



PROJECT BRIEFING #8

NATIONAL MITIGATION ROADMAPS WORLDWIDE*

VERSION #2 | OCTOBER 2021

*AS OF FEBRUARY 2020

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AIM

The aim of this fact sheet is to provide a brief overview on the most commonly used parameters in existing and legally binding national decarbonisation roadmaps, which might be highly relevant to define and set key criteria to draw up other decarbonisation strategies and pathways on a national level.

PARIS AGREEMENT

The central objective of the Paris Agreement (12 December 2015, 196 signatory parties) is to “strengthening the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius” (UNFCCC, 2020a). Thus, it aims at a substantial risk reduction in terms of climate change impacts. Explicit target of this accord is to **achieve a balance between anthropogenic emissions and removal of greenhouse gases in the second half of the century** (UNFCCC, 2020b). In this sense, all available scenarios consistent with the 2°C temperature goal require reaching net-zero carbon emissions¹ globally by mid-century (Anderson & Peters, 2016; IPCC, 2018a; Hoegh-Guldberg et al., 2018).

The Paris Agreement requires all parties to put forward their best efforts through nationally determined contributions and to strengthen these efforts in the years ahead (see *Figure 1*). This includes requirements that all parties report regularly on their emissions and on their implementation efforts (UNFCCC, 2020b).

“All Parties should strive to formulate and communicate long-term low greenhouse gas emission development strategies, mindful of Article 2 taking into account their common but differentiated responsibilities and respective capabilities, in the light of different national circumstances.”

Figure 1: Article 4, Paragraph 19, of the Paris Agreement (UNFCCC, 2016).

¹ Net-zero carbon emissions are achieved “when anthropogenic CO₂ emissions are balanced globally by anthropogenic CO₂ removals over a specified period. Net zero CO₂ emissions are also referred to as carbon neutrality” (IPCC, 2018b, 555).

ROADMAP MAPPING

Nevertheless, only a limited number of so-called *Long-Term Low Greenhouse Gas Emission Development Strategies* (LT-LEDS) has been drawn up on each national level, outline the importance, advantages and urgencies of net-zero strategies.

In order to get a current overview, a mapping of already existing long-term national mitigation roadmaps has been carried out between October 2019 and February 2020 and encompasses, as a first step, 14 national LT-LEDS that have legal force (available in English, see *Figure 2*):

- **14 long-term strategies published by Paris Agreement signatory states**, including the European Union, which officially reported their LT-LEDS to UNFCCC (UNFCCC, 2016; UNFCCC, 2015). *Table 1* gives an overview of the analysed national roadmaps and provides web links to directly access the documents.
- In spite of the officially announced withdrawal of “United States Mid-Century Strategy (MCS) for Deep Decarbonization”, the **U.S. roadmap** will be taken into account for this analysis as the 2017 U.S. withdrawal from Paris Agreement could be reversed again, depending on the U.S. voters’ election decisions in early November 2020 (UNTC, 2019).
- This Project Briefing represents the **stage of affairs as of 28 February 2020**.

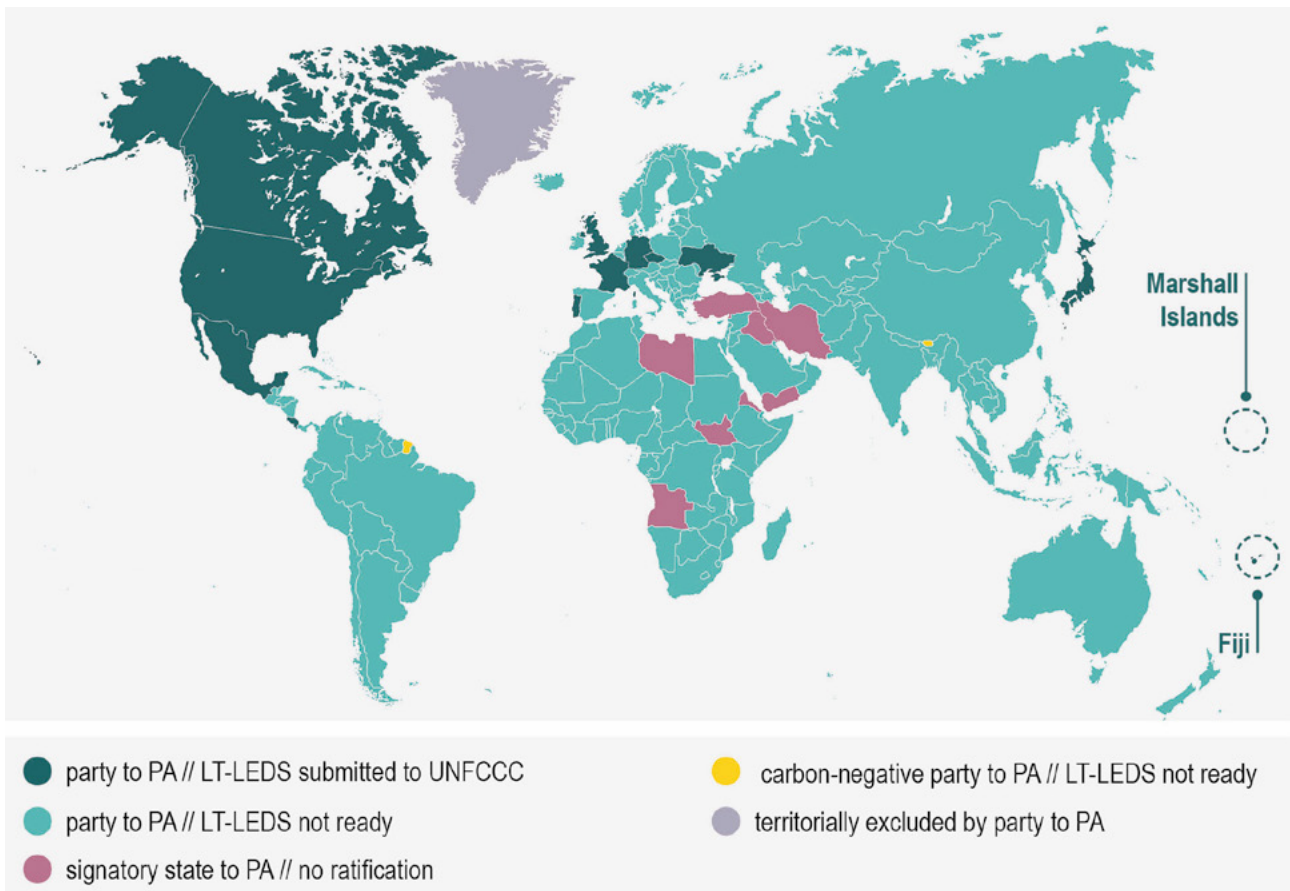


Figure 2: Overview on the Paris Agreement and the status of the states' LT-LEDS (based on UNTC, 2020; UNFCCC, 2020c; Muntean et al. 2018, 49f.).

In order to increase the readability of this document, references to the roadmaps have been omitted in the text. However, an overview can be found in *Table 1*.

MAIN RESULTS

In the following overview, the key results of this mapping of national greenhouse gas mitigation roadmaps will be introduced and summarised briefly. The relevant data collected from the long-term strategies have been categorised by quantitative and qualitative criteria. The range of these criteria, feasible solution measures and scenarios outlined, are quite heterogeneous overall, reflecting numerous special requirements and transition obstacles to be addressed depending on each country's structure, needs and ambitions in terms of climate mitigation and adaptation.

Quantitative criteria with particular relevance for a purposeful long-term greenhouse gas (GHG) mitigation strategy, recorded in all LT-LEDS examined, are as follows:

- **Overall long-term greenhouse gas reduction rates:** focusing GHG emission reductions of at least 80% by 2050.
- All greenhouse gas reduction rates are based on **carbon dioxide equivalent**², often abbreviated as CO₂-eq (UNFCCC, 2020d).
- **Decarbonisation scenarios:** For five countries different GHG reduction scenarios, resulting in a different range of carbon emission budgets remaining at the end of each scenario period.
- **Base years** for calculation of GHG reductions: between 1990 and 2010
- **Greenhouse gas reduction by sectors:** Eight main sectors, namely:
 - energy generation
 - industry
 - transportation
 - buildings & housing
 - agriculture & livestock (and/or agriculture, forestry, and other land use)
 - waste
 - public sector, and
 - a separate category, addressing natural carbon sink potentials from land use, land use change, and forestry.

Qualitative criteria contained in most LT-LEDS particularly targeting further greenhouse gas emission sources, their balancing, budgeting, avoiding and reducing:

- **“Offshore” GHG emissions:** Greenhouse gas emissions from aviation, shipping, international trade and trans-border services are regularly not mentioned and not taken into account, accordingly.
- **International CO₂ offsets** like “European Emissions Trading System”, etc.: Among the world's transnational carbon market systems EU's “cap and trade” (EU 2020) system covering large GHG emitters is the first and largest one to support GHG emission reductions over time by setting a total amount of GHG to be emitted and an according emission cap to be reduced year by year which might change each nation's total GHG emissions balance and budgets remaining.

² “The amount of CO₂ emission that would cause the same integrated radiative forcing or temperature change, over a given time horizon, as an emitted amount of a GHG or a mixture of GHGs” (IPCC, 2018b, 546).

- **Non-CO₂ emissions:** GHG other than CO₂ such as methane (CH₄), nitrous oxides (N₂O, NO₂), ozone (O₃), sulphur hexafluoride (SF₆), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs).
- **Negative emissions and negative emission technologies:** Negative emissions³ based on carbon-capturing or negative emission technologies, such as bioenergy with carbon dioxide capture and storage, carbon dioxide capture and storage, carbon dioxide capture and utilisation, carbon dioxide capture, utilisation and storage as well as direct air carbon dioxide capture and storage, also known as direct air capture and storage.
- **Nuclear energy options:** A couple of countries maintain a “nuclear option” to generate and provide electricity based on a significant share of nuclear energy, enclosing it into their long-term strategies, resulting in according carbon budget calculations. Among the 14 countries examined, Canada, Czech Republic, France, Japan, Ukraine, the U.K. and the U.S. will definitely rely on nuclear energy as part of their climate mitigation strategy up to 2050.
- **Further key supplemental measures, with a special focus on carbon pricing:** Carbon pricing is regarded as strong measure to underpin and accompany climate mitigation strategies in a couple of countries and often associated or combined with their LT-LEDS each. After being initially introduced in Finland (1990) and Sweden (1991), carbon emission related levies or taxes are strongly considered to support the limitation of greenhouse gas emissions by setting appropriate and effective price signals for the use of fossil fuels, in particular when critical price thresholds are being reached or exceeded. Currently, more than two dozens of countries worldwide are imposing carbon taxes in a range between about € 13 (Portugal) and € 120 (Sweden) per tonne CO₂-eq (World Bank, 2019).

ADAPTATION ROADMAPS

- Five climate mitigation roadmaps – namely **Fiji, Marshall Islands, Mexico, Portugal and the U.S.** – and the **EU’s long-term strategy** contain designated chapters or sub-chapters focusing on long-term climate adaptation strategies.
- With regards to the high vulnerabilities and even multiple threat potentials imposed by climate change, the adaptation sections contained in LT-LEDS of the two low-lying islands states Fiji and Marshall Islands have been carried out very comprehensively and in a detailed-oriented manner.
- Mexico’s climate change adaptation related strategy particularly addresses 480 "very highly" or "highly vulnerable" municipalities, based on a vulnerability assessment using the Representative Concentration Pathway 8.5 scenario. The adaptation strategy focuses on the following important fields: water availability, floods and droughts, extreme hydro-meteorological events (tropical storms), spread of diseases, maintaining of food security, biodiversity conservation, and socio-environmental, infrastructural and economic damage prevention.

³ Negative emissions refer to the “removal of GHGs from the atmosphere by deliberate human activities, i.e., in addition to the removal that would occur via natural carbon cycle processes” (IPCC, 2018b, 554).

CARBON NEGATIVE COUNTRIES

- In spite of their still increasing greenhouse gas emissions, two countries in the world have a negative GHG balance: **Bhutan and Suriname** (Muntean et al., 2018, 49f.) due to their high share of forest-covered areas⁴, which function as net carbon sinks (Protano-Goodwin, 2019; Tobgay, 2016; Walker, 2018).
- Moreover, Bhutan and Suriname renewed their pledges at UNFCCC recently to save the extension and quality of the forests and to avoid deforestation within their national boundaries on a long-term basis to warrant their significant carbon sink function (Penjor, 2019; UN, 2014; UNFCCC, 2018).

COUNTRY	ROADMAP TITLE	REFERENCE
Republic of Ukraine	Ukraine 2050 Low emission Development Strategy	https://bit.ly/3rOjV6t
Canada	Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy	https://bit.ly/2NIfYBn
Costa Rica	National Decarbonization Plan Costa Rica	https://bit.ly/3cklgwb
Czech Republic	Climate Protection Policy of the Czech Republic	https://bit.ly/2MhGD7R
European Union	A Clean Planet for all – A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy	https://bit.ly/36lx26G
France	Stratégie Nationale Bas-Carbone	https://bit.ly/3pvwjYh
Germany	Climate Action Plan 2050 – Principles and goals of the German government's climate policy	https://bit.ly/3pqEvZl
Japan	The Long-term Strategy under the Paris Agreement	https://bit.ly/3ciBmaN
Mexico	Mexico's Climate Change Mid-Century Strategy	https://bit.ly/2KZreZ7
Portugal	Roadmap for Carbon Neutrality 2050 (RNC 2050) – Long-Term Strategy for Carbon Neutrality of the Portuguese Economy by 2050	https://bit.ly/3oB0z2M
Republic of Fiji	Fiji Low Emission Development Strategy 2018-2050	https://bit.ly/2YlcfM7
Republic of the Marshall Islands	Tile Til Eo – 2050 Climate Strategy "Lighting the way"	https://bit.ly/3ciBKpL
United Kingdom	The Clean Growth Strategy – Leading the way to a low carbon future	https://bit.ly/2YrdOIA
United States of America	United States Mid-Century Strategy for Deep Decarbonization	https://bit.ly/3oxGFW6

Table 1 Overview on National Roadmaps that have been submitted to the UNFCCC until February 2020.

⁴ 2016: 70.8% of Bhutan`s and 94% of Suriname`s national territory (FRMD, 2017, 1; Republic of Suriname, 2015, 2).

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The Helmholtz Climate Initiative (HI-CAM) is funded by the Helmholtz Association's Initiative and Networking Fund. The authors are responsible for the content of this publication.

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October 2021

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