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## Aligning short-term climate action with long-term climate goals

### Opportunities and options for enhancing alignment between NDCs and long-term strategies

Prepared for the Climate Change Expert Group

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# Foreword

This document was prepared by the OECD and IEA Secretariats in response to a request from the Climate Change Expert Group (CCXG) on the United Nations Framework Convention on Climate Change (UNFCCC). The Climate Change Expert Group oversees development of analytical papers for the purpose of providing useful and timely input to the climate change negotiations. These papers may also be useful to national policy-makers and other decision-makers. Authors work with the CCXG to develop these papers. However, the papers do not necessarily represent the views of the OECD or the IEA, nor are they intended to prejudge the views of countries participating in the CCXG. Rather, they are Secretariat information papers intended to inform Member countries, as well as the UNFCCC audience.

Members of the CCXG are those countries who are OECD members and/or who are listed in Annex I of the UNFCCC (as amended by the Conference of the Parties in 1997 and 2010). The Annex I Parties or countries referred to in this document are: Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, the European Community, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, the Netherlands, New Zealand, Norway, Poland, Portugal, Romania, the Russian Federation, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, the United Kingdom of Great Britain and Northern Ireland, and the United States of America. Chile, Israel, Korea and Mexico are also members of the CCXG. In April 2020, Colombia has become an OECD Member. Where this document refers to “countries” or “governments”, it is also intended to include “regional economic organisations”, if appropriate.

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# Abstract

## **Aligning short-term climate action with long-term climate goals**

### **Opportunities and options for enhancing alignment between NDCs and long-term strategies**

The Paris Agreement and its accompanying decision call for Parties to strive to formulate mid-century communicate long-term low-greenhouse gas emission development strategies (LT-LEDS) by 2020. Moreover, the Paris decision requests Parties to communicate a new or updated Nationally Determined Contribution (NDC) by 2020. This paper finds that there is potential for these long-term strategies to guide short- and mid-term action and feed into future NDC submissions. This paper highlights that long-term strategies can substantially shape countries' short- and mid-term priorities, policies and investment pipelines, leading to significant cost reductions in the long-term. Linking NDCs to long-term mitigation strategies will be key in ensuring efficient use of resources, particularly crucial for responding to climate change amidst and following the COVID-19 crisis. This paper presents seven case studies from countries' experiences that highlight how a long-term perspective can drive short-term action, and provides concrete insights into how countries may best leverage a long-term perspective in their NDC process.

**JEL Classification:** Q58, Q56, Q54, F53

**Keywords:** Climate change, LT-LEDS, NDCs, Paris Agreement, decarbonisation, carbon markets

# Résumé

## **Lutte contre le changement climatique : aligner l'action de court terme sur les objectifs de long terme**

### **Possibilités et moyens envisageables de mieux accorder les CDN et les stratégies de long terme**

Dans l'Accord de Paris et la décision en portant adoption, il est demandé aux Parties de s'employer à formuler, d'ici à 2020, des stratégies de développement à faibles émissions pour le milieu du siècle. Dans cette même décision, les Parties sont invitées à communiquer d'ici à 2020 une première ou nouvelle contribution déterminée au niveau national (CDN). Les auteurs du présent document constatent que ces stratégies de long terme peuvent orienter l'action à court et moyen termes et influencer sur les futures CDN. Ils soulignent que les stratégies de long terme peuvent fortement peser sur les priorités, les politiques et les filières d'investissement nationales de court et moyen termes et, partant, entraîner d'importantes réductions de coût sur le long terme. Il est donc indispensable de relier les CDN aux stratégies d'atténuation de long terme afin de veiller à l'utilisation rationnelle des ressources, lesquelles sont particulièrement cruciales pour lutter contre le changement climatique, en cette période de crise de la COVID-19 et par la suite. Le présent document contient sept études de cas qui concernent différents pays et montrent comment une vision à long terme peut stimuler l'action à court terme; il fournit en outre des enseignements concrets sur la manière dont les pays pourraient exploiter au mieux cette vision de long terme dans la réalisation de leur CDN.

**Classification JEL :** Q58, Q56, Q54, F53

**Mots-clés :** Changement climatique, stratégie de développement à faibles émissions, CDN, Accord de Paris, décarbonation, marchés du carbone

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# List of Acronyms

<b>CCXG</b>	Climate Change Expert Group
<b>CCUS</b>	Carbon capture, use and storage
<b>CDM</b>	Clean Development Mechanism
<b>GHG</b>	Greenhouse gas
<b>IEA</b>	International Energy Agency
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>ITMOs</b>	Internationally Transferred Mitigation Outcomes
<b>LT-LEDS</b>	Long-term low emission development strategy
<b>NDC</b>	Nationally Determined Contribution
<b>NETs</b>	Negative Emissions Technologies
<b>NZET</b>	Net-zero emissions target
<b>OECD</b>	Organisation for Economic Co-Operation and Development
<b>R&amp;D</b>	Research and Development
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change

# Executive summary

Current international efforts to mitigate climate change, including those deriving from countries' Nationally Determined Contributions (NDCs), are expected to fall short of meeting the global long-term temperature goal set by the Paris Agreement. In particular, there is a substantial gap between short-/mid-term mitigation targets included in countries' NDCs and the reductions in global GHG emissions that are needed to achieve the long-term temperature goal in the Paris Agreement. In this context, long-term climate strategies represent an opportunity for countries to identify and set a long-term vision and/or target that defines a roadmap for the deep, economy-wide transformations needed to achieve low-emissions development. This paper finds that there is potential for these long-term strategies or goals to guide short- and mid-term action and feed into the next rounds of NDCs.

Article 4.19 of the Paris Agreement calls for Parties to “strive to formulate and communicate long-term low-greenhouse gas emission development strategies” (LT-LEDS), and the Paris decision states that Parties “should strive” to communicate these “mid-century” LT-LEDS to the United Nations Framework Convention on Climate Change (UNFCCC) by 2020. Moreover, the Paris decision requests Parties to communicate a new NDC by 2020 for NDCs with a time frame up to 2025, or to communicate or update by 2020 NDCs with a time frame up to 2030. The 2020 COVID-19 health crisis could delay some countries' efforts in communicating or updating both NDCs and long-term climate strategies. The health crisis can however render even more important the alignment between NDCs and LT-LEDS. This is because such alignment can ensure more effective climate policymaking, more efficient use of resources and may also promote stronger well-being benefits associated with a mitigation strategy; all of these factors will be key in governments' response to the climate change challenge amidst and post the COVID-19 crisis.

LT-LEDS are long-term national strategies that identify opportunities or pathways for low-emission development that also consider broader socio-economic goals. While NDCs are mandatory for all Parties<sup>1</sup>, LT-LEDS are voluntary, and as of May 2020, 17 Parties have communicated and submitted a LT-LEDS to the UNFCCC. 11 of these 17 LT-LEDS set milestone targets to e.g. 2025 or 2030 that correspond to or that are more ambitious than the targets put forward in the NDC, and none of these LT-LEDS set milestone targets that are less ambitious than the respective NDC targets.

Since 2019, an increasing number of countries have put forward commitments to reach net-zero CO<sub>2</sub> or GHG emissions by mid-century or sooner. Other countries have been developing national long-term climate strategies but have not submitted them to the UNFCCC. These long-term strategies, targets and commitments, along with recent scientific insights on long-term global GHG trajectories that are consistent with the goals of the Paris Agreement, can play an important role in the development and submission of future NDCs. For example, long-term climate mitigation goals can have a significant impact on decision makers' choice of priorities, policies and mitigation options for the short- and mid-term. In particular, if a long-term vision or goal is not taken into account when establishing short- or mid-term actions, this can lead to the design of policy packages that are capable of achieving a short- or mid-term target, but that are not able to deliver the structural and economic transformations needed to achieve a subsequent, and more ambitious longer-term goal.

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<sup>1</sup> In this paper, “Party” or “Parties” is also used to include regional economic organisations (e.g. the European Union) when applicable. In this specific context, it is important to note that the Member States of the European Union have submitted a joint, EU-wide NDC.

This paper presents seven case studies from countries' experiences that highlight how a long-term climate mitigation perspective (included in LT-LEDS, other national long-term strategies, long-term goals and sectoral long-term strategies) can drive and shape short-term action. In particular the different ways these long-term strategies influence short-term action include:

- **Helping define strategic areas where action in the short-/mid-term is crucial for achievement of long-term goals.** For example, the achievement of an agreed long-term mitigation goal in France's transport sector and New Zealand's transition to a low-emissions economy could be more challenging without early interventions in strategic areas (e.g. focus on fuel switching in France) or sectors (e.g. land use in New Zealand).
- **Unlocking long-term mitigation opportunities.** Long-term strategies, such as the roadmaps the development and deployment of future technologies enable decision makers to sequence policies in such a way as to facilitate the development of disruptive technologies, whose commercialisation may otherwise be difficult in the long-term. For example, early action and careful sequencing of short- and mid-term measures are needed to scale-up Carbon Capture, Use and Storage (CCUS) in China. Otherwise, CCUS might not be available at the scale needed to support the country's climate goals.
- **Providing strong political signal and support for action in the short-/mid-term.** A national long-term goal is important to communicate a clear direction of travel for the short- and mid-term across different sectors and stakeholders, potentially withstanding political fluctuations if enshrined in national law. For example, the 2008 Climate Change Act of the United Kingdom and the 2017 Climate Policy Framework of Sweden adopt a step-by-step approach to achieving a long-term target. Accordingly, a long-term goal was set and mid-term targets to achieve it are defined progressively so to take into account changes such as availability of new technologies or market opportunities.
- **Avoiding or reducing risk of locking in GHG emissions.** Long-term strategies can facilitate the identification of risks of carbon lock-in, informing short- and mid-term action accordingly. Costa Rica's LT-LEDS and Ireland's Climate Action Plan have identified concrete potentials for carbon lock-in in investments in technologies that in other contexts may be considered as transitional or cheaper (e.g. natural gas as a heating source in buildings).

Linking NDCs and LT-LEDS from a climate mitigation perspective means that ideally the mitigation targets put forward by an NDC would be concrete milestones along the low-emissions pathway resulting from the long-term strategy. Other aspects of NDC/LT-LEDS linkages are fundamental in order to operationalise long- and short-term alignment, and include setting-up common or co-ordinated institutional arrangements, linking monitoring systems of NDCs and LT-LEDS and co-ordinating review and revision cycles of the two. Options that can be useful to countries as they consider how to operationalise long- and short-term alignment vary according to three different contexts include (WRI, 2019<sup>[1]</sup>):

- Countries that have already put forward a long-term strategy or target can use these long-term strategies/targets to inform their upcoming NDC submission as well as future NDCs. In this situation, countries could also consider revising their long-term strategy, if new scientific insights or technologies have become available since its publication, or following important political, social or economic developments.
- Countries that plan to develop a long-term strategy the same year as their NDC could do so by establishing a sequential process that allows for the establishment of a long-term goal or vision first. If the two documents are being developed concomitantly, it is important to establish regular communication between the two processes to ensure alignment.
- Countries that do not have a long-term strategy and that do not intend to prepare one in the immediate future can draw from existing studies and literature to assess regional or global mitigation trends and trajectories to check whether these are in line with their short- and mid-term targets. Countries could also decide to commission new studies aimed at assessing national trends. In this situation, it is important for countries to consider how to best avoid risk of potential carbon lock-in derived from short- and mid-term action.

# 1 Introduction

The Paris Agreement sets the long-term temperature goal of “holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels” (Paris Agreement, 2015<sub>[2]</sub>). According to the IPCC Special Report on Global Warming of 1.5°C (IPCC SR 1.5°C), in order to ensure no or limited overshoot of 1.5°C above pre-industrial levels, global CO<sub>2</sub> emissions need to reach net-zero by around 2050 (IPCC, 2018<sub>[3]</sub>).<sup>2</sup> As of April 2020, 186 Parties<sup>3</sup> have developed and communicated one or more Nationally Determined Contribution(s) (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC), which outlines national efforts towards meeting the goal of the Agreement. However, there is a substantial gap between aggregate emissions resulting from current NDCs and emissions levels that would be consistent with the global temperature goal of the Paris Agreement (UNEP, 2019<sub>[4]</sub>).<sup>4</sup> Unconditional NDCs (i.e. NDCs that countries could implement based on own resources and capabilities) would lead to an increase in the global average temperature of 2.8°C above pre-industrial levels by 2100 (Climate Action Tracker, 2019<sub>[5]</sub>).

A wide range of scientific literature is dedicated to exploring global long-term infrastructural transformations needed to unlock emissions reductions that are consistent with the long-term temperature goal of the Paris Agreement (IPCC, 2018<sub>[3]</sub>; UNEP, 2019<sub>[4]</sub>; OECD/The World Bank/UN Environment, 2018<sub>[6]</sub>; IEA, 2019<sub>[7]</sub>). However, there is limited guidance available to policymakers on how to translate these long-term infrastructural transformations into short- or mid-term concrete action in their country or region. Existing analyses find that the choice of an optimal package of policies needed to achieve a mid-term mitigation goal (e.g. to 2030) is strongly impacted by the existence and aim of longer-term mitigation goals (e.g. to 2050) (Vogt-Schilb and Hallegatte, 2014<sub>[8]</sub>; del Río González, 2008<sub>[9]</sub>; IEA, 2017<sub>[10]</sub>; Iyer et al., 2017<sub>[11]</sub>). In particular, not considering long-term objectives may lead to the development of policy packages capable of achieving a short- or a mid-term target, but that cannot deliver the structural and economic transformations needed to achieve a subsequent, and more ambitious longer-term goal. This is because, without a long-term goal or strategy, policymakers may find it difficult to identify and implement short- and mid-term regulatory, structural and/or financial conditions necessary to unlock long-term mitigation opportunities (Vogt-Schilb and Hallegatte, 2014<sub>[8]</sub>; del Río González, 2008<sub>[9]</sub>; Fabert and Foussard, 2016<sub>[12]</sub>; IEA, 2017<sub>[10]</sub>; WRI, 2019<sub>[1]</sub>; WRI and UNEP, 2019<sub>[13]</sub>). Developing a long-term strategy represents an opportunity for countries to identify and set a long-term vision or target that can guide them towards a low-carbon future while aligning broader societal goals with climate mitigation (Rocha and Falduto, 2019<sub>[14]</sub>; OECD, 2020<sub>[15]</sub>). There is potential for these long-term strategies or goals to feed into the next rounds of NDCs, and guide the short- and mid-term action of NDCs.

<sup>2</sup> The IPCC SR 1.5°C also demonstrates that limiting global warming to 1.5°C compared to limiting it to 2°C brings substantial economic, social and environmental benefits. In addition, it finds that overshooting presents large risks for natural and human systems, as some of these risks may be “long-lasting and irreversible”. (IPCC, 2018<sub>[3]</sub>)

<sup>3</sup> In this paper, “Party” or “Parties” is also used to include regional economic organisations (e.g. the European Union) when applicable. In this specific context, it is important to note that the Member States of the European Union have submitted a joint, EU-wide NDC.

<sup>4</sup> Scientific evidence indicates the existence of a strong, consistent and almost linear relationship between cumulative CO<sub>2</sub> emissions and increase in global temperature. (IPCC, 2014<sub>[102]</sub>)

In early 2020, the world has been hit by the COVID-19 pandemic, leading to a crisis deeply affecting people, countries and economies. Undoubtedly, this crisis has important implications on how countries – and the international community – cope with a range of other challenges in the short, medium and longer terms, including the climate change challenge. With the goal of helping countries to enhance the effectiveness of short-term action/targets put forward in subsequent rounds of NDCs, the present paper explores the existing synergies between long-term strategies and/or goals and NDCs. Linking NDCs to long-term climate strategies may contribute to more effective climate policymaking, in terms of efficient use of resources and of enhancing well-being benefits, which is crucial in responding to climate change, and in particular, amidst and following the COVID crisis.

Building on recent CCXG work (Rocha and Falduto, 2019<sup>[14]</sup>), the paper first examines the current experience in linking and aligning LT-LEDS and NDCs<sup>5</sup> (Chapter 2). Then, the paper analyses how a long-term target and/or vision can be relevant for planning short-term action, highlighting concrete examples where long-term goals or strategies were essential in shaping effective short-term action (Chapter 3). Lastly, considering three different starting points countries may be at, the paper provides concrete insight into how countries may best leverage a long-term perspective in their NDC process (Chapter 4).

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<sup>5</sup> As part of their long-term strategies and NDCs, some countries may decide to include an adaptation component. This document will primary focus on climate change mitigation.

# 2 Current experience in linking long-term strategies and NDCs

The Paris Agreement introduces long-term strategies in its Article 4.19, which states that “all Parties should strive to formulate and communicate long-term low-greenhouse gas emissions development strategies” (LT-LEDS) to the UNFCCC (Paris Agreement, 2015<sup>[2]</sup>). In addition to the LT-LEDS submitted to the UNFCCC, an increasing number of countries have been putting forward and developing different types of plans, strategies or targets to communicate their long-term efforts towards the achievement of the global goal of the Paris Agreement. The Paris Agreement also requires Parties to prepare, communicate and maintain successive NDCs (Paris Agreement, 2015<sup>[2]</sup>). This section (i) analyses these different types of targets and instruments and their characteristics; (ii) provides an overview of countries’ current experience in linking and/or aligning long-term goals and/or strategies to NDCs.

It is important to note that the COVID-19 pandemic has resulted in uncertainties in the timeline for submission to the UNFCCC or publication of such strategies and targets. Indeed, the COVID-19 pandemic led to the necessary postponement of important climate change meetings, such as the UNFCCC COP26, delaying the conclusion of the negotiations of crucial elements required for the operationalisation and the implementation of the Paris Agreement. Moreover, domestic climate policy processes, including the submission of new or updated NDCs expected for 2020, and the development of long-term strategies are also likely to be delayed by measures put in place to address the health crisis.

## NDCs, LT-LEDS, carbon and climate neutrality goals

LT-LEDS, other national long-term climate strategies and long-term climate goals can play an important role in shaping short-term targets and actions as provided for by e.g. the NDCs.<sup>6</sup> However, in the context of the Paris Agreement, it is only Parties’ NDCs that are mandatory. While Parties are required to (“shall”) prepare successive NDCs, the development of LT-LEDS is voluntary (“Parties should strive to”) (Paris Agreement, 2015<sup>[2]</sup>). As of May 2020, 186 Parties<sup>7</sup> have submitted at least a first NDC to the UNFCCC, and 17 Parties<sup>8</sup> have communicated a LT-LEDS to the UNFCCC (UNFCCC, 2020<sup>[16]</sup>) (UNFCCC, 2020<sup>[17]</sup>). Indeed, some Parties may still intend to submit a LT-LEDS to the UNFCCC in 2020 or ahead of COP26,

<sup>6</sup> This document mainly focuses on LT-LEDS submitted to the UNFCCC. When relevant, examples of non-UNFCCC long-term or climate neutrality strategies will be highlighted as well. For more information see (Rocha and Falduto, 2019<sup>[14]</sup>)

<sup>7</sup> These 186 Parties include the European Union and its 28 Member States, which have submitted a joint NDC (European Commission, 2015<sup>[41]</sup>).

<sup>8</sup> Note that the European Union LT-LEDS document, rather than laying out a strategy for decarbonisation, recalls the Conclusions of the European Council of 12 December 2019, which state that the European Council “endorses the objective of achieving a climate-neutral EU by 2050”. The document also states that “The European Council invites the Commission to prepare a proposal for the EU’s long-term strategy as early as possible in 2020 with a view to its adoption by the Council and its submission to the UNFCCC”. (European Commission, 2020<sup>[18]</sup>)

now deferred to 2021.<sup>9</sup> Notably, in its LT-LEDS submission to the UNFCCC, the European Union states that “the EU Member States prepare their national long-term low greenhouse gas emissions development strategies and submit them to the UNFCCC” (European Commission, 2020<sup>[18]</sup>). In addition, numerous countries have been communicating long-term climate goals and strategies through other channels and means. For example, Sweden has included a long-term strategy to 2045 in its Seventh National Communication (Government of Sweden, 2018<sup>[19]</sup>), submitted to the UNFCCC. Countries such as the United Arab Emirates and Indonesia have developed national long-term climate strategies outside of the UNFCCC context (Government of the United Arab Emirates, 2017<sup>[20]</sup>; Government of Indonesia, 2019<sup>[21]</sup>). Other countries have developed long-term climate-related strategies that focus on specific sectors (e.g. Malta’s National Transport Strategy) or areas (e.g. Burkina Faso’s National Adaptation Plan) (Government of Malta, 2016<sup>[22]</sup>; Government of Burkina Faso, 2015<sup>[23]</sup>; WRI, 2020<sup>[24]</sup>).

Numerous countries have communicated their intention to achieve a carbon or climate neutrality goal by 2050 or earlier (see Box 1). These carbon or climate neutrality targets, while not communicated in a formal LT-LEDS document to the UNFCCC, are an important component of a country’s long-term planning, as they can influence the process of NDC formulation in a similar way to a long-term target in a LT-LEDS or a long-term strategy. For the time being, only few of these targets are accompanied by political announcements, documentation or legislation to back them and only five countries have enshrined such a target in law.

Given their nationally determined nature, NDCs embody efforts determined by each country to reduce domestic emissions and to adapt to climate change.<sup>10</sup> The Paris Agreement nevertheless provides general indications on the elements that could or are to be included in a country’s NDC. First, Article 4.2 of the Agreement requires countries to “pursue mitigation measures, with the aim of achieving the objectives of such contributions” (Paris Agreement, 2015<sup>[2]</sup>). Article 4.4 of the Paris Agreement requests that developed countries continue undertaking economy-wide absolute emission reduction targets, and encourages developing countries to move over time towards such targets, in light of their different national circumstances (Paris Agreement, 2015<sup>[2]</sup>). Also, paragraph 27 of the Paris decision states that countries’ NDCs may include information to facilitate clarity, transparency and understanding, such as timeframes and/or planning processes, assumptions and methodological approaches adopted and considerations on how the NDC is fair and ambitious, in light of the country’s national circumstances (UNFCCC, 2016<sup>[25]</sup>). Lastly, guidance on NDCs has been developed and adopted internationally in decision 4/CMA.1 in 2018, including on NDC features, on information for clarity, transparency and understanding of NDCs, and on accounting for NDCs (UNFCCC, 2018<sup>[26]</sup>).

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<sup>9</sup> While paragraph 23 of decision 1/CP.21 defines 2020 as a deadline for NDC communication and/or update, paragraph 25 of the same decision states that “Parties shall submit to the secretariat their nationally determined contributions referred to in Article 4 of the Agreement at least 9 to 12 months in advance of the relevant session of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement [CMA]”. Due to the 2020 COVID-19 health crisis, the relevant CMA session –scheduled to take place in 2020 in Glasgow—has now been postponed to 2021. It is therefore not clear whether this will have an impact on the submission deadline of upcoming NDCs.

<sup>10</sup> At COP24 in Katowice, countries decided to continue consideration of further guidance on features of NDCs in 2024, during the seventh Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA7) (Decision 4/CMA.1) (UNFCCC, 2019<sup>[100]</sup>)

### Box 1. Carbon and climate neutrality

Carbon neutrality is defined as the achievement of net balance between anthropogenic carbon dioxide (CO<sub>2</sub>) emissions and CO<sub>2</sub> removals by carbon sinks (IPCC, 2018<sup>[3]</sup>). Climate neutrality recalls the same idea, however covering all other GHGs and implying a net balance of in terms of CO<sub>2</sub> equivalent (CO<sub>2</sub>e).

The IPCC SR 1.5°C estimates that, in order to limit the increase in global average temperature to 1.5°C, global CO<sub>2</sub> emissions are to be reduced by about 45% between 2010 and 2030 and carbon neutrality is to be reached around 2050. To limit the increase in global average temperature to 2°C, global CO<sub>2</sub> emissions are to be reduced by about 25% between 2010 by 2030 and carbon neutrality is to be reached around 2070 (IPCC, 2018<sup>[3]</sup>)

As of May 2020, two countries (Bhutan and Suriname) have achieved carbon neutrality. Since 2019, an increasing number of countries have formulated formal or informal commitments to achieve carbon neutrality by mid-century or earlier. In particular, as of May 2020:

- Five countries have enshrined a climate or carbon neutrality target in domestic law, although have not communicated their neutrality target in a formal LT-LEDS document to the UNFCCC yet (Sweden by 2045, Denmark, France, New Zealand and the United Kingdom by 2050);
- Five jurisdictions have a 2050 carbon or climate neutrality target in proposed legislation (European Union, Hungary, Spain, Chile and Fiji);
- Thirteen countries have a carbon or climate neutrality target in national and policy documents (Austria by 2040, Costa Rica by 2050, Finland by 2035, Iceland by 2040, Germany by 2050, Japan “as early as possible in the second half of the century”, Marshall Islands by 2050, Norway by 2030, Portugal by 2050, Singapore “as soon as viable in the second half of the century”, Slovakia by 2050, Switzerland by 2050 and Uruguay by 2030).

As of May 2020, 120 countries are part of the Climate Ambition Alliance, signalling that they are working towards achieving net-zero CO<sub>2</sub> emissions, or carbon neutrality, by 2050 (UNFCCC, 2020<sup>[27]</sup>) (Annex A for full list of countries). These 120 countries include countries that have also undertaken carbon/climate neutrality effort and commitments.

Note: Information on national commitments to carbon or climate neutrality is listed here to the best of our knowledge and according to public information available in English. A list of supporting documents and references is available in Annex A  
Source: Authors and Luca Lo Re (IEA)

Similar indications to guide countries’ development of long-term strategies and targets are not present either in the Paris Agreement or in any other UNFCCC document. Countries’ current experience and existing literature show that, in practice, long-term strategies are being developed by countries with the goal of integrating climate change mitigation and/or adaptation strategies with broader goals of sustainable development (Rocha and Falduto, 2019<sup>[14]</sup>). NDCs and LT-LEDS submitted to the UNFCCC to date vary in terms of scope (adaptation, mitigation, support)<sup>11</sup>, sectoral coverage (economy-wide or sector-specific), targets (qualitative and/or quantitative)<sup>12</sup> and level of detail (general principles and/or specific measures and policies).<sup>13</sup> Long-term strategies and/or goals developed outside of the UNFCCC context present similar variance (Box 1). Importantly, Article 4.13 of the Paris Agreement requires (“shall”) Parties to

<sup>11</sup> Most NDCs include both mitigation and adaptation. Several developing countries’ NDCs include support.

<sup>12</sup> Only 15 countries do not include a quantitative mitigation target (IGES, 2019<sup>[31]</sup>).

<sup>13</sup> See (Rocha and Falduto, 2019<sup>[14]</sup>), (Vaidyula and Rocha, 2018<sup>[97]</sup>) and (Hood and Soo, 2017<sup>[98]</sup>) for further analysis.

account for their NDCs (Paris Agreement, 2015<sup>[2]</sup>). The Paris decision further ensures that, *inter alia*, Parties account for anthropogenic emissions and removals in accordance with IPCC methodologies and common metrics. Accounting for NDC mitigation targets can help Parties better understand progress towards their achievement (Vaidyula and Hood, 2018<sup>[28]</sup>). On the other hand, accounting for LT-LEDS targets is not stipulated for neither in the Paris Agreement nor in its accompanying decision.

Long-term climate strategies and/or goals and NDCs differ from each other in terms of the time horizon of the targets and visions that they set.<sup>14</sup> While NDCs are to contain short- and mid-term climate change targets, long-term climate strategies allow countries to lay out a long-term, quantified climate change mitigation (and adaptation) goal and/or a long-term aspirational vision for low-emissions development. Notably, the Paris decision invites Parties to communicate *mid-century* LT-LEDS. As a result, almost all NDCs under Article 4 of the Paris Agreement set targets to 2025 or 2030, and the very large majority of the long-term strategies submitted to date set a vision to 2050 (Rocha and Falduto, 2019<sup>[14]</sup>). Some countries who have developed net-zero emissions plans outside of the UNFCCC context, including Norway, Uruguay and Finland, set targets to 2030 or 2035.

The Paris Agreement provides for NDCs to be part of an iterative process. Starting in 2020, Parties “shall prepare, communicate and maintain successive” NDCs (Paris Agreement, 2015<sup>[2]</sup>). Such NDCs shall be communicated every five years in accordance with decision 1/CP.21 (UNFCCC, 2016<sup>[25]</sup>).<sup>15</sup> According to the Paris Agreement, successive NDCs will represent a “progression beyond” a country’s current NDC and “reflect its highest possible ambition” (Paris Agreement, 2015<sup>[2]</sup>), potentially meaning increased ambition over time. A similar iterative process for LT-LEDS is not provided for in the UNFCCC context. In practice, however, LT-LEDS and other long-term strategies seem to be often understood to be “living” documents that are to be regularly updated and revised (WRI, 2019<sup>[29]</sup>; IDDRI, 2016<sup>[30]</sup>) (see Chapter 4). This is because it is useful for these strategies to remain practical and up-to-date in light of changes in, *inter alia*, domestic policies, national and international socio-economic trends, international climate negotiations, progress in climate science and availability of new technologies (WRI, 2019<sup>[29]</sup>). Indeed, some countries that have submitted a long-term strategy to the UNFCCC indicate that they plan for their periodic revisions and update (Rocha and Falduto, 2019<sup>[14]</sup>).

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<sup>14</sup> Definitions of the time horizon that characterises short-, mid- and long-term policies and goals vary considerably in policy literature depending on context. For the purpose of this paper, which revolves around the linkages between NDCs and LT-LEDS, the authors refer to “long-term”, “mid-term” and “short-term” for policies that have a timeline of 30-50, 10-30 and 10-5 years, respectively.

<sup>15</sup> In particular, decision 1/CP.21 requests those Parties whose intended NDC contains a time frame up to 2025 to communicate by 2020 a new NDC, and requests those Parties whose NDC contains a time frame up to 2030 to communicate or update by 2020 their NDC (UNFCCC, 2016<sup>[25]</sup>).

**Table 1. Comparison of role and purpose of NDCs, LT-LEDS and other long-term strategies**

	Nationally Determined Contributions	Long-term Low Emission Development Strategies	Carbon or Climate Neutrality Strategies
Included in the Paris Agreement	Yes	Yes	No
Countries concerned	All Parties	All Parties and countries	Any country that wishes to develop a strategy
Binding nature	Mandatory (“shall”) for Parties to the Paris Agreement	Voluntary (“should strive to formulate”) for Parties to the Paris Agreement	Depending on national legislation
N° of submissions to UNFCCC (Feb 2020)	186 <sup>a</sup>	14	N/A
Guidance	Only limited broad UNFCCC guidance given nationally determined nature; Significant non-UNFCCC guidance	No UNFCCC guidance; Some non-UNFCCC guidance	Some non-UNFCCC guidance
Scope	Sector- and/or economy wide; Climate change mitigation and/or adaptation	Sector- and/or economy wide; Climate change mitigation/adaptation and other socio-economic areas	Sector- and/or economy-wide; Primarily climate change mitigation and other socio-economic areas.
Time horizon	Short- and mid-term (5-15 years from today <sup>b</sup> )	Mainly long-term (30-50 years from today)	Mainly long-term (30-50 years from today)

Note: (a) This number does not include re-submissions or Second NDCs. As of January 2020, 3 countries have submitted a Second NDC; (b) While almost all NDCs set targets to 2025 or 2030, some NDCs set targets to 2035 (e.g. Cameroon), or 2050<sup>16</sup> (e.g. Panama) (UNFCCC, 2020<sub>[16]</sub>; IGES, 2019<sub>[31]</sub>).

Source: Authors

## Aligning NDCs, LT-LEDS and mid-century carbon neutrality targets: Key messages and lessons learned

Aligning a country’s NDC to its long-term strategies and targets, from a climate mitigation perspective, means that the mitigation pathway envisaged by the NDC is consistent with the decarbonisation pathway identified in any national long-term strategy or with the pathways resulting from carbon neutrality. Ideally, the mitigation targets put forward by an NDC would be concrete milestones along the low-emissions pathway resulting from the long-term strategy (Rocha and Falduto, 2019<sub>[14]</sub>; WRI, 2019<sub>[11]</sub>). Long-term targets are increasingly being developed following a scientific/modelling exercise. Such an exercise can enhance understanding of the technological and policy options needed to achieve the target as well as economic uncertainties in the long-run. This modelling exercise may also provide valuable information on the short- and mid-term options and uncertainties, which can support the NDC formulation process. Benefits to an individual country of long- and short-term targets include increasing the perceived certainty in plans for achieving the needed emissions reduction, thus encouraging climate action, and potentially enhancing investment opportunities.

Recent CCXG analysis (Rocha and Falduto, 2019<sub>[14]</sub>) on LT-LEDS finds that more than half of the LT-LEDS submitted by October 2019 do not contain any explicit linkages to the country or region’s NDC. Table 2 provides a more detailed analysis on countries’ current experience with NDC and LT-LEDS alignment. Importantly, the analysis does not take into consideration new and more ambitious long-term mitigation targets that countries have put forward in recent months, if these are not reflected in the LT-LEDS. This is for example the case of France, Germany and the United Kingdoms, whose governments

<sup>16</sup> This is no longer in line Decision 6/CMA.1, which states that “Parties shall apply common time frames to their nationally determined contributions to be implemented from 2031 onward” (UNFCCC, 2019<sub>[101]</sub>).

have recently put forward carbon or climate neutrality commitments, whereas the LT-LEDS –published beforehand– set a less ambitious long-term goal.<sup>17</sup> Limited alignment between NDCs and LT-LEDS in some cases may not be surprising considering that virtually all long-term strategies and carbon neutrality targets were communicated after the country’s first NDC was submitted. The potential lack of a long-term plan for decarbonisation at the time of the first NDC submission may have resulted in the establishment of short-term targets that are not truly reflective of the steps needed to achieve decarbonisation. Other reasons beyond timing could also render the linkage/alignment between the two instruments difficult. These could be due to, for example, the lack of experience and limited technical capacity in the development of the first NDCs, un-coordinated institutional arrangements, lower public pressure on the urgency of decarbonisation and scarce analysis on the interactions between long-term goals and short-term action, among others.

The alignment of short- and long-term targets could be expected to improve over time, as countries acquire experience in developing and communicating NDCs and long-term strategies. In fact, some of the countries that have revised their NDCs after having communicated a LT-LEDS or that have submitted a new or updated NDC after the LT-LEDS submission show improved alignment between the two instruments. In addition, some countries have recognised the need for stronger and more explicit alignment between their LT-LEDS and their NDC. A few examples include:

- Canada’s First NDC (submitted in October 2016 as a carbon copy of the country’s INDC developed in 2015) shows only partial alignment with the policies and measures contained in its LT-LEDS (submitted in November 2016) (Government of Canada, 2016<sup>[32]</sup>; Government of Canada, 2016<sup>[33]</sup>). Canada’s revised submission of its First NDC (submitted in May 2017), instead, shows greater alignment of the two instruments (Government of Canada, 2017<sup>[34]</sup>). The revised NDC lays out policies that are more detailed and both documents refer to the Pan-Canadian Framework (PCF), which outlines the actions that are to be implemented in order to achieve the 2030 target and Canada’s LT-LEDS is intended to inform the PCF. In addition, both the LT-LEDS and the NDC present a stronger focus on short-lived climate pollutants.
- The LT-LEDS of the Marshall Islands explicitly recommends for the country’s new NDC to commit to a quantified economy-wide target to reduce GHG emissions by at least 45% below 2010 levels by 2030 (Government of the Marshall Islands, 2018<sup>[35]</sup>). This recommendation has indeed been taken up by the country’s Second NDC (Government of the Marshall Islands, 2018<sup>[36]</sup>).
- Costa Rica’s LT-LEDS acknowledges that “organizing and implementing the next versions of the NDCs will require a strong planning effort, as part of a long-term strategy” of which the LT-LEDS is the first pillar (Government of Costa Rica, 2019<sup>[37]</sup>).

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<sup>17</sup> All these government have nonetheless communicated their intention to regularly review and revise their long-term strategies.

Table 2. Current experience: NDC and LT-LEDS alignment of submitted documents

Country	Date of NDC submission	Date of LT-LEDS communication	Aligned / linked elements	Description
Benin	10/2017	12/2016	Targets (partial) Policies and measures	The LT-LEDS sets a 2025 target, whereas the NDC sets a 2030 target. The LT-LEDS states that the main expected outcome of the implementation of the programmes laid out in the strategy is the achievement of GHG reductions at least up to the level committed in the country's NDC. Both the NDC and the LT-LEDS identify similar sectoral priorities and actions; for example, both documents prioritise actions in agriculture and forestry. The NDC provides more details on expected outcomes of such actions (e.g. in terms of emissions reductions) and also includes targets for most actions. (Government of Benin, 2017 <sup>[38]</sup> ; Government of Benin, 2016 <sup>[39]</sup> )
Canada	05/2017 <sup>a</sup>	11/2016	Targets Policies and measures (partial)	The LT-LEDS does not make any explicit reference to the country's NDC. The LT-LEDS sets a milestone target that coincides with that set by the NDC (30% reduction in GHG emissions by 2030 compared to 2005 levels). Compared to the NDC, the LT-LEDS presents models and projections that are more sophisticated. In terms of policies and measures, both documents make reference to the Pan-Canadian Framework (PCF), which lays out actions needed to reach the 2030 target. The LT-LEDS is intended to inform the PCF. (Government of Canada, 2017 <sup>[34]</sup> ; Government of Canada, 2016 <sup>[33]</sup> )
Costa Rica	10/2016	12/2019	Targets (partial) Policies and measures (partial) Governance	Aligned elements of the country's LT-LEDS and its NDC include targets for emissions reductions and some policy priorities. The same Ministry and Directorate have led the preparation of both the LT-LEDS and the NDC. Compared to the NDC, the LT-LEDS lays out targets that are more ambitious for the same timescale, has a wider sectoral scope, presents models and projections that are that are more sophisticated and proposes detailed policy packages. The LT-LEDS recognises the importance of alignment with the country's NDC. The LT-LEDS is expected to provide crucial guidance to development of Second NDC, and LT-LEDS/NDC alignment is expected to improve significantly. (Government of Costa Rica, 2015 <sup>[40]</sup> ; Government of Costa Rica, 2019 <sup>[37]</sup> )
Czech Republic <sup>b</sup>	10/2016	01/2018	NA <sup>b</sup>	The LT-LEDS takes into consideration the joint, EU-wide mitigation target and lays out more ambitious targets for the same timescale. The LT-LEDS presents some indicative policy measures to be implemented by 2030. (European Commission, 2015 <sup>[41]</sup> ; Government of the Czech Republic, 2017 <sup>[42]</sup> )
European Union	10/2016	03/220	NA	The LT-LEDS document submitted by the European Union to the UNFCCC does not lay out a strategy for decarbonisation. Rather, the document recalls the Conclusions of the European Council of 12 December 2019, which state that the European Council "endorses the objective of achieving a climate-neutral EU by 2050". The document also states that "The European Council invites the Commission to prepare a proposal for the EU's long-term strategy as early as possible in 2020 with a view to its adoption by the Council and its submission to the UNFCCC". (European Commission, 2020 <sup>[18]</sup> )
Fiji	04/2016	02/2019	Targets Policies and measures Governance	The LT-LEDS is intended to inform the development and implementation of future NDCs. The emissions reduction targets and other types of quantitative targets included in the NDC are aligned with the targets set by the LT-LEDS. Compared to the NDC, the LT-LEDS set longer-term targets, presents models and projections that are more sophisticated and has a broader sectoral scope. Both the NDC and the LT-LEDS are aligned to existing strategic frameworks such as the Green Growth Framework. The review cycles of the NDC and LT-LEDS are co-ordinated. (Government of Fiji, 2016 <sup>[43]</sup> ; Government of Fiji, 2018 <sup>[44]</sup> )

Country	Date of NDC submission	Date of LT-LEDS communication	Aligned / linked elements	Description
France <sup>b</sup>	10/2016	04/2017	NA <sup>b</sup>	The LT-LEDS identifies three carbon budgets for 2015-2018, 2019-2023 and 2024-2028, respectively. The levels of the second and third carbon budget take into account the objective adopted for 2030 that is included in EU's NDC (40% reduction by 2030 compared to 1990 levels). The strategy and the carbon budgets do not yet take into account EU's 2018 Effort Sharing Decision. The LT-LEDS identifies one main scenario that is consistent with the long-term goal of reducing economy-wide GHG emissions by 75% by 2050, compared to 1990 levels. The LT-LEDS outlines numerous policy recommendations to achieve mitigation outcomes across different sectors, and makes reference to existing sectoral plans. (European Commission, 2015 <sup>[41]</sup> ; Government of France, 2017 <sup>[45]</sup> )
Germany <sup>b</sup>	10/2016	05/2017	NA <sup>b</sup>	The LT-LEDS does not make any explicit reference to the EU-wide NDC. The LT-LEDS aims to a 80-95% reduction in GHG emissions by 2050 compared to 1990 levels, and sets a milestone target of reducing GHG emissions by 55% by 2030, compared to 1990 levels. The LT-LEDS includes sectoral guidelines and key options for long-term decarbonisation. (European Commission, 2015 <sup>[41]</sup> ; Government of Germany, 2016 <sup>[46]</sup> )
Japan	11/2016	06/2019	Policies and measures (partial)	The LT-LEDS does not make any explicit reference to the country's NDC. The emissions reduction target set by the NDC is not mentioned in the LT-LEDS. Both the NDC and the LT-LEDS provide relatively detailed policy and measures to be implemented in different sectors. (Government of Japan, 2016 <sup>[47]</sup> ; Government of Japan, 2019 <sup>[48]</sup> )
Mexico	09/2016	11/2016	Targets	The LT-LEDS presents two different policy scenarios that would allow the country to meet its long-term mitigation goal of reducing GHG emissions by 50% from 2000 to 2050. The first scenario includes a 2030 milestone that is in line with the NDC's unconditional target. The second scenario includes a 2030 milestone that is more ambitious than the NDC's conditional target. For each scenario, the LT-LEDS outlines detailed lines of action. Both documents tackle all sectors of the economy and place particular importance on short-lived climate pollutants. (Government of Mexico, 2016 <sup>[49]</sup> ; Government of Mexico, 2016 <sup>[50]</sup> )
Portugal <sup>b</sup>	10/2016	09/2019	NA <sup>b</sup>	The LT-LEDS includes the EU-wide NDC target and presents GHG scenarios that allow for GHG reductions that are more ambitious than what included in EU's NDC. The scenarios modelled in the LT-LEDS are based on a trajectory of emissions reductions of -45% to -55% by 2030, -65% to -75% by 2040 and -85% to -90% by 2050, compared to 2005. (European Commission, 2015 <sup>[41]</sup> ; Government of Portugal, 2019 <sup>[51]</sup> )
Republic of the Marshall Islands	11/2018 <sup>c</sup>	09/2018	Targets Policies and measures	The country's NDC is explicitly mentioned in the LT-LEDS. The LT-LEDS sets a pathway for carbon neutrality by 2050 and includes milestone targets to 2025 and 2030 that coincide with those put forward in the NDC. The LT-LEDS makes a recommendation for the country's Second NDC target for 2035. The NDC and the LT-LEDS identify the same key sectoral priorities for decarbonisation, namely power generation, transport, cooking and lighting and waste. (Government of the Marshall Islands, 2018 <sup>[36]</sup> ; Government of the Marshall Islands, 2018 <sup>[35]</sup> )
Singapore	09/2016 (First NDC) 03/2020 (NDC update)	03/2020	Targets Policies and measures Governance	The country's LT-LEDS sets a long-term goal to halve emissions from its peak to 33MtCO <sub>2</sub> by 2050, building upon the target set by the country's updated NDC, which aims to peak emissions at 65 MtCO <sub>2</sub> by 2030. The implementation plans of the country's updated NDC are developed and expanded in existing national development plans and strategy documents. These resources are also integrated in the country's LT-LEDS. Both the NDC and the LT-LEDS processes are co-ordinated by the Inter-ministerial Committee on Climate Change. (Government of Singapore, 2016 <sup>[52]</sup> ; Government of Singapore, 2020 <sup>[53]</sup> ; Government of Singapore, 2020 <sup>[54]</sup> )

Country	Date of NDC submission	Date of LT-LEDS communication	Aligned / linked elements	Description
Slovakia <sup>b</sup>	10/2016	03/2020	NA <sup>b</sup>	The country's LT-LEDS explicitly references the EU-wide NDC target and lays out two additional 2030 targets that are more ambitious than what include in EU's NDC. These targets are based on the two different emission scenarios analysed in the document and aim respectively at a 41% and 47% reduction in GHG emissions by 2030, compared to 1990 levels. The LT-LEDS includes additional milestone targets for emissions in the ETS sector, share of renewable energies, and energy efficiency. These targets are based on other EU-wide targets contained in various EU regulations. The LT-LEDS focuses on a vision to 2030 and does not set any milestones to 2040. The LT-LEDS also sets as an indicative 2050 goal that of achieving climate neutrality. (Government of Slovakia, 2020 <sup>[55]</sup> ; European Commission, 2015 <sup>[41]</sup> )
Ukraine	09/2016	07/2018	Targets (partial)	The LT-LEDS does not make any explicit reference to the country's NDC. The NDC indicates, as next steps, the development of a long-term strategy. The Energy and IPPU emissions reductions targets set by the LT-LEDS are compatible with those set by the NDC. Compared to the NDC, the LT-LEDS lays out targets that are more ambitious, has a wider sectoral scope, presents projections and proposes relatively detailed policy packages. It is not clear whether the LT-LEDS will feed into the country's next NDC. (Government of Ukraine, 2016 <sup>[56]</sup> ; Government of Ukraine, 2017 <sup>[57]</sup> )
United Kingdom <sup>b</sup>	11/2016	04/2018	NA <sup>b</sup>	The LT-LEDS does not make any explicit reference to the EU-wide NDC. The LT-LEDS illustrates the five carbon budgets set by the 2008 Climate Change Act. These carbon budgets are caps on the greenhouse gas emissions that can be emitted across the UK over a 5-year period. The fifth carbon budget requires a 57% average reduction in emissions over 2028-32 across the UK compared to a 1990 baseline, representing a more ambitious target compared to the EU-wide emissions reduction target of 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990, to be fulfilled jointly. (European Commission, 2015 <sup>[41]</sup> ; Government of the United Kingdom, 2017 <sup>[58]</sup> )
United States	09/2016	11/2016	Targets	The country's LT-LEDS was developed ahead of the NDC and does not make any explicit reference to it. Nevertheless, the LT-LEDS includes a 2025 milestone mitigation target that coincides with the target put forward by the NDC (25-28% reduction in GHG emissions compared to 2005 levels). Importantly, the country's LT-LEDS ("United States Mid-Century Strategy for Deep Decarbonization") was released in 2016 by a previous administration and is no longer being implemented by the United States. (Government of the United States, 2016 <sup>[59]</sup> ; Government of the United States, 2016 <sup>[60]</sup> )

## Notes:

(a) Canada's First NDC was originally submitted in 10/2016; a revision was submitted in 05/2017. This analysis considers the revision only;

(b) Member State of the European Union. The NDC of the EU and its Member States sets a joint mitigation target and does not contain any country-specific indications or details on e.g. national targets, policy and measures, governance. Therefore, for these countries the degree of alignment LT-LEDS/NDC and aligned elements are not analysed (NA);

(c) The Republic of the Marshall Islands has submitted a First NDC in 04/2016 and a Second NDC in 11/2018. This analysis considers the Second NDC only;

Source: Authors

# 3 How can a long-term vision shape short- and mid-term action?

Long-term strategies can support NDCs by providing an economy-wide vision for long-term decarbonisation, capable of capturing the long-term infrastructural transformations needed to reduce emissions. In addition, a long-term vision for decarbonisation can promote fiscal, legal and regulatory certainty. As a result, LT-LEDS may be useful to support buy-in, attract private and other relevant stakeholders and encourage enhanced climate action (Rocha and Falduto, 2019<sup>[14]</sup>). Foreseeing a long-term target and planning its achievement will allow policymakers to design policy mixes and deploy technologies in an optimal, cost-effective manner. This section will (i) explore why a long-term vision is crucial for shaping effective short-term policy-making, and (ii) provide concrete examples on how long-term targets and strategies can influence or guide short-term action.

## A long-term perspective for cost-effective short- and mid-term action

Aligning short-term policies, such as those contained in NDCs, to a long-term objective or vision makes economic sense and is fundamental for effective policy-making, i.e. policy-making that is cost-optimal and sustainable, including in terms of sustainable infrastructure needs. Long-term goals have in fact a significant influence over the choice of cost-optimal mitigation measures needed to achieve a short-term target (Vogt-Schilb and Hallegatte, 2014<sup>[8]</sup>; del Río González, 2008<sup>[9]</sup>; Fabert and Foussard, 2016<sup>[12]</sup>). As a result, aligning shorter-term action to long-term goals may lead to emissions abatements up to four times cheaper than abatement measures implemented without a longer-term perspective (Vogt-Schilb and Hallegatte, 2014<sup>[8]</sup>). There are at least three main reasons that justify the adoption of a long-term perspective for short- and mid-term action.

Firstly, adopting only a short-term perspective to climate policy planning may bias decision makers' preferences towards policies and measures with immediate mitigation effects, overlooking the measures that are needed to unlock long-term mitigation opportunities. This will leave the economy ill-prepared for a sustained longer-term transformation (IEA, 2017<sup>[10]</sup>). Climate policies and measures are needed both to realise immediate GHG emission reductions (e.g. incentives for enhanced energy efficiency), and to lay the foundations for a longer-term transition (e.g. investments in RD&D for offshore wind). Yet, strong preference for incentive-based mitigation policies with a short-term effect (e.g. carbon taxes and carbon pricing) can indeed result in greater adoption of lowest-cost abatement technologies in the short-term, but will not lead to the diffusion of more expensive technologies, with a higher abatement potential (del Río González, 2008<sup>[9]</sup>). Incentivising the large-scale deployment of such technologies is particularly important as it is a necessary condition to reduce their costs in the long-term. In addition, adopting a preferred policy instrument without taking into consideration its long-term effects is unlikely to lead to transformational change. For example, carbon pricing, which is meant to act as a signal across the economy, is not sufficient alone to promote transformational change, as it leads at best to incremental improvements of performance towards the best available technologies (Lo Re et al., 2019<sup>[61]</sup>). Long-term planning is therefore key for the development and long-term, large-scale deployment of technologies and systems such as Carbon Capture, Utilisation and Storage (CCUS).

Secondly, the lack of a long-term perspective when formulating policy packages in the short-term may also significantly increase associated risks of carbon lock-in, whereby past or current policy and/or investment decisions impact future levels of GHG emissions, making it more difficult to achieve more ambitious climate mitigation objectives. Carbon lock-in is strongly related to costly risks of stranded assets, i.e. assets that suffer from premature reductions in value and use, representing a major loss for public and private investors. Examples of carbon lock-in include short-term policies and measures that promote new gas infrastructure in a country, or that involve investing in highways rather than rail, or airports rather than high speed rail. Carbon lock-in will have a significant economic impact on public and private balance sheets. IRENA estimates that USD 20 trillion would be stranded globally if appropriate and early action to prevent carbon lock-in is not undertaken in the energy, building and industry sectors (IRENA, 2017<sup>[62]</sup>).

Thirdly, from an international perspective, long-term strategies are useful to indicate countries' possible need for international carbon offsets to achieve their domestic mitigation targets (see Box 2). Long-term planning is crucial when assessing the feasibility of reductions in domestic emissions. Emissions from certain sectors, such as those from the cement production process or aviation, might be very challenging to abate from both a technical and financial perspective (IEA, 2019<sup>[63]</sup>; IEA, 2019<sup>[64]</sup>). One of the options available to further reduce the accounting of any potential residual GHG emissions is to purchase international carbon credits that correspond to emissions that have been reduced by another country.

## Box 2. The role of international carbon markets in long-term strategies and the importance of short- and mid-term planning

International carbon markets offer countries the opportunity to purchase credits that correspond to emissions that have been reduced elsewhere. Some NDCs, LT-LEDS and net-zero emission target (NZET) national plans mention whether the Party intends to use international carbon markets to achieve their goals. For example, 17 NDCs (including those of the European Union and the United States) explicitly exclude the contribution of international carbon market mechanisms to meet their targets. Conversely, 23 clarify they will need international carbon market mechanisms to meet the NDC mitigation target, while 75 indicate some level of intention or option to use international carbon markets (DIE, ACTS and SEI, 2016<sup>[65]</sup>). Around 50 NDCs (25% of total) do not specify the intention to use or not international market mechanisms. Only two LT-LEDS (Marshall Islands and Portugal) and two NZET plans (France and Spain) clearly exclude the use of international carbon market mechanisms to reach their goals, while only three other countries (Norway, Sweden, and the United Kingdom) have instead specified the need to use them (see Annex B). The majority of countries that communicated LT-LEDS or NZET plans (in law or in proposed legislation) to date do not specify whether they intend to use international carbon markets.

The use of international carbon markets to achieve goals within long-term strategies could entail four main risks. First, if countries end up needing international carbon credits without having planned for this – or having underestimated their need – this could potentially result in unplanned extra costs to achieve their mitigation goals. However, planning for the use credits is a difficult exercise, given uncertainty related to the availability and cost of future carbon credits. Second, if many countries would simultaneously find themselves in an unplanned need to acquire international carbon credits, there might be a potential lack of global supply of such credits. For instance, the Clean Development Mechanism (CDM), one of the international carbon market mechanisms of the Kyoto Protocol, issued credits corresponding to 2 GtCO<sub>2</sub>e of GHG emission reduction, in around 15 years of activity (UNFCCC, 2020<sup>[66]</sup>). To provide sense of scale, the estimated emission gap by 2030 to stay within the 2°C limit is 12-15 GtCO<sub>2</sub>e and 29-32 GtCO<sub>2</sub>e for the 1.5°C limit (UNEP, 2019<sup>[4]</sup>). Third, as countries move towards decarbonisation to pursue the Paris Agreement temperature goals, there would be fewer and fewer mitigation opportunities to trade in international carbon markets (Kachi et al., 2019<sup>[67]</sup>). Therefore, unplanned overreliance on international carbon markets by many countries could risk creating a situation where potentially the available credit supply cannot not satisfy the demand. However, planning to use credits from international carbon markets in long-term strategies is a difficult exercise, given uncertainty related to the availability and cost of future carbon credits. Finally, overreliance on emission reductions from other countries to attain domestic mitigation goals could also potentially delay decisions for decarbonisation in the short- and mid-term, resulting in carbon lock-in and stranded assets.

Sweden's Climate Act and Climate Policy Framework is an example of an effort towards quantifying the need of international carbon markets to achieve its long-term goal. The Swedish Parliament adopted in 2017 a net-zero emission goal by 2045, which consists of a reduction of GHG emissions from activities in Swedish territory of 85% by 2045 compared with 1990 levels. Complementary measures, including credits from international carbon markets, will reduce the remaining 15% of GHGs (Government of Sweden, 2018<sup>[19]</sup>).

Source: Luca Lo Re (IEA)

## Concrete examples of long-term goals driving short-term action

Some countries are already adopting a long-term perspective to shape climate action in the short- and mid-term. Such an approach is not only being embodied in LT-LEDS, but also in other national strategies or studies that aim to explore the short- and long-term connection, for example by producing policy analysis that applies a long-term perspective to short-term policy decisions. This section highlights concrete examples of how long-term goals and strategies drive short-term action.

### **Long-term goals defining strategic areas for action in the short- and mid-term: The cases of France and New Zealand**

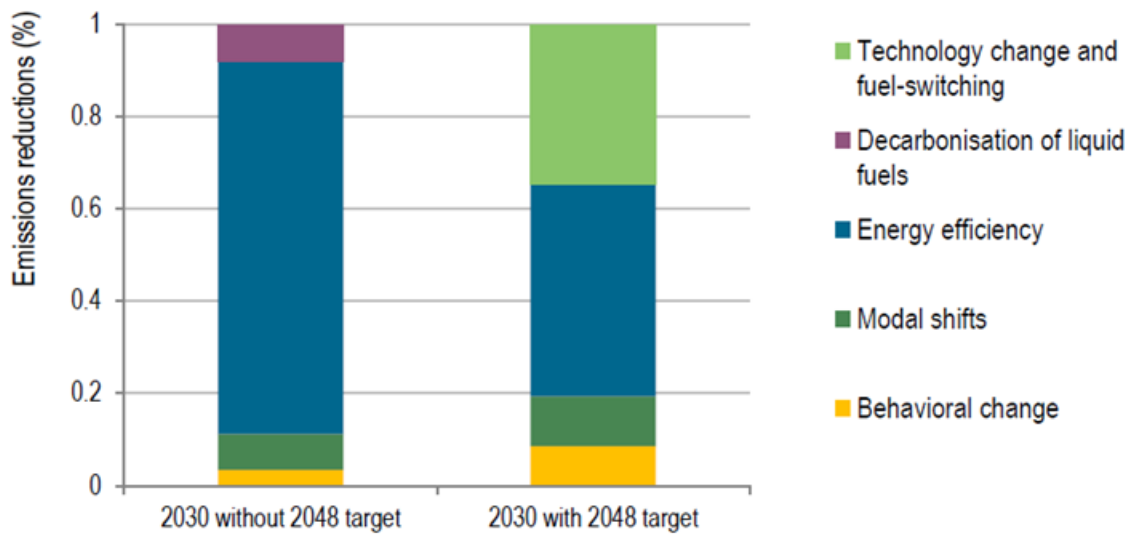
A study commissioned by the French government models two different policy mixes for reducing transport emissions by 2030 based on whether or not a 2048 target is taken into account (Fabert and Foussard, 2016<sup>[12]</sup>).<sup>18</sup> Optimisation of the 2030 target in the absence of a 2048 goal would entail a strong focus on policies promoting energy efficiency of existing vehicles, and insufficient policy focus on electric vehicles, which would otherwise be necessary to achieve the longer-term target. In fact, optimisation of the 2030 target policy pathway that also takes into account a 2048 target would include measures that encourage deployment of electric and hydrogen vehicles already ahead of 2030. The achievement of the 2030 target taking into consideration the 2048 target can lead to significant cost reductions in the long-term. In the absence of electric vehicle deployment ahead of 2030, post-2030 action to achieve a 2048 goal will require the mobilisation of other technologies that in this context are assessed as more expensive, such as metro and tramway.

Since the publication of the study in 2016, France has developed and communicated a LT-LEDS (2017) and has committed to a net-zero target (2019). In its LT-LEDS France aims to achieve, *inter alia*, a 65% reduction in GHG emissions (compared to 1990 levels) in the transport sector by 2050 and to reduce overall emissions by a factor of four (compared to 1990 levels) by 2050. To achieve such target, the policy proposals included in the LT-LEDS are in line with the 2016 study. In particular, the LT-LEDS mentions that the milestone target of 22% reduction in GHG emissions for 2023-2028 will be in line with the 2050 target if it takes into account the need of diversifying the energy mix of the transport sector. As a result, the LT-LEDS advises for the policies to be adopted to improve vehicle energy efficiency and to diversify the energy mix of vehicles (Government of France, 2017<sup>[68]</sup>). The 2019 target to achieve carbon neutrality by 2050 is more ambitious than the target included in the LT-LEDS but it does not yet provide a new target for the transport sector (Government of France, 2019<sup>[69]</sup>).

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<sup>18</sup> The 2048 objective is set at 42.5 MtCO<sub>2</sub>, or a 65% reduction in GHG emissions compared to 1990 levels. The 2030 target is set at 63 MtCO<sub>2</sub>.

**Figure 1. Policy mixes for French transport sector with and without consideration of a long-term objective**



Source: Taken from (IEA, 2017<sup>[10]</sup>), readapted from (Fabert and Foussard, 2016<sup>[12]</sup>)

Similarly, a study commissioned by the government of New Zealand on the country's scenarios to achieve domestic decarbonisation in the second half of the century shows the importance of early action on land use (Vivid Economics, 2017<sup>[70]</sup>). The study models four different scenarios for domestic decarbonisation, representing four different levels of ambition. A scenario without significant changes in land-use patterns does not allow New Zealand to achieve net-zero CO<sub>2</sub> emissions by 2050, nor does it allow the country to be on track for a net-zero trajectory to 2100. In fact, although further opportunities for emissions reductions beyond 2050 are possible, lack of early action in land use will keep the country well above net-zero to 2100. Since the publication of the study in 2017, New Zealand has legislated an emissions reduction target that requires all greenhouse gas emissions (except biogenic methane)<sup>19</sup> to reach net-zero by 2050 and for biogenic methane to be reduced to 24-47 per cent below 2017 levels by 2050 (Government of New Zealand, 2019<sup>[71]</sup>).

### ***Providing strong political signal and support for action in the short- and mid-term: the cases of the United Kingdom and of Sweden***

In 2008, the United Kingdom adopted the Climate Change Act, with the purpose of formalising the country's strategy to tackle climate change (Government of the United Kingdom, 2019<sup>[72]</sup>). The 2008 Climate Change Act has maintained cross-party consensus, ensuring a stable direction of travel towards the long-term goal separately from political fluctuations (Committee on Climate Change, 2020<sup>[73]</sup>). The Climate Change Act establishes, inter alia, five successive carbon budgets, which currently run until 2032. The carbon budgets cap the GHG emissions that can be emitted across the United Kingdom over a period of five years, and are meant to place the country on a pathway for the achievement of carbon neutrality by 2050. The United Kingdom is currently working to meet its third carbon budget, set for the period 2018 to 2022. According to the Climate Change Act, carbon budgets are to be set at least 12 years ahead of their implementation

<sup>19</sup> Biogenic methane is produced from biological sources such as plants and animals. It is primarily emitted by livestock, waste treatment and wetlands.

cycle, and a sixth carbon budget is expected to be set by the end of 2020, following the recommendation of the Committee on Climate Change (CCC)<sup>20</sup> to be published in September 2020. The United Kingdom's approach of setting successive carbon budgets allows the country to allow for flexibility and innovation in the long-term, while providing defined guidance in the short- and mid-term.

The carbon budgets of the Climate Change Act have fed into the country's LT-LEDS. The strategy, which sets a vision for 2050, lays out a defined pathway only up to 2032 (Government of the United Kingdom, 2017<sup>[58]</sup>; OECD, 2020<sup>[15]</sup>). Beyond 2032, the strategy identifies three different pathways that allow for the 2050 target to be reached: an electrification pathway, a hydrogen pathway and an emissions removal pathway. These pathways are modelled based on extreme assumptions. For example, the electrification pathway assumes the achievement of a 100% share of electric cars by 2050. Through this approach, the United Kingdom is able to identify key needs, opportunities and challenges for each pathway. The approach is meant to provide a better understanding of the different policy and economic implications of the three proposed pathways, and does not exclude that the way forward may be a combination of the three. Importantly, this exercise results in the identification of concrete short-term actions that would be needed for the implementation of any of these three different pathways. Such actions include improved energy efficiency of buildings, efforts to decarbonise electricity and increasing the fleet of electric vehicles. Such actions are "no-regret policy options", i.e. measures that are cost-effective and that do not lead to any major trade-offs in other areas. Importantly, since the publication of the LT-LEDS in 2017, the United Kingdom has adopted a carbon neutrality target by 2050. Ahead of the adoption of the target, the country's CCC has published a Net-zero Technical Report, which identifies further options to be in line with the new target (Committee on Climate Change, 2019<sup>[74]</sup>)

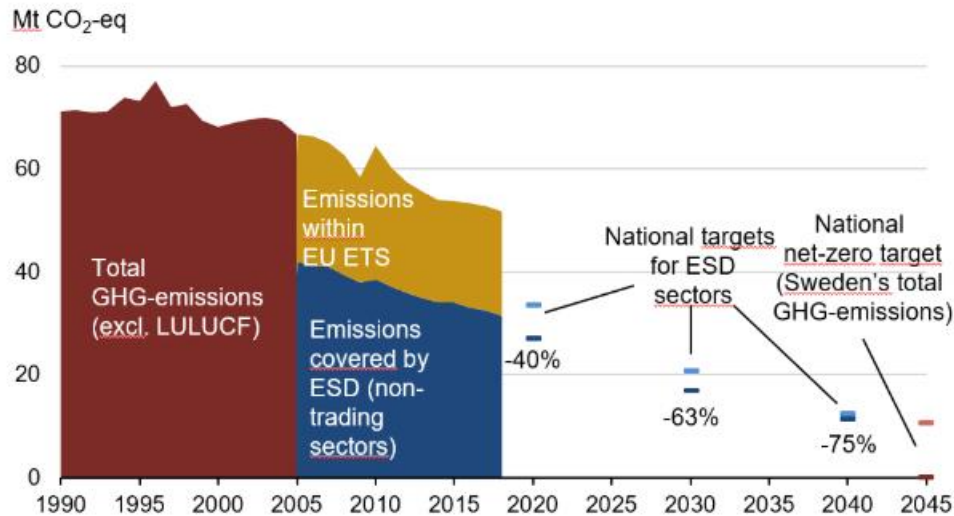
In 2017, Sweden adopted a new Climate Policy Framework, with the main purpose of sending signals to market and other actors on the opportunities of a low-carbon transition (Government of Sweden, 2019<sup>[75]</sup>). One of the strengths of the Swedish Climate Policy Framework is that it has been adopted by the Parliament and by the broad majority of political parties (seven out of eight Swedish parties), meaning that the framework is very likely to withstand political shifts. At the heart of the framework is Sweden's long-term target to have zero net greenhouse gas emissions by 2045 at the latest<sup>21</sup>. Sweden's long-term target constitutes the endpoint of a trajectory on which milestone targets are set (Figure 2). The Climate Act, which entered into force in January 2018, requires the Government to: (i) present a climate report in its Budget Bill each year; (ii) formulate a climate action policy plan every four years describing how the milestone targets can be achieved; and (iii) ensure that climate policy and budget policy goals work together. Such a step-by-step approach to achieving the long-term target is beneficial to take into account recurrent changes in e.g. market opportunities, technological solutions, political momentum, which can greatly influence the choice of policies and actions in the nearer term.

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<sup>20</sup> The Committee on Climate Change (CCC) is an independent and statutory body established by the 2008 Climate Change Act. The purpose of the CCC is that of providing advice to the United Kingdom's government on setting and meeting carbon budgets. The CCC is also tasked with conducting independent analysis on climate change science, economics and policy (Government of the United Kingdom, 2019<sup>[72]</sup>) (Committee on Climate Change, 2020<sup>[99]</sup>)

<sup>21</sup> This target corresponds to an effective 85% reduction below 1990 emissions levels, with further reductions being achieved through "supplementary measures".

Figure 2. Sweden's trajectory to net-zero greenhouse gas emissions



Notes: National targets for non-trading sectors are depicted in blue for 2020, 2030 and 2040. The Swedish Climate Change Act notes that parts of the 2030 and 2040 targets can be reached by carbon sinks or by mitigation outside of Swedish territory. At the most, 8 percent of the 2030 target and 2 percent of the 2040 target can be reached by such measures.

Source: Naturvårdsverket (Government of Sweden, 2019<sup>[75]</sup>)

### Acting today to unlock mitigation opportunities in the long-term: the case of China

Long-term strategies are useful to identify short- and mid-term actions needed to secure mitigation options in the long-term. For example, CCUS in combination with other mitigation technologies and practices can help to achieve emissions reductions in the industrial and power sectors (e.g. retrofitting coal-fired power plants<sup>22</sup> or high-carbon industrial facilities) in the long-term (IPCC, 2018<sup>[3]</sup>). Yet, financial, economic and institutional constraints today are a key challenge to the development of many future mitigation technologies, including CCUS. Short-term policies are fundamental to encourage development and large-scale deployment of e.g. CCUS in the long-term, allowing for future cost reductions up to 67% (Cornot-Gandolphe, 2019<sup>[76]</sup>).

The Chinese Roadmap for Carbon Capture and Storage Demonstration and Deployment tries to address this challenge by combining a longer-term perspective with practical short- and mid-term actions to kick-start CCUS, whose widespread commercial deployment may take at least 10-15 years (Asian Development Bank, 2015<sup>[77]</sup>). The strategy builds upon economic modelling to provide quantitative estimates for the need of CCUS in China's power sector up to 2050, with interim targets for 2020 and 2030. The strategy identifies three key phases and policy recommendations for each: the 13th Five-Year Plan period (short-term action), the expansion phase (mid-term action) and the commercialisation phase (long-term action). In the short-term, key measures include a strong focus on demonstration projects, favouring financial support for first-mover projects (e.g. providing tax credits to owners of CCS equipment), investments in RD&D (e.g. creating of a specialised public trust fund for CCS) and adopting CCS-Ready policies (e.g. including CCS-Ready assessments in new power plants feasibility studies). In the mid-term,

<sup>22</sup> Retrofitting with carbon capture, usage and storage (CCUS) could lead up to 99.7% of reductions in CO<sub>2</sub> emissions, implying investments of USD 1 billion per gigawatt. Retrofitting with biomass co-firing would lead to 5-20% reductions in CO<sub>2</sub> emissions, at a lower cost than CCUS (IEA, 2019<sup>[7]</sup>). In 2019, only two coal-fired power plants (in Canada and the United States) have been retrofitted with carbon capture. Six additional projects (4 in China and 2 in South Korea) are currently under development (Cornot-Gandolphe, 2019<sup>[76]</sup>).

key measures include a focus on commercialisation in order to drive down costs, enhancing support for the development of CO<sub>2</sub> pipeline infrastructure (e.g. via a public-private venture), continued support to RD&D to achieve cost reductions and strengthening governance of storage sites after closure. Without early action and correct sequencing of policies, as identified by the long-term strategy, CCUS might not be available at the scale needed to support China's climate goals.<sup>23</sup>

### ***Avoiding or reducing the risk of locking-in GHG emissions: The cases of Costa Rica and Ireland***

Costa Rica's LT-LEDS identifies potential risks of long-term lock-in for each one of the 10 sectors (or "axes") that are included in the strategy, and advises on policy options that can help avoid it (Government of Costa Rica, 2019<sup>[37]</sup>). Insights on carbon lock-in risks are meant to inform subsequent NDCs and short-term and mid-term action. For mobility, for instance, the LT-LEDS advises to "avoid investments in infrastructure that favour the use of private vehicles rather than public transport [...], and to "avoid the promotion and adoption of transport technologies called "transitional" that create barriers for the decarbonization of transport". Costa Rica is planning to refine the methodologies for identification of carbon lock-in through the use of consolidated dynamic models and a Robust Decision Making (RDM) methodology. RDM is a set of methodologies and tools that are designed to support decision making in the context of deep future uncertainties. RDM's methods and tools allow to design strategies capable of evolving over time as new information is available. In RDM, strategies are tested against different future scenarios to identify key vulnerabilities, whose effects are then studied and used to revise and improve current strategies (WRI, 2019<sup>[78]</sup>). Similarly, Ireland's Climate Action Plan to 2050, estimates that although natural gas might be the cheapest heating source up to 2030, short-term investments in natural gas for the building sector would inevitably lead to carbon lock-in, preventing the country from meeting the decarbonisation objective to 2050<sup>24</sup> (Government of Ireland, 2019<sup>[79]</sup>). As a result, the strategy advises for the sustained introduction of 600,000 renewable energy heating sources in residential buildings by 2030. In the case of Ireland's Plan, insights on carbon lock-in have been provided through the development of Marginal Abatement Cost Curves (MACC) for mitigation options to be implemented over the period 2021 to 2030.

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<sup>23</sup> CCUS has been included in China's 12<sup>th</sup> and 13<sup>th</sup> Five-Year plans as part of the country's climate mitigation strategy.

<sup>24</sup> The Climate Action Plan lays out a pathway to 2030 that is compatible with the indicative target of reaching net zero CO<sub>2</sub> emissions by 2050.

Table 3. Summary of analysed case studies

	Theme	Description
Decarbonising France's Transport Sector (Fabert and Foussard, 2016 <sup>[12]</sup> )	Helping define strategic areas where action in the short- and mid-term is crucial for achievement of long-term goals	France's policy mix needed to achieve a 2030 goal in the transport sector changes substantially if a 2048 goal is also taken into account. Without a 2048 goal, a 2030 goal can be reached by focusing on energy efficiency of existing vehicles. With the inclusion of a 2048 goal, optimal achievement of the 2030 goal would need to include deployment of electric and hydrogen vehicles already ahead of 2030.
Achieving net-zero in New Zealand (Vivid Economics, 2017 <sup>[70]</sup> )	Helping define strategic areas where action in the short- and mid-term is crucial for achievement of long-term goals	For New Zealand to be able to reach a net-zero trajectory by 2100, mitigation opportunities in the land use sector have to be unlocked already ahead of 2050. Without early action in land use, the country will remain well above the net-zero trajectory to 2100.
UK's Green Growth Strategy (Government of the United Kingdom, 2017 <sup>[58]</sup> )	Providing strong political signal and support for action in the short- and mid-term	The carbon budgets of the 2008 Climate Change Act have fed into the country's LT-LEDS. The strategy, which sets a vision for 2050, lays out a defined pathway only up to 2032. Accordingly, a long-term goal is set and mid-term targets to achieve it are defined progressively so to take into account recurrent changes such as availability of new technologies or market opportunities.
Sweden's new Climate Policy Framework (Government of Sweden, 2019 <sup>[75]</sup> )	Providing strong political signal and support for action in the short- and mid-term	Sweden's new Climate Policy Framework is meant to send policy signals to market and other stakeholders regarding decarbonisation opportunities. Sweden's Framework implies an incremental approach whereby the Government is required to prepare climate action policy plan every four years describing how the short- and mid-term targets (milestones) can be achieved. This approach is beneficial to take into account recurrent changes in e.g. market opportunities, technological solutions, political leaderships, which can greatly influence the choice of policies and actions in the nearer term.
Roadmap for Carbon Capture and Storage Demonstration and Deployment (Asian Development Bank, 2015 <sup>[77]</sup> )	Unlocking potential for future mitigation options	China has estimated that Carbon Capture, Usage and Storage (CCUS) technologies will be needed to achieve domestic decarbonisation of the power sector. The Chinese Roadmap for Carbon Capture and Storage Demonstration and Deployment lays out practical short- and mid-term actions to kick-start CCUS, whose widespread commercial deployment may take at least 10-15 years. Without early action and correct sequencing of policies, as identified by the long-term strategy, China may not be able to meet its CCUS goal in 2050.
Costa Rica's National Decarbonisation Plan (Government of Costa Rica, 2019 <sup>[37]</sup> )	Avoiding or reducing the risk of locking-in GHG emissions	Costa Rica's LT-LEDS identifies potential risks of long-term lock-in for each one of the 10 sectors (axes) that are included in the strategy, and advises strategies to avoid it. These insights are meant to inform subsequent NDCs and short-term and mid-term action.
Ireland's Climate Action Plan (Government of Ireland, 2019 <sup>[79]</sup> )	Avoiding or reducing the risk of locking-in GHG emissions	Ireland's Climate Action Plan to 2050, estimates that although gas might be the cheapest heating source up to 2030, short-term investments in gas for the building sector would inevitably lead to carbon lock-in, preventing the country from meeting the decarbonisation objective to 2050.

Source: Authors

# 4 Options for aligning LT-LEDS and/or other long-term goals and NDCs

While long-term goals and strategies can usefully shape short- and mid-term action, it is important for countries to consider how to operationalise the alignment between long-term strategies/goals and NDCs. Co-ordinated processes through shared institutional arrangements, common systems for monitoring and assessing progress and co-ordinated review and revision cycles are good practices for enhanced alignment. This section explores and provides options for enhancing NDC/LT-LEDS alignment. Importantly, the COVID-19 health crisis may delay some countries' efforts in developing a new or updated NDC or a long-term climate strategy. Yet, opportunities remain for countries to further explore NDC and LT-LEDS alignment.

## Good practices for operationalising alignment between NDCs and LT-LEDS and/or long-term goals

Co-ordinated processes for LT-LEDS and/or long-term goals and NDCs render long- and short-term alignment more effective, avoiding duplication of efforts and allowing for regular exchange of information between the two. LT-LEDS and NDCs can be aligned, inter alia, in terms of institutional arrangements, systems for monitoring and assessing progress, and revisions or review cycles.

### *Institutional arrangements*

In many countries, the development of long-term strategies and NDCs is being led by different institutions or teams. The work of these groups is not always co-ordinated, potentially rendering alignment between the two documents challenging (OECD, 2020<sup>[15]</sup>). Shared or co-ordinated institutional arrangements for LT-LEDS and NDC development can be a precondition for effective LT-LEDS and NDC alignment. Shared or co-ordinated LT-LEDS/NDC institutional arrangements can facilitate communication and exchange of critical information (e.g. data, projections, policy priorities) across teams and working groups, promoting the development of coherent and aligned policies and priorities for the short- and long-term (OECD, 2020<sup>[80]</sup>). Key practical advantages of establishing co-ordinated institutional arrangements include direct economic savings from simplified and streamlined administrative structures and facilitated co-ordination of common resources, such as personnel or modelling tools and datasets.

To operationalise effective co-ordination across different institutional arrangement and leadership from the top, a good starting point may be that of ensuring that both processes are initiated and supervised by the same lead institution (e.g. a specific ministry or an agency). This is for example what was done by Costa Rica or Singapore (WRI, 2019<sup>[1]</sup>; Government of Costa Rica, 2019<sup>[37]</sup>; Government of Singapore, 2020<sup>[54]</sup>). Moreover, for institutional arrangements to be effective, it is important that these are defined by clear roles and mandates, are guided by leadership from the top and that they ensure co-ordination at the horizontal (i.e. between different ministries) and vertical (i.e. between national and sub-national stakeholders) levels. Recent OECD analysis based on selected countries' experience highlights that establishing an inter-ministerial committee may be particularly beneficial in the context of climate change, as requires action

from different ministries (OECD, 2020<sup>[80]</sup>). LT-LEDS or other long-term strategies and NDCs could ideally rely on the same inter-ministerial committees and their associated personnel, lightening the burden on staff capacity (WRI, 2019<sup>[11]</sup>). If a whole-of-government approach is adopted, a common inter-ministerial committee may be in charge of fostering high-level discussions across different sectors to identify key priorities and areas of action for both the short- and the long-term. Indeed, countries with limited institutional and staff capacity may decide to repurpose the institutional arrangements established for developing the NDC in order to develop a long-term strategy, or vice versa (WRI, 2019<sup>[11]</sup>).

### ***Measurement, Reporting and Verification (MRV) and Monitoring and Evaluation (M&E) systems***

Monitoring progress and assessing results over time are important components for the successful and effective implementation of NDCs and LT-LEDS. Under the Paris Agreement and its accompanying decision, only NDCs require some form of MRV processes. Information that is requested or required from Parties to track progress made in implementing and achieving NDCs is outlined in the Modalities, Procedures and Guidelines (MPGs) of the Paris Agreement. On the contrary, measuring progress towards implementing and achievement of long-term strategies is not required nor requested neither in the Paris Agreement nor in any COP decision. Nevertheless, MRV and M&E systems are useful to assess the effectiveness of actions and are thus important to inform decision-making, both in the short- and in the long-term. MRV systems are useful to measure, inter alia, whether reductions in GHG emissions have taken place, and M&E systems can be useful to assess whether implemented policies have led to the outcomes desired. For these reasons, both MRV and M&E systems are particularly important in the context of review and revision cycles of both LT-LEDS and NDCs. Monitoring, measuring and evaluating progress of short-term action and NDC implementation can be useful to inform and re-adjust longer-term strategies.

In the context of NDCs and LT-LEDS alignment, it could be useful for countries to establish MRV and M&E arrangements that are common to both the NDC and the LT-LEDS. For example, MRV of NDC implementation can be also useful to assess progress towards the achievement of a longer-term mitigation goal set by the long-term strategy. In addition, MRV and M&E systems that are common to both the LT-LEDS and the NDC can also result in reduced costs and streamlined institutional structures, as they can rely on common personnel, data collection and management processes. In order to co-ordinate MRV and M&E systems of LT-LEDS and NDCs, it could be useful to identify key indicators that are common to both the NDC and the LT-LEDS. In particular, the long-term perspective of LT-LEDS can identify indicators for progress with emissions targets or other short-term policy goals; if these are off track, then this might trigger follow-up actions, or may call for adjustments to longer-term policy pathways (Haasnoot, van 't Klooster and van Alphen, 2018<sup>[81]</sup>). Indeed, the same level of detail for MRV and M&E may not be needed for both NDCs and LT-LEDS. This is partially due to the aforementioned differences in international reporting obligations, but also due to the differences in scope and timelines of LT-LEDS and NDC.

### ***Review and revision cycles***

Deep uncertainty related to long-term planning makes it challenging to identify today clear strategies and pathways to mid-century. Planning for the regular review and revision of long-term strategies is key to ensure that these documents remain strategic and relevant, and reflect the ever-changing national and international circumstances of countries, as well as latest economic trends (Rocha and Falduto, 2019<sup>[14]</sup>; WRI, 2019<sup>[29]</sup>; IDDRI, 2016<sup>[30]</sup>). Changes in technology costs and availability, new scientific insights and changing socio-economic trends can lead to the need for a substantial revision of long-term assumptions and objectives, along with policy pathways needed to achieve a long-term objective. For example, because of rapid cost declines in certain mitigation technologies, United Kingdom's estimate of the cost of achieving 80% reductions in GHG emissions by 2050, undertaken in 2008, are now equal to today's costs of achieving net-zero CO<sub>2</sub> emissions by 2050 (Committee on Climate Change, 2019<sup>[82]</sup>). Information

processed by MRV and M&E systems can also prompt the country to reconsider or adjust policies and strategies that are not having the desired outcomes.

Analysis of current experience shows that at least nine of the 17 Parties that have submitted a LT-LEDS by May 2020 have planned for its periodic revision, for example every 5 years. The revision may concern adjustments in terms of long-term targets or in terms of policies and priorities. Changes in long-term strategies can be used to provide useful and new inputs to NDCs and short-term actions. To co-ordinate this process, governments could decide to schedule for review and revision of long-term strategies and NDC development in a co-ordinated manner. For example, Fiji has planned the periodical review of its LT-LEDS to take place one year ahead of new NDC submissions (Government of Fiji, 2018<sup>[44]</sup>).

## Options for operationalising alignment in 2020 and beyond

Decision 1/CP.21 states that Parties “should strive to” communicate LT-LEDS by 2020. In addition, Parties with an NDC time frame up to 2025 are requested to communicate new NDCs, and Parties with a time frame up to 2030 are requested to communicate or update their NDCs by 2020.<sup>2526</sup> The upcoming months represent an important opportunity for countries to further explore and experiment with long- and short-term alignment. In addition, the experience gathered by countries in preparing and submitting the first round of NDCs may have helped identify further opportunities for short- and mid-term steps needed for the implementation of national objectives. The increased focus on carbon neutrality and scientific insights on long-term GHG trajectories needed to achieve the global 1.5°C temperature target of the Paris Agreement can strengthen the case for having long-term strategies that guide short-term action. This, in turn, could potentially create momentum for the development and submission of LT-LEDS in 2020 and beyond.

The 2020 COVID-19 health crisis may render it challenging for some countries to initiate a LT-LEDS process and/or to develop a new or updated NDC. This is because countries’ immediate response to the pandemic will likely result in redirecting efforts and resources to address the needs of national health systems. Moreover, the postponement of important international conferences and events on climate change, including that of COP26, may also contribute to delays in NDC and LT-LEDS processes. Finally, the logistical implication of the partial or total lockdown imposed by governments around the world may have a significant impact on staff capacity to implement these processes. Yet, the socio-economic benefits deriving from enhanced LT-LEDS/NDC alignment may render this exercise even more important in the upcoming months and years.

Importantly, countries’ responses to the COVID-19 crisis may have both short-lived and more long lasting impacts. Countries’ responses to COVID-19 pandemic has led to a sudden fall in greenhouse gas emissions worldwide, because of lockdown and confinement measures (IEA, 2020<sup>[83]</sup>). This directly affects short-term local and regional air pollution, but may not *per se* have long-lasting impact on the air pollution problem, let alone on climate. What path countries take to recover from the economic and social crises

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<sup>25</sup> Specifically, paragraph 23 of decision 1/CP.21 requests Parties whose NDC contains a time frame up to 2030 to communicate or update by 2020 their NDC, and requests Parties whose NDC contains a time frame up to 2025 to communicate by 2020 a new NDC. In addition, it invites Parties to communicate by 2020 to the UNFCCC mid-century, long-term low greenhouse gas emission development strategies. (UNFCCC, 2016<sup>[25]</sup>)

<sup>26</sup> While paragraph 23 of decision 1/CP.21 defines 2020 as a deadline for NDC communication and/or update, paragraph 25 of the same decision states that “Parties shall submit to the secretariat their nationally determined contributions referred to in Article 4 of the Agreement at least 9 to 12 months in advance of the relevant session of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement [CMA]”. Due to the 2020 COVID-19 health crisis, the relevant CMA session –scheduled to take place in 2020 in Glasgow—has now been postponed to 2021. It is therefore not clear whether this will have an impact on the submission deadline of upcoming NDCs.

triggered by governments' health response to the pandemic, however, will be crucial to the collective ability of countries to meet the goals of the Paris Agreement. It is therefore important that the recovery from the COVID-19 crisis does not jeopardise climate goals currently on the table. Moreover, if climate change becomes a central policy priority in countries' recoveries from the COVID-19 crisis, governments' recovery efforts over the coming months and years may also avoid repeated systemic crises in the long-term related to climate change and biodiversity loss.

As explored in this paper, LT-LEDS and/or other long-term goals could have an important impact in shaping short-term action. Whether a country has already submitted an LT-LEDS or put forward a carbon/climate neutrality goal may have significant consequences in their process of preparing a new or an updated NDC ahead of COP26. Those countries which will communicate a new or updated NDC in 2020 will find themselves in one of the three contexts (further analysed in Table 4, adapted from (WRI, 2019<sub>[11]</sub>)):

- **Countries that have already submitted a LT-LEDS and/or another long-term target** could consider how their long-term goal can shape short-term action in their new or updated NDC. Countries may wish to consider whether the long-term strategy's target or vision still reflects the country's highest possible ambition, or whether there is scope and political will for revision which will also potentially enhance the ambition of the NDC to be communicated in 2020. If the long-term strategy provides different pathways towards low-emission development based on current circumstances (e.g. technology availability and prices), countries could identify whether one of the proposed pathways is more feasible than others, or whether a combination of no-regret measures along the multiple pathways, could inform the process of formulating the new NDC. The development of a new or updated NDC can be the opportunity for a country to put in place institutional arrangements to link NDCs and LT-LEDS. For example, the NDC process could be supported by the same personnel involved in the development of the LT-LEDS. This is important because it allows to build upon existing skills and capacity (OECD, 2012<sub>[84]</sub>). Also, a common committee supervising both processes could be established, and models and assumptions used to develop the long-term strategy could be updated and re-used to set targets and objectives to be contained in the country's NDC.
- **Countries that are planning to prepare and submit both a new or updated NDC and a long-term strategy in 2020** will benefit from establishing a co-ordinated process across personnel, data and institutional arrangements involved. Ideally, countries could strive to arrange for the two processes to be undertaken in sequence, whereby a long-term strategy or target is set before developing a NDC. When this is not possible, it would be important to put in place a review system that monitors developments in either processes and that makes sure that key elements (e.g. targets and priorities) are aligned. Also in this case, personnel involved in the development of the NDC already submitted could be involved in both the LT-LEDS process and in the development of the new or updated NDC (WRI, 2019<sub>[11]</sub>). The development of a long-term strategy can also be an opportunity for countries to include other Ministries in the process (i.e. adopt a whole-of-government-approach) and gather an economy-wide view towards long-term decarbonisation.
- **Countries that are not planning to prepare a long-term strategy in 2020** but that will submit a new or updated NDC could plan short- and mid-term actions which avoid carbon lock-in. In the absence of a national strategy, these countries can use e.g. global/regional analyses and scenarios to get an understanding of what are key trends and issues that need to be considered when setting a 2030 target. For example, IPCC reports and/or the IEA World Energy Outlook provide useful information on global or regional pathways compatible with the goal of the Paris Agreement. In the absence of national target-setting exercises, the sectoral benchmarks provided by the IPCC SR 1.5°C could be used to sense check mid-term sectoral actions. If the country is planning to prepare a long-term strategy in the future, it could be useful to lay the ground and shape the institutional arrangements for the NDC preparation in a way such as to allow for a parallel process of long-

term-strategy development. Data and models used to prepare the NDC can be stored for easy access to support the potential development of an upcoming long-term strategy.

Despite potential increased efforts in linking long-term strategies and NDCs, reaching good levels of alignment between the two as early as 2020 may still be challenging. Beyond the challenges deriving from the 2020 COVID-19 health crisis, the development of LT-LEDS and other long-term strategies is voluntary, hence many countries may decide not to formulate and communicate long-term strategies this year. In addition, for those countries that will formulate a LT-LEDS, its development will be a first-time experience in most cases. Because of its technical challenges (e.g. availability of data, modelling capacities), planning and developing a long-term strategy is a steep learning curve, and successive iterations and revisions may be needed to fine-tune its content. Furthermore, given that countries have already developed a first NDC, the potential political inertia lying behind some of the NDC content may render alignment more challenging (WRI, 2019<sub>[1]</sub>). Finally, by the end of 2020 the implementation of all countries' NDCs communicated to date will be just about to start. Without first-hand experience in the key challenges linked to short-term implementation and early assessments on NDC-achievement, understanding the interplay between long-term targets and short-term actions will be difficult. It is also important to note that beyond technical and practical difficulties in aligning NDCs to long-term strategies and goals, some countries may see a benefit in deliberately maintaining the two documents separate. Because they are not tied to political cycles, long-term strategies in particular may allow countries to explore more ambitious and visionary goals (WRI, 2019<sub>[1]</sub>).

Table 4. Key questions for operationalising LT-LEDS / NDCs alignment in 2020

	Case 1: country already has a long-strategy	Case 2: Country is developing long-term strategy and NDC concomitantly in 2020	Case 3: country will develop NDC in the absence of a long-term strategy
Opportunities and priorities	The existing LT-LEDS, if up-to-date, can usefully inform the targets of the NDC. Key priorities identified by the LT-LEDS can inform NDC sectoral actions, when appropriate. Countries may decide to focus on strengthening institutional linkages between LT-LEDS and NDC arrangements, so to activate a cycle of mutual exchange of information.	Simultaneous development of LT-LEDS and NDC could be challenging in terms of capacity and resources. Ideally, priority would be to begin with the development of a LT-LEDS, that can thereafter inform the NDC. When this is not possible, it is important to ensure that co-ordinated institutional setups ensure continuous exchange of information between the two processes.	The NDC is not be guided by a long-term vision for low-emission development. For these countries, it would be important to consider how to best avoid lock-in carbon intensive technologies in short- and mid-term policies. When possible, it is useful to verify whether existing literature provides regional or sectoral benchmarks for emissions reductions that can be used to check the target of the NDC.
Key questions	<ul style="list-style-type: none"> <li>• Has the country put forward a carbon or climate neutrality target after the publication of the LT-LEDS? <ul style="list-style-type: none"> <li>○ If the target is not reflected in the LT-LEDS, is there sufficient time, capacity and political appetite to update the strategy?</li> </ul> </li> <li>• In the absence of a carbon or climate neutrality goal or target, does the long-term goal expressed in the LT-LEDS reflect the country's highest possible ambition? <ul style="list-style-type: none"> <li>○ If not, is there sufficient time, capacity and political appetite to revise the goal?</li> </ul> </li> <li>• Does the LT-LEDS include interim targets that correspond to the timelines of the NDC update? <ul style="list-style-type: none"> <li>○ Can these be included in the NDC?</li> </ul> </li> <li>• Does the LT-LEDS identify key priorities for the short- and mid-term? <ul style="list-style-type: none"> <li>○ Can these priorities be reflected in the NDC target?</li> </ul> </li> <li>• Is there already an institutional structure that can co-ordinate alignment between the two strategies? <ul style="list-style-type: none"> <li>○ If not, can this be developed? For example, can some of the LT-LEDS personnel be assigned to the NDC update?</li> </ul> </li> <li>• Are there any long-term indicators included in the long-term strategy that could be reflected in the country's NDC, when applicable?</li> </ul>	<ul style="list-style-type: none"> <li>• Will LT-LEDS and NDC be developed in parallel?</li> <li>• Is it possible to accommodate a sequential process that develops the LT-LEDS before the NDC? <ul style="list-style-type: none"> <li>○ If not, is it possible to set up a mechanism to review alignment periodically up to submission date?</li> </ul> </li> <li>• Does the country already have a national long-term climate mitigation goal that could be used as a starting point?</li> <li>• Does the country already have any national development and/or climate change strategies that could be used to inform the LT-LEDS?</li> <li>• What are common resources and elements (e.g. data collection, studies, modelling) that are needed for either document (e.g. studies commissioned by the French and New Zealand Government)?</li> <li>• Is there already an institutional structure that can co-ordinate the development of the two strategies? <ul style="list-style-type: none"> <li>○ If not, is it possible to set up a committee supervising the development of both strategies?</li> </ul> </li> <li>• What are the relevant ministries, agencies and other government actors in the country that should participate in the process?</li> <li>• What ministry or institution could take the lead in the development of the two documents?</li> </ul>	<ul style="list-style-type: none"> <li>• Is there another mid-term or long-term climate strategy that can be used to inform the NDC? <ul style="list-style-type: none"> <li>○ If so, does the goal / vision expressed reflect the country's highest possible ambition?</li> </ul> </li> <li>• Does the strategy include any milestone targets that could be used to inform the NDC?</li> <li>• Does the country have any long-term projections for GHG trajectories (e.g. official government documents or other scientific studies)? <ul style="list-style-type: none"> <li>○ Can milestone targets be derived from such trajectories?</li> </ul> </li> <li>• Are there any official or verified studies that assess key national or regional opportunities for long-term decarbonisation? <ul style="list-style-type: none"> <li>○ Do these studies include any targets or benchmarks that could be included in the country's NDC?</li> </ul> </li> <li>• Does the country have in place a system to store data for future use (e.g. for the development of a LT-LEDS or for the development of a successive NDC)?</li> </ul>

Source: Based on (WRI, 2019<sup>[11]</sup>) and further expanded by Authors

# Conclusions

This paper has highlighted the important role that long-term national strategies and/or goals for low-emission development can play in driving short-term action. This includes by providing critical information to shape and potentially enhance short-term action needed to implement and achieve Nationally Determined Contributions (NDCs). This, in turn, may help to close the current gap between expected GHG emissions resulting from countries' NDC and the GHG emission levels that are needed globally to be consistent with the long-term temperature goal of the Paris Agreement. This paper has also provided options for operationalising alignment between long-term strategies and shorter-term goals.

Countries can benefit in many different ways by aligning their short-term action to a longer-term vision or target. Long-term targets can help governments define countries' short- and mid-term priorities, policy packages, investment pipelines and mitigation options. Importantly, a long-term goal informing short- and mid-term action can significantly lower the cost of meeting such targets both in the short- and in the long-term. When long-term targets and goals are not considered when setting short or medium-term targets, policymakers may prioritise mitigation measures with immediate and/or low-cost mitigation effects. However, these measures are not necessarily the same as those needed to enable key mitigation opportunities for the longer-term. A longer-term perspective allows governments to consider possible long-term trends including e.g. availability and cost of technologies and systems, facilitating countries' ability to adopt measures that favour their large-scale deployment. Furthermore, implementing short-term measures with a long-term perspective reduces the risk of locking-in GHG-intensive infrastructure inconsistent with mid- and long-term infrastructural transformations needed to achieve sustained decarbonisation. Building upon these ideas, the concrete examples from seven countries' experiences highlighted in this paper show that:

- A long-term strategy can help define strategic areas where action in the short- and mid-term is crucial for the achievement of long-term goals. For example, for France's transport sector to achieve an agreed long-term target it is necessary to focus on fuel switching in the short-term. For New Zealand to achieve a low-emissions economy early action in land use is important.
- A long-term approach helps countries to sequence the short- and mid-term policies needed to fully develop and scale-up new technologies that may be needed in the future, such as Carbon Capture, Use and Storage (CCUS). For example, for CCUS to be available at the scale needed to support China's climate goals, concrete measures need to be adopted in the short-term.
- A long-term target can provide strong political signal and support for action in the short- and mid-term. If enshrined in national law, this could enhance the chances of such policies to withstand political shifts. For example, the 2008 Climate Change Act of the United Kingdom and the 2017 Climate Policy Framework of Sweden provide a clear long-term target, while allowing short- and mid-term action and targets to take into account recurrent changes such as availability of new technologies or market opportunities.
- A longer-term perspective can facilitate the identification of risks of carbon lock-in. This is particularly relevant for those technologies that in other contexts may be useful transition technologies. As a result, long-term strategies can guide short- and mid-term action to minimise

the risks of locking in GHG emissions. For example, Costa Rica's LT-LEDS and Ireland's Climate Action Plan provide concrete potentials for carbon lock-in in investments that may be deemed cheaper in the short-term but that will lead to carbon lock-in in the future.

The Paris decision requests Parties to communicate a new NDC by 2020 for NDCs with a time frame up to 2025, or to communicate or update by 2020 NDCs with a time frame up to 2030. The 2020 COVID-19 health crisis may constrain some countries' capacities to initiate LT-LEDS and NDC update and/or communication processes. These constraints may be economic, political or logistics-related (as a result of lockdown measures). Yet, there are opportunities in 2020 and beyond for countries to consider options for exploring and operationalising alignment between NDCs and long-term climate strategies. In fact, the health crisis may render even more important the alignment between NDCs and long-term strategies. This is because the measures and actions undertaken by countries to recover from the economic and social crises triggered by the pandemic will be crucial to the collective ability of countries to meet the goals of the Paris Agreement. A long-term climate perspective to the recovery can guide short-term target setting and action, potentially leading to more effective use of resources while also promoting stronger well-being benefits associated with a mitigation strategy.

Eleven of the 17 LT-LEDS analysed set milestone targets to e.g. 2025 or 2030 that correspond to or that are more ambitious than the targets put forward in the NDC, and none of these LT-LEDS set milestone targets that are less ambitious than the respective NDC targets. All but four long-term strategies do not provide explanations in terms of LT-LEDS/NDC process linkages, it is therefore not clear whether / how milestone targets relate to the country's NDC or whether the LT-LEDS will be used to inform subsequent NDCs. As of May 2020, 17 Parties, including the European Union, have developed and communicated a LT-LEDS to the UNFCCC. Outside of the context of the Paris Agreement, 121 Parties have communicated their commitment to achieve net-zero CO<sub>2</sub> emissions by mid-century and other countries have developed national long-term climate strategies

Alignment in terms of governance, revision and review processes and systems for monitoring and evaluating progress are key to operationalising alignment between NDCs and long-term climate strategies. Co-ordinated or shared institutional arrangements between these two processes, for example, can increase the effectiveness of governance, and render more efficient the development of short-term policies that are consistent with a long-term target. Different national contexts and starting points influence the actions that countries could prioritise as they put in place such alignment. In particular:

- Countries that have put forward a long-term strategy or target prior to 2020, or who have put forward a long-term target such as carbon neutrality, can use this long-term strategy/target to inform the short-term targets in their upcoming NDC submission. In this situation, countries may also consider revising today their long-term strategy, if new scientific insights or technologies have become available since its publication.
- Countries that plan to develop a long-term strategy the same year as their NDC could do so by establishing sequential processes that would allow for the development of a long-term strategy first. When this is not possible, it would be useful for countries to set up a system that allows for regular exchange of information between the two processes.
- Countries that do not have a long-term strategy and that do not intend to prepare one ahead of COP26 can draw from existing studies and literature to assess regional or global mitigation trends and trajectories to verify that their short- and mid-term targets are in line with levels of climate mitigation advised. In this situation, it would be important for countries to consider how to best avoid risk of potential lock-in derived from short- and mid-term action.

Despite potential increased efforts in linking long-term strategies and NDCs, reaching good levels of alignment between long-term strategies and NDCs as early as 2020 will be challenging. Beyond the aforementioned challenges deriving from the 2020 COVID-19 health crisis, this is because the development of LT-LEDS is voluntary, and some countries may decide not to develop a long-term strategy in 2020. In addition, limited experience on key challenges of NDC implementation may render it more challenging for countries to understand the interplay between long-term planning and short-term action. Finally, some countries may see a benefit in deliberately maintaining the two documents (and processes for developing them) separate, as long-term strategies are less tied to political cycles and allow countries to set visionary goals.

# Annex A. List of countries having indicated their intention to work towards carbon and/or climate neutrality by 2050

## List of countries that are part of the Climate Ambition Alliance

Afghanistan, Angola, Antigua and Barbuda, Argentina, Armenia, Austria, Bahamas, Bangladesh, Barbados, Belgium, Belize, Benin, Bhutan, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Cambodia, Canada, Central African Republic, Chad, Chile, Colombia, Comoros, Cook Islands, Costa Rica, Croatia, Cyprus, Czech Republic, Democratic Republic of the Congo, Denmark, Djibouti, Dominica, Dominican Republic, Ecuador, Eritrea, Estonia, Ethiopia, Fiji, Finland, France, Gambia, Germany, Greece, Grenada, Guinea, Guinea-Bissau, Guyana, Haiti, Hungary, Iceland, Ireland, Italy, Jamaica, Kiribati, Lao People's Democratic Republic, Latvia, Lebanon, Lesotho, Liberia, Lithuania, Luxembourg, Madagascar, Malawi, Maldives, Mali, Malta, Marshall Islands, Mauritania, Mauritius, Mexico, Micronesia (Federated States of), Monaco, Mozambique, Myanmar, Namibia, Nauru, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Niue, Pakistan, Palau, Papua New Guinea, Peru, Portugal, Romania, Rwanda, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Slovakia, Slovenia, Solomon Islands, Somalia, South Sudan, Spain, Sudan, Suriname, Sweden, Switzerland, Timor-Leste, Togo, Tonga, Trinidad and Tobago, Tuvalu, Uganda, United Kingdom of Great Britain and Northern Ireland, United Republic of Tanzania, Uruguay, Vanuatu, Yemen, Zambia. These countries are working towards achieving net-zero CO<sub>2</sub> emissions by 2050 in line with latest scientific information.

## Documentation supporting Box 1. Carbon and climate neutrality

(Government of Bhutan, 2015<sup>[85]</sup>; Government of Suriname, 2015<sup>[86]</sup>; Government of Costa Rica, 2015<sup>[40]</sup>; European Commission, 2020<sup>[18]</sup>; Government of Fiji, 2018<sup>[44]</sup>; Government of the Marshall Islands, 2018<sup>[35]</sup>; Government of Portugal, 2019<sup>[51]</sup>; Government of Slovakia, 2020<sup>[55]</sup>; Government of Sweden, 2019<sup>[75]</sup>; Government of Denmark, 2018<sup>[87]</sup> (Government of France, 2019<sup>[69]</sup>) (Government of New Zealand, 2019<sup>[71]</sup>) (Government of the United Kingdom, 2019<sup>[72]</sup>) (European Commission, 2020<sup>[88]</sup>) (Government of Spain, 2019<sup>[89]</sup>) (Government of Chile, 2019<sup>[90]</sup>) (Government of Fiji, 2018<sup>[44]</sup>) (Reuters, 2019<sup>[91]</sup>) (Government of Finland, 2019<sup>[92]</sup>) (Government of Iceland, 2018<sup>[93]</sup>) (Government of Germany, 2016<sup>[46]</sup>) (Government of Japan, 2019<sup>[48]</sup>) (Government of Norway, 2017<sup>[94]</sup>) (Government of Portugal, 2019<sup>[51]</sup>) (Government of Singapore, 2020<sup>[54]</sup>) (Government of Uruguay, 2016<sup>[95]</sup>)

## Annex B. Selected countries' stated plans to use carbon markets in achieving their LT-LEDS or NZET plans

**Table 5. Selected countries' stated plans to use international carbon markets in achieving their LT-LEDS or NZET plans**

	LT-LEDS containing a NZET or NZET plan	Target year	Intention to use international carbon markets (e.g. offsets) to achieve target
Bhutan	NZET (achieved)	Achieved	Not specified
Chile	NZET (proposed legislation)	2050	Not specified
Costa Rica	LT-LEDS	2050	Not specified
Denmark	NZET (in law)	2050	Not specified
European Union	NZET (proposed legislation)	2050	Not specified
Fiji	LT-LEDS	2050	Yes (aviation)
Finland	NZET (in policy document)	2035	Not specified
France*	NZET (in law)	2050	No
Iceland	NZET (in policy document)	2040	Not specified
Japan	LT-LEDS	"As early as possible in the second half of the century"	Not specified
New Zealand	NZET (in law)	2050	Not specified
Norway	NZET (in policy document)	2030	Yes
Portugal	LT-LEDS	2050	No
Republic of the Marshall Islands	LT-LEDS	2050	No
Spain	NZET (proposed legislation)	2050	No
Suriname	NZET (achieved)	Achieved	Unclear**
Sweden	NZET (in law)	2045	Yes
Switzerland	NZET (in policy document)	2050	Not specified
United Kingdom*	NZET (in law)	2050	Yes
Uruguay	NZET (in policy document)	2030	Not specified

Note: NZET plans considered in this analysis are only those achieved, in law, proposed legislation or in policy document. (\*) France and the United Kingdom have also communicated to the UNFCCC an LT-LEDS that was developed before the NZET plan passed in law. (\*\*) In its second submitted NDC in December 2019, Suriname stated that it will "consider the use of co-operative approaches available [...] under Art. 6 of the Paris Agreement, especially those under Article 6.8" (Paris Agreement, 2015<sup>[21]</sup>). Article 6.8 of the Paris Agreement consists of "non-market" approaches. Therefore, from the current formulation it is unclear if Suriname would consider participating in international carbon markets. Source: Luca Lo Re (IEA) based on (Energy & Climate Intelligence Unit, 2020<sup>[96]</sup>) and (UNFCCC, 2020<sup>[17]</sup>)

# References

- Asian Development Bank (2015), *Roadmap for carbon capture and storage demonstration and deployment in the People's Republic of China*, Asian Development Bank. [77]
- Climate Action Tracker (2019), *Warming Projections Global Update - December 2019*, NewClimate Institute and Climate Analytics. [5]
- Committee on Climate Change (2020), *About the Committee on Climate Change - Committee on Climate Change*, <https://www.theccc.org.uk/about/> (accessed on 9 March 2020). [99]
- Committee on Climate Change (2020), *Ten years of the Climate Change Act - Committee on Climate Change*, <https://www.theccc.org.uk/our-impact/ten-years-of-the-climate-change-act/> (accessed on 9 March 2020). [73]
- Committee on Climate Change (2019), *Net Zero - The UK's contribution to stopping global warming - Committee on Climate Change*, Committee on Climate Change, London, <https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/#key-findings>. [82]
- Committee on Climate Change (2019), *Net Zero - Technical Report*, Committee on Climate Change, London. [74]
- Cornot-Gandolphe, S. (2019), "Carbon Capture, Storage and utilization to the rescue of Coal? Global Perspectives and Focus on China and the United States", *Etudes d'Ifrri*. [76]
- del Río González, P. (2008), "Policy implications of potential conflicts between short-term and long-term efficiency in CO2 emissions abatement", *Ecological Economics*, Vol. 65/2, pp. 292-303, <http://dx.doi.org/10.1016/j.ecolecon.2007.06.013>. [9]
- DIE, ACTS and SEI (2016), *NDC Explorer*, German Development Institute (DIE) African Centre for Technology Studies (ACTS) Stockholm Environment Institute (SEI), [http://dx.doi.org/10.23661/ndc\\_explorer\\_2017\\_2.0](http://dx.doi.org/10.23661/ndc_explorer_2017_2.0). [65]
- Energy & Climate Intelligence Unit (2020), *Net Zero Tracker | Energy & Climate Intelligence Unit*, <https://eciu.net/netzerotracker> (accessed on 10 March 2020). [96]
- European Commission (2020), *European climate law – achieving climate neutrality by 2050*, <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12108-Climate-Law> (accessed on 15 May 2020). [88]

- European Commission (2020), *Submission by Croatia and the European Commission on behalf of the European Union and its Member States, Subject: Long-term low greenhouse gas emission development strategy of the European Union and its Member State*, Croatian Presidency of the Council of the European Union. [18]
- European Commission (2015), *Nationally Determined Contribution of the EU and its Member States*, UNFCCC Secretariat. [41]
- Fabert, B. and A. Foussard (2016), “Trajectoires de transition bas carbone en France au moindre cout”, Ministry of Environment, Paris. [12]
- Government of Benin (2017), *Benin’s First Nationally Determined Contribution*, UNFCCC Secretariat. [38]
- Government of Benin (2016), *Stratégie de développement à faible intensité de carbone et résilient aux changements climatiques*, Ministry of Sustainable Development, [https://unfccc.int/files/focus/long-term\\_strategies/application/pdf/benin\\_long-term\\_strategy.pdf](https://unfccc.int/files/focus/long-term_strategies/application/pdf/benin_long-term_strategy.pdf). [39]
- Government of Bhutan (2015), *Kingdom of Bhutan’s Intended Nationally Determined Contribution*, UNFCCC Secretariat. [85]
- Government of Burkina Faso (2015), *Burkina Faso National Climate Change Adaptation Plan (NAP)*, Ministry of Environment and Fishery Resources. [23]
- Government of Canada (2017), *Canada’s First NDC (Re-vised submission)*, UNFCCC Secretariat. [34]
- Government of Canada (2016), *Canada’s First NDC*, UNFCCC Secretariat. [32]
- Government of Canada (2016), *Canada’s mid-century long-term low-greenhouse gas development strategy*, Environment and Climate Change Canada, Gatineau, <https://unfccc.int/sites/default/files/resource/Canada%27s%20Mid-Century%20Long-Term%20Low-GHG%20Strategy.pdf>. [33]
- Government of Chile (2019), *Proceso de consulta pública del anteproyecto de ley marco de cambio climático – Cambio Climático*, <https://cambioclimatico.mma.gob.cl/proceso-de-consulta-publica-del-anteproyecto-de-ley-marco-de-cambio-climatico/> (accessed on 15 May 2020). [90]
- Government of Costa Rica (2019), *National Decarbonization Plan 2018-2050*, <https://unfccc.int/sites/default/files/resource/NationalDecarbonizationPlan.pdf> (accessed on 15 January 2020). [37]
- Government of Costa Rica (2015), *Costa Rica’s First Nationally Determined Contribution*, UNFCCC Secretariat. [40]
- Government of Denmark (2018), *Together for a greener future*. [87]
- Government of Fiji (2018), *Fiji Low Emission Development Strategy 2018-2050*, Ministry of Economy, Suva, [https://unfccc.int/sites/default/files/resource/Fiji\\_Low%20Emission%20Development%20%20Strategy%202018%20-%202050.pdf](https://unfccc.int/sites/default/files/resource/Fiji_Low%20Emission%20Development%20%20Strategy%202018%20-%202050.pdf). [44]

- Government of Fiji (2016), *Fiji's Nationally Determined Contribution*, UNFCCC Secretariat, [43]  
<http://data.worldbank.org/country/fiji> (accessed on 13 August 2018).
- Government of Finland (2019), *Programme of Prime Minister Antti Rinne's Government 6 June 2019: Inclusive and competent Finland*. [92]
- Government of France (2019), *LOI n° 2019-1147 du 8 novembre 2019 relative à l'énergie et au climat | Legifrance*, [69]  
[https://www.legifrance.gouv.fr/affichTexte.do;jsessionid=D184AC4BD7FCEB7B184A3B3CAAEC0047.tplqfr41s\\_2?cidTexte=JORFTEXT000039355955&categorieLien=id](https://www.legifrance.gouv.fr/affichTexte.do;jsessionid=D184AC4BD7FCEB7B184A3B3CAAEC0047.tplqfr41s_2?cidTexte=JORFTEXT000039355955&categorieLien=id) (accessed on 13 November 2019).
- Government of France (2017), *Plan Climat*, Ministry for an Ecological and Solidary Transition, [45]  
[https://www.ecologique-solidaire.gouv.fr/sites/default/files/2017.07.06%20-%20Plan%20Climat\\_0.pdf](https://www.ecologique-solidaire.gouv.fr/sites/default/files/2017.07.06%20-%20Plan%20Climat_0.pdf).
- Government of France (2017), *Strategie nationale bas-carbone*, Ministry for the Ecological and [68]  
 Solidary Transition, Paris,  
[https://unfccc.int/sites/default/files/resource/151119\\_SNBC\\_publiee%20Avec%20resume.pdf](https://unfccc.int/sites/default/files/resource/151119_SNBC_publiee%20Avec%20resume.pdf).
- Government of Germany (2016), *Climate Action Plan 2050*, Federal Ministry for the [46]  
 Environment, Nature Conservation, Building and Nuclear Safety,  
<http://www.bmub.bund.de/english>.
- Government of Iceland (2018), *Iceland's Climate Action Plan for 2018-2030*, [93]  
<http://www.government.is> (accessed on 15 May 2020).
- Government of Indonesia (2019), *Low Carbon Development: A Paradigm Shift Towards a Green [21]  
 Economy in Indonesia*, Ministry of National Development Planning, Jakarta,  
<https://drive.bappenas.go.id/owncloud/index.php/s/ZgL7fHeVquMi8rG#pdfviewer>.
- Government of Ireland (2019), *Climate Action Plan*. [79]
- Government of Japan (2019), *The Long-term Strategy under the Paris Agreement*, Government [48]  
 of Japan, Tokyo, <https://unfccc.int/sites/default/files/resource/The%20Long-term%20Strategy%20under%20the%20Paris%20Agreement.pdf>.
- Government of Japan (2016), *Japan's First Nationally Determined Contribution*, UNFCCC [47]  
 Secretariat.
- Government of Malta (2016), *National Transport Strategy 2050 and Transport Master Plan 2025*, [22]  
 Government of Malta,  
[https://meae.gov.mt/en/Public\\_Consultations/MTI/Pages/Consultations/NationalTransportStrategy2050andTransportMasterPlan2025.aspx](https://meae.gov.mt/en/Public_Consultations/MTI/Pages/Consultations/NationalTransportStrategy2050andTransportMasterPlan2025.aspx).
- Government of Mexico (2016), *Mexico's Climate Change Mid-Century Strategy*, Ministry of [50]  
 Environment and Natural Resources, Mexico City, <http://www.semarnat.gob.mx>.
- Government of Mexico (2016), *Mexico's First Nationally Determined Contribution*, UNFCCC [49]  
 Secretariat.

- Government of New Zealand (2019), *Climate Change Response Act 2002 (amended 14 november 2019)*, <http://www.legislation.govt.nz/act/public/2002/0040/latest/whole.html#LMS282044> (accessed on 13 November 2019). [71]
- Government of Norway (2017), *Meld. St. 41 (2016–2017) : Norway’s Climate Strategy for 2030: a transformational approach within a European cooperation framework — Meld. St. 41 (2016–2017) Report to the Storting (white paper)*, regjeringen.no. [94]
- Government of Portugal (2019), *Roadmap for Carbon Neutrality 2050*. [51]
- Government of Singapore (2020), *Charting Singapore’s Low-carbon and Climate Resilient Future*, <http://www.nccs.gov.sg>. [54]
- Government of Singapore (2020), *Singapore’s Update of its First NDC*, UNFCCC Secretariat. [53]
- Government of Singapore (2016), *Singapore’s First NDC*, UNFCCC Secretariat. [52]
- Government of Slovakia (2020), *Low-Carbon Development Strategy of the Slovak Republic until 2030 with a View to 2050*, Government of Slovakia, <https://unfccc.int/sites/default/files/resource/LTS%20SK%20eng.pdf>. [55]
- Government of Spain (2019), *Marco Estratégico de Energía y Clima: Una oportunidad para la modernización de la economía española y la creación de empleo.*, <https://www.miteco.gob.es/es/cambio-climatico/participacion-publica/marco-estrategico-energia-y-clima.aspx> (accessed on 15 May 2020). [89]
- Government of Suriname (2015), *Suriname’s Intended Nationally Determined Contribution*, UNFCCC Secretariat. [86]
- Government of Sweden (2019), *Sweden’s Climate Act and Climate Policy Framework - Swedish Environmental Protection Agency*, <http://www.swedishepa.se/Environmental-objectives-and-cooperation/Swedish-environmental-work/Work-areas/Climate/Climate-Act-and-Climate-policy-framework/> (accessed on 31 October 2019). [75]
- Government of Sweden (2018), *Seventh National Communication to the UNFCCC*, UNFCCC Secretariat, Bonn, <http://www.naturvardsverket.se/publikationer>. [19]
- Government of the Czech Republic (2017), *Climate protection policy of the Czech Republic*, Ministry of Environment, Prague, [https://unfccc.int/files/na/application/pdf/cze\\_climate\\_protection\\_policy\\_summary.pdf](https://unfccc.int/files/na/application/pdf/cze_climate_protection_policy_summary.pdf). [42]
- Government of the Marshall Islands (2018), *2050 Climate Strategy*, [https://unfccc.int/sites/default/files/resource/180924%20mi%202050%20climate%20strategy%20final\\_0.pdf](https://unfccc.int/sites/default/files/resource/180924%20mi%202050%20climate%20strategy%20final_0.pdf). [35]
- Government of the Marshall Islands (2018), *The Republic of the Marshall Islands’ Second Nationally Determined Contribution*, UNFCCC Secretariat, <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Marshall%20Islands%20Second/20181122%20Marshall%20Islands%20NDC%20to%20UNFCCC%2022%20November%202018%20FINAL.pdf>. [36]

- Government of the United Arab Emirates (2017), *National Climate Change Plan of the United Arab Emirates*, Ministry of Climate Change and the Environment, Abu Dhabi, <http://www.moccae.gov.ae>. [20]
- Government of the United Kingdom (2019), *The Climate Change Act 2008 (2050 Target Amendment) Order 2019*, <https://www.legislation.gov.uk/ukdsi/2019/9780111187654/article/2>. [72]
- Government of the United Kingdom (2017), *The Clean Growth Strategy: Leading the way to a low carbon future*, Department for Business, Energy and Industrial Strategy, <http://www.nationalarchives>. [58]
- Government of the United States (2016), *The United State's First Nationally Determined Contribution*, UNFCCC Secretariat. [60]
- Government of the United States (2016), *United States Mid-Century Strategy for deep decarbonization*, Government of the United States, Washington D.C., [https://unfccc.int/files/focus/long-term\\_strategies/application/pdf/mid\\_century\\_strategy\\_report-final\\_red.pdf](https://unfccc.int/files/focus/long-term_strategies/application/pdf/mid_century_strategy_report-final_red.pdf). [59]
- Government of Ukraine (2017), *Ukraine 2050 Low Emission Development Strategy*, [https://unfccc.int/sites/default/files/resource/Ukraine\\_LEDs\\_en.pdf](https://unfccc.int/sites/default/files/resource/Ukraine_LEDs_en.pdf). [57]
- Government of Ukraine (2016), *Ukraine's Nationally Determined Contribution*, UNFCCC Secretariat. [56]
- Government of Uruguay (2016), *Nationally Determined Contribution*, Government of Uruguay, Montevideo, [http://www4.unfccc.int/ndcregistry/PublishedDocuments/Uruguay%20First/Uruguay\\_First%20Nationally%20Determined%20Contribution.pdf](http://www4.unfccc.int/ndcregistry/PublishedDocuments/Uruguay%20First/Uruguay_First%20Nationally%20Determined%20Contribution.pdf) (accessed on 10 August 2018). [95]
- Haasnoot, M., S. van 't Klooster and J. van Alphen (2018), "Designing a monitoring system to detect signals to adapt to uncertain climate change", *Global Environmental Change*, Vol. 52, pp. 273-285, <http://dx.doi.org/10.1016/j.gloenvcha.2018.08.003>. [81]
- Hood, C. and C. Soo (2017), "Accounting for mitigation targets in Nationally Determined Contributions under the Paris Agreement", *OECD/IEA Climate Change Expert Group Papers*, No. 2017/5, OECD Publishing, Paris, <https://dx.doi.org/10.1787/63937a2b-en>. [98]
- IDDRI (2016), "Long-term low emissions development strategies and the Paris Agreement – Why, what and how?", No. 06/16, Institut du développement durable et des relations internationales, Paris, <http://www.iddri.org> (accessed on 4 June 2019). [30]
- IEA (2020), *Global Energy Review 2020*, International Energy Agency, Paris, <https://www.iea.org/reports/global-energy-review-2020>. [83]
- IEA (2019), *The Future of Hydrogen*, International Energy Agency, <https://www.iea.org/reports/the-future-of-hydrogen>. [64]
- IEA (2019), *Transforming Industry through CCUS*, International Energy Agency, <https://www.iea.org/reports/transforming-industry-through-ccus>. [63]
- IEA (2019), *World Energy Outlook 2019*, OECD Publishing, Paris, <https://dx.doi.org/10.1787/caf32f3b-en>. [7]

- IEA (2017), *Real-world policy packages for sustainable energy transitions*, International Energy Agency, Paris, <https://webstore.iea.org/insights-series-2017-real-world-policy-packages-for-sustainable-energy-transitions>. [10]
- IGES (2019), *IGES NDC Database [database]*, Institute for Global Environmental Strategies. [31]
- IPCC (2018), *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*, IPCC, Geneva, <https://www.ipcc.ch/sr15/>. [3]
- IPCC (2014), *AR5 Synthesis Report: Climate Change 2014*, IPCC, <https://www.ipcc.ch/report/ar5/syr/>. [102]
- IRENA (2017), *Stranded Assets and Renewables: How the energy transition affects the value of energy reserves, buildings and capital stock - a REmap working paper*, International Renewable Energy Agency (IRENA), Abu Dhabi, <http://www.irena.org/remap>. [62]
- Iyer, G. et al. (2017), "Measuring progress from nationally determined contributions to mid-century strategies", *Nature Climate Change*, <http://dx.doi.org/10.1038/s41558-017-0005-9>. [11]
- Kachi, A. et al. (2019), *The role of international carbon markets in a decarbonising world Aligning Article 6 with long-term strategies* *The role of international carbon markets in a decarbonising world*, NewClimate Institute, <http://newclimate.org/publications/>. [67]
- Lo Re, L. et al. (2019), "Designing the Article 6.4 mechanism: assessing selected baseline approaches and their implications", *OECD/IEA Climate Change Expert Group Papers*. [61]
- OECD (2020), "Long-term low emissions development strategies: cross-country experience", *OECD Environment Working Papers*. [15]
- OECD (2020), *Towards Sustainable Land Use: Aligning Biodiversity, Climate and Food Policies*, OECD Publishing, Paris, <https://dx.doi.org/10.1787/3809b6a1-en>. [80]
- OECD (2012), *Greening Development: Enhancing Capacity for Environmental Management and Governance*, OECD Publishing, Paris, <https://dx.doi.org/10.1787/9789264167896-en>. [84]
- OECD/The World Bank/UN Environment (2018), *Financing Climate Futures: Rethinking Infrastructure*, OECD Publishing, Paris, <https://dx.doi.org/10.1787/9789264308114-en>. [6]
- Paris Agreement (2015), *15 December 2015*, United Nations Treaty Collection Certified True Copies (CTCs) of Multilateral Treaties Deposited with the Secretary-General Chapter XXVII.7.d, <https://treaties.un.org/doc/Publication/UNTS/No%20Volume/54113/Part/I-54113-0800000280458f37.pdf> (accessed on 28 April 2020). [2]
- Reuters (2019), *More EU leaders sign up to carbon net-zero goal by 2050 ahead of summit - Reuters*, <https://www.reuters.com/article/us-eu-climate/more-eu-leaders-sign-up-to-carbon-net-zero-goal-by-2050-ahead-of-summit-idUSKCN1T11XF> (accessed on 15 May 2020). [91]
- Rocha, M. and C. Falduto (2019), "Key questions guiding the process of setting up long-term low-emission development strategies", *OECD/IEA Climate Change Expert Group Papers*, OECD Publishing. [14]

- UNEP (2019), *Emissions Gap Report 2019*, United Nations Environment Programme, <https://www.unenvironment.org/resources/emissions-gap-report-2019>. [4]
- UNFCCC (2020), *CDM Project Activities*, UNFCCC Secretariat, Bonn, <https://cdm.unfccc.int/Statistics/Public/CDMinsights/index.html#iss> (accessed on 28 February 2020). [66]
- UNFCCC (2020), *Climate Ambition Alliance: Net Zero 2050*, <https://climateaction.unfccc.int/views/cooperative-initiative-details.html?id=94> (accessed on 15 May 2020). [27]
- UNFCCC (2020), *Communication of long-term strategies*, UNFCCC Secretariat, <https://unfccc.int/process/the-paris-agreement/long-term-strategies> (accessed on 6 March 2020). [17]
- UNFCCC (2020), *NDC Registry*, UNFCCC Secretariat, <https://www4.unfccc.int/sites/ndcstaging/Pages/Home.aspx> (accessed on 6 March 2020). [16]
- UNFCCC (2019), *Conference of the Parties serving as the meeting of the Parties to the Paris Agreement Report of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement on the third part of its first session, held in Katowice from 2 to 15 December 2018, Part two: Action taken by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement, Further guidance in relation to the mitigation section of decision 1/CP.21*, UNFCCC Secretariat, Bonn. [100]
- UNFCCC (2019), *Report of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement on the third part of its first session, held in Katowice from 2 to 15 December 2018. Part two: Action taken by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement. Decision 6/CMA.1: Common time frames for nationally determined contributions referred to in Article 4, paragraph 10, of the Paris Agreement*, UNFCCC Secretariat. [101]
- UNFCCC (2018), *Decision 4/CMA.1 Further guidance in relation to the mitigation section of decision 1/CP.21. FCCC/PA/CMA/2018/3/Add.1*, [https://unfccc.int/sites/default/files/resource/cma2018\\_03a01E.pdf](https://unfccc.int/sites/default/files/resource/cma2018_03a01E.pdf) (accessed on 28 April 2020). [26]
- UNFCCC (2016), *Decision 1/CP.21 Adoption of the Paris Agreement, Report of the Conference of the Parties on its twenty-first session, held in Paris from 30 November to 13 December 2015*, UNFCCC Secretariat, Bonn, <https://unfccc.int/resource/docs/2015/cop21/eng/10a01.pdf>. [25]
- Vaidyula, M. and C. Hood (2018), "Accounting for baseline targets in NDCs: Issues and options for guidance", *OECD/IEA Climate Change Expert Group Papers*, No. 2018/02, OECD Publishing, Paris, [http://www.oecd.org/environment/cc/Accounting\\_for\\_baselines\\_targets\\_in\\_NDCS.pdf](http://www.oecd.org/environment/cc/Accounting_for_baselines_targets_in_NDCS.pdf) (accessed on 13 August 2018). [28]
- Vaidyula, M. and M. Rocha (2018), "Tracking progress towards NDCs and relevant linkages between Articles 4, 6 and 13 of the Paris Agreement", *OECD/IEA Climate Change Expert Group Papers*, No. 2018/04, OECD Publishing, Paris, <https://dx.doi.org/10.1787/358aae24-en>. [97]

- Vivid Economics (2017), *Net Zero in New Zealand*, Vivid Economics, [70]  
<https://www.vivideconomics.com/casestudy/net-zero-in-new-zealand/>.
- Vogt-Schilb, A. and S. Hallegatte (2014), "Marginal abatement cost curves and the optimal timing of mitigation measures", *Energy Policy*, Vol. 66, pp. 645-653, [8]  
<http://dx.doi.org/10.1016/j.enpol.2013.11.045>.
- WRI (2020), *Long-term Climate Strategies: Case Studies*, <https://www.wri.org/climate/case-studies> (accessed on 28 April 2020). [24]
- WRI (2019), *Climate Action for Today and Tomorrow: The Relationship between NDCs and LTSs*, World Resource Institute and 2050 Pathways Platform, [1]  
<https://wriorg.s3.amazonaws.com/s3fs-public/wri-commentary-climate-action-today.pdf>.
- WRI (2019), *Good Governance for Long-term Low-emissions Development Strategies*, World Resources Institute, <https://wriorg.s3.amazonaws.com/s3fs-public/good-governance-long-term-low-emissions-development-strategies.pdf>. [29]
- WRI (2019), *Uncertainty, scenario analysis and long-term strategies: State of play and a way forward*, World Resources Institute, <http://www.wri.org/>. [78]
- WRI and UNEP (2019), *Scaling up ambition: Leveraging nationally determined contributions and long-term strategies to achieve the Paris Agreement goal*, <http://www.wri.org/publication/scaling-up-ambition>. (accessed on 13 January 2020). [13]