.nl/sites/default/files/downloads/newclimate-pbl-iiasa-2023-greenhouse-gas-mitigation-scenarios-for-major-emitters-2023-update_5280.pdf

Annex B

Table B: LTS targets (net-zero)

Region	Emission type official submission	Net-zero target year GHG	Net-zero target year CO ₂
Argentina	GHG	2050	
Australia	GHG	2050	
Brazil	GHG	2050	
Canada	GHG	2050	
China	CO ₂		2060
EU-27	GHG	2050	
India	GHG	2070	
Indonesia	GHG	2060	
Japan	GHG	2050	
Republic of Korea	CO ₂		2050
Russian Federation	GHG	2060	
Saudi Arabia	CO ₂		2060
South Africa	CO ₂		2050
Thailand	CO ₂		2065
Turkiye	GHG	2053	
USA	GHG	2050	
Viet Nam	GHG	2050	

Source: <https://zerotracker.net/> & <https://climateactiontracker.org/>

Annex C

Table C: Net-zero target years per GCAM region

GCAM Region	Countries	Target year	Share of GHG emissions covered
Eastern Africa	Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Mauritius, Reunion, Rwanda, Sudan, Somalia, Uganda	2050	56%
Northern Africa	Algeria, Egypt, Western Sahara, Libya, Morocco, Tunisia	2050	3%
Southern Africa	Angola, Botswana, Lesotho, Mozambique, Malawi, Namibia, Swaziland, Tanzania, Zambia, Zimbabwe	2050	40%
Western Africa	Benin, Burkina Faso, Central African Republic, Cote d'Ivoire, Cameroon, Democratic Republic of the Congo, Congo, Cape Verde, Gabon, Ghana, Guinea, Gambia, Guinea-Bissau, Equatorial Guinea, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Sao Tome and Principe, Chad, Togo	2057	51%
Argentina	Argentina	2050	100%
Australia/NZ	Australia, New Zealand	2050	100%
Brazil	Brazil	2050	100%
Canada	Canada	2050	100%
Central America and the Caribbean	Aruba, Anguilla, Netherlands Antilles, Antigua & Barbuda, Bahamas, Belize, Bermuda, Barbados, Costa Rica, Cuba, Cayman Islands, Dominica, Dominican Republic, Guadeloupe, Grenada, Guatemala, Honduras, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Montserrat, Martinique, Nicaragua, Panama, El Salvador, Trinidad and Tobago, Saint Vincent and the Grenadines	2049	61%
Central Asia	Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Turkmenistan, Uzbekistan	2059	40%
China	China	2060	98%
Colombia	Colombia	2050	100%
EU-12	Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Malta, Poland, Romania, Slovakia, Slovenia	2050	100%
EU-15	Andorra, Austria, Belgium, Denmark, Finland, France, Germany, Greece, Greenland, Ireland, Italy, Luxembourg, Monaco, Netherlands, Portugal, Sweden, Spain, United Kingdom	2050	100%
Eastern Europe	Belarus, Moldova, Ukraine	2060	74%

European Free Trade Association	Iceland, Norway, Switzerland	2050	100%
Europe Non-EU	Albania, Bosnia and Herzegovina, Croatia, Macedonia, Montenegro, Serbia, Turkey	2053	81%
India	India	2070	100%
Indonesia	Indonesia	2060	100%
Japan	Japan	2050	100%
Mexico	Mexico	2050	72%
Middle East	United Arab Emirates, Bahrain, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Syria, Yemen	2057	50%
Pakistan	Pakistan	2050	100%
Russia	Russia		
South Africa	South Africa	2050	85%
Northern South America	French Guiana, Guyana, Suriname, Venezuela	2050	7%
Southern South America	Bolivia, Chile, Ecuador, Peru, Paraguay, Uruguay	2050	62%
South Asia	Afghanistan, Bangladesh, Bhutan, Sri Lanka, Maldives, Nepal	2049	100%
Southeast Asia	American Samoa, Brunei Darussalam, Cocos (Keeling) Islands, Cook Islands, Christmas Island, Fiji, Federated States of Micronesia, Guam, Cambodia, Kiribati, Lao Peoples Democratic Republic, Marshall Islands, Myanmar, Northern Mariana Islands, Malaysia, Mayotte, New Caledonia, Norfolk Island, Niue, Nauru, Pacific Islands Trust Territory, Pitcairn Islands, Philippines, Palau, Papua New Guinea, Democratic Peoples Republic of Korea, French Polynesia, Singapore, Solomon Islands, Seychelles, Thailand, Tokelau, Timor Leste, Tonga, Tuvalu, Viet Nam, Vanuatu, Samoa	2054	75%
South Korea	South Korea	2050	100%
Taiwan	Taiwan	2050	100%
USA	United States of America	2050	100%