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Long-term low emissions development strategies: Cross-country experience

Aimée Aguilar Jaber,
Brilé Anderson,
Daniel Nachtigall,
Fatoumata Ngom

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LONG-TERM LOW EMISSIONS DEVELOPMENT STRATEGIES: CROSS-COUNTRY EXPERIENCE – ENVIRONMENT WORKING PAPER No. 160

By Aimée Aguilar Jaber, Brilé Anderson, Daniel Nachtigall and Fatoumata Ngom (1)

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Abstract

The Paris Agreement invites signatory countries to formulate and communicate long-term low greenhouse gas emission development strategies (LT-LEDS). This report compares the experience of three developed countries that have communicated LT-LEDS within the framework of the United Nations Framework Convention on Climate Change (UNFCCC): France (Stratégie National Bas-Carbone), Germany (Klimaschutzplan 2050) and the United Kingdom (Clean Growth Strategy). The report analyses the three stages of the LT-LEDS process in detail: a) the institutional and technical process to create the LT-LEDS; b) the document strategy resulting from the process; and c) the design of specific mechanisms to facilitate implementation of the LT-LEDS. While LT-LEDS will reflect countries own "common but differentiated responsibilities and respective capabilities, in the light of different national circumstances", it is hoped that the lessons and messages included in this report can be useful to other developed and developing countries interested in creating and implementing LT-LEDS.

Keywords: Paris Agreement, UNFCCC, Climate Change, LT-LEDS

JEL Classification: H23, O44, Q01, Q52, Q54, Q56, Q58, R11

Résumé

L'Accord de Paris encourage les pays signataires à formuler et à communiquer des stratégies de développement à long terme à faible émission de gaz à effet de serre (LT-LEDS). Ce rapport compare l'expérience de trois pays développés ayant communiqué des LT-LEDS dans le cadre de la Convention-cadre des Nations unies sur les changements climatiques (CCNUCC): la France (Stratégie Nationale Bas-Carbone), l'Allemagne (Klimaschutzplan 2050) et le Royaume-Uni (Stratégie de croissance propre). Le rapport analyse en détail les trois étapes du processus LT-LEDS entrepris: a) le processus institutionnel et technique de création du système LT-LEDS; b) le document de stratégie résultant du processus; et c) la conception de mécanismes spécifiques pour faciliter la mise en œuvre du LT-LEDS. Les LT-LEDS refléteront les « responsabilités communes mais différenciées et les capacités respectives des pays, à la lumière des circonstances nationales différentes », mais il est à espérer que les leçons et les messages contenus dans le présent rapport pourront être utiles aux autres pays développés et en voie de développement intéressés par créer et mettre en œuvre leurs LT-LEDS.

Mots clé : Accord de Paris, CCNUCC, Changement climatique, LT-LEDS

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Acronyms

ADEME	Agence de l'Environnement et de la Maîtrise de l'Energie
AGRESTE	Statistics and prospectives publication department, Ministry for Agriculture and Food
AMS2+	Avec Mesures Supplémentaires 2+
AMS2	Avec Mesures Supplémentaires 2
BEIS	Department for Business, Energy and Industrial Strategy
BMUB	Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit (Federal Ministry for the Environment, Nature Conservation, Housing, and Nuclear Safety)
CCC	Committee on Climate Change
CCUS	Carbon Capture, Utilisation and Storage
CCXG	Climate Change Expert Group
CETE	Comité d'Experts pour la Transition Energétique
CITEPA	Inter-professional Technical Centre for Atmospheric Pollution
CO_2eq	Carbon dioxide equivalent
COP	Conference of the Parties
DEFRA	Department for Environment, Food and Rural Affairs
ECO	Energy Company Obligation
EPC	Energy Performance Certificates
ETGG	Energy Transition for Green Growth
ETS	Emissions Trading System
EU	European Union
FRA	France

GER	Germany
GHG	Greenhouse gases
I4CE	Institute for Climate Economics
INSEE	Institut National de la Statistique et des Études Économiques
LT-LEDS	Long-term low emission development strategies
METI	Ministry of Ecological and Inclusive Transition
Mt	Megatonne
NDCs	Nationally Determined Contributions
NEMESIS	New Econometric Model for Environment and Sustainable development Implementation Strategies
NGOs	Non-Governmental Organisation
NOTRe	Nouvelle Organisation Territoriale de la République
PCAET	Plan Climat-Air-Énergie Territorial
PCSD	Policy Coherence for Sustainable Development
PDU	Plan de Développement Urbain
PLUi-D	Plan Local d'Urbanisme intercommunal Déplacements
SCOT	Schéma de Cohérence Territorial
SDG	Sustainable Development Goals
SRADDET	Schéma Régional d'Aménagement, de Développement Durable et d'Egalité des Territoires
T	tonne
THREEME	Modèle Macroéconomique Multisectoriel d'Evaluation des politiques Energétiques et Environnementales
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change

Executive summary

Effective action to limit climate damages and risks requires all countries to pursue an economic transformation, which will have far reaching implications on employment, local and regional development, fiscal and budgetary issues; to mention a few. Nevertheless, each country faces a unique set of challenges and constraints when tackling the transformation that lies ahead. The Paris Agreement incorporates elements which, inter alia, aim at supporting countries in developing tailored approaches to mitigation, while collectively contributing to the international commitment of staying well below 2°C. One of these is the creation of Long-Term Low-Emission Development Strategies (LT-LEDS). In broad terms, depending on countries capabilities and domestic circumstances, such strategies sketch pathway(s) for an economy's development and greenhouse gas (GHG) emissions pathways that is consistent with the global goal of reaching net-zero emissions early in the second half of the century.

As countries embark on this exercise and communicate their LT-LEDS, there is an opportunity to build on the prior experiences of countries who have already developed them - to draw lessons, identify good practice, and better understand the most relevant aspects of this tool. After providing a brief analysis of the main features of existing LT-LEDS, this paper provides a detailed comparative analysis of the LT-LEDS of France (Stratégie Nationale Bas-Carbone (SNBC)), the United Kingdom (Clean Growth Strategy) and Germany (Klimaschutzplan 2050), submitted to the United Nations Framework Convention on Climate Change (UNFCCC). Drawing on the OECD's Policy Coherence for Sustainable Development (PCSD) framework the report identifies examples of good practice in the three key phases of an LT-LEDS namely: a) the institutional and technical process of creating the LT-LEDS; b) the document resulting from this process; and c) the design of specific mechanisms to facilitate implementation of the LT-LEDS.

The institutional and technical process of creating the LT-LEDS

Political commitment proved essential to the process of creating the LT-LEDS in all three countries, be it through early endorsement from the highest level of government, via legal backing to create a LT-LEDS binding (e.g., Climate Change Act in the UK), or by delegating the creation of the LT-LEDS to an appropriate institution. Each of these add credibility and legitimacy to the process, helping to facilitate the engagement and cooperation of relevant ministries across government.

Engaging key stakeholders, including youth, in the development of the LT-LEDS can facilitate broad consensus across society, thereby enhancing the political acceptability and credibility while strengthening political support in the implementation of the LT-LEDS. Engaging key stakeholders at early stages can initiate a national debate on a country's long-term vision regarding climate change mitigation and other policy objectives. A clear and transparent process as well as timeline for stakeholder engagement enhances buy-in while broadening participation.

Policy co-ordination through the involvement of other ministries as well as local and sub-national governments ensures policy consistency with existing strategies. Embedding the LT-LEDS into existing climate-related strategies also enhances credibility by referring to pre-existing action and laws. Developing

a LT-LEDS represents a great opportunity for defining a country's long-term vision that does not only focus on climate change, but also on other policy objectives.

The formulation of the LT-LEDS

Underpinning the interim and long-run targets of the LT-LEDS by scientifically sound modelling demonstrates the feasibility of the targets and, in turn, enhances the credibility of the whole LT-LEDS. Using in-house models helps to build capacity and expertise needed for updating the LT-LEDS or for developing long-term strategies for other purposes. At the same time, involving external experts and research institutes to use their know-how and expertise ensures the use of scientifically sound state-of-the-art-methods. Modelling the impact of the targets in the LT-LEDS on other policy dimensions, including employment, competitiveness, distributional consequences, and air pollution, helps to demonstrate synergies between climate mitigation and other policy priorities. Short-term targets, as for example stated in countries' Nationally Determined Contributions (NDCs), need to be linked to these long-term pathways to ensure alignment between the short-term and long-term goals.

Setting out a clear vision of the major changes to be pursued to reach climate ambitions is key. Showing strong political commitment in the LT-LEDS by outlining the level of ambition and providing a clear vision of the desired future confers credibility to a country's transition to a low-carbon economy. This entails: i) determining national emissions reduction targets and allocating these targets to key economic sectors; ii) a clear demarcation of responsibilities at ministerial, sub-national and local level; and iii) outlining strategies and recommendations for achieving the goals.

The mechanisms that facilitate implementation of the LT-LEDS

To ensure political acceptance and ultimately credibility, well-being and sustainable development must be at the core of LT-LEDS. The LT-LEDS should communicate on benefits other than climate change mitigation, such as clean air, health, biodiversity and jobs. Potential trade-offs, and complementary measures and policies to cope with them, should also be outlined in the strategy. Indeed, considering political economy factors such as redistribution or social compensatory measures for those adversely affected by the transition provides credibility and enhances political acceptance.

Coordinating the integration of the LT-LEDS across the economy by putting in place an inter-ministerial body, clearly allocates responsibilities across relevant stakeholders at national, sub-national and local level facilitates effective implementation across the economy. Country commitment to the implementation of the LT-LEDS can also be signalled by the creation of independent advisory bodies or dedicated teams within government to monitor progress as well as through legislation that specifies consequences if targets are not met. Programmes that support implementation by providing funding and technical capacity building (e.g. for different territories) can also accelerate and facilitate implementation and help foster technological innovation. Fostering climate finance and green budgets, aligning incentives to match climate change and other sustainable development objectives, and making core climate policies like carbon pricing central to the strategy is also key to enhancing climate action across the economy.

1 Introduction

In December 2015, the 21st Conference of Parties (COP 21) of the United Nations Framework Convention on Climate Change (UNFCCC) adopted the Paris Agreement, which provides a framework for multilateral co-operation towards climate change mitigation. At the core of this Agreement is the objective to limit "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 taking into account the specific national conditions," (UNFCCC, 2015[1]).

Meeting this global goal requires all countries to pursue an economic, social, technological transformation, which will have far reaching implications on economic structures, employment, local and regional development, and fiscal and budgetary issues; to mention a few. Nonetheless, the magnitude, nature, timing and form of these changes will differ across countries. Thus, the pace, approach, priorities and precise actions chosen for the transformation will need to be adapted on a case-by-case basis considering country-specific circumstances.

Accordingly, the Paris Agreement incorporates several ways to support countries in the development of tailored approaches, while collectively contributing to the international commitment and keeping track of progress. Countries are to prepare, communicate and maintain successive Nationally Determined Contributions (NDCs) every five years that ratchet up ambition each time. Present NDCs specify contributions from 2020 to 2025 or 2030.

In addition, Article 4.19 of the Paris Agreement invites signatory countries to create long-term low greenhouse gas emission development strategies (LT-LEDS) (UNFCCC, 2015[1]). The process of developing and communicating LT-LEDS is already underway, and as of October 2019, 13 countries have submitted their strategies through the UNFCCC admission portal. In addition, some countries had developed their own domestic strategies, independently of the UNFCCC context such as the United Arab Emirates (National Climate Change Plan) and Indonesia (Low Carbon Development Report) (Rocha and Falduto, 2019[2]).

While no definition is provided in the Paris Agreement, collective efforts by countries, international institutions and think tanks, have increased clarity on the main principles underlying the LT-LEDS (2050 Pathways Platform, 2017[3]). The 2050 Pathways Platform,[1] for example, defines LT-LEDS as pathways that will help to envision the transition to low carbon economic development integrating the needed institutional, economic, technological and social changes, and the phases to achieve them (2050 Pathways Platform, 2017[3]). The link between NDCs and LT-LEDS is also spelled out as part of the 2050 Pathways Platform work, as these pathways should provide insights in terms of the development and implementation of NDCs, as well as key milestones for main policies and infrastructure investment (2050 Pathways Platform, 2017[3]).

As different countries prepare and communicate their LT-LEDS, there is an opportunity to build on existing tools and analysis to draw lessons, identify best practice, and better understand the most relevant aspects to enhance utility and effectiveness of these tools (e.g. (Clapp, Briner and Karousakis, 2010[4])). Prior OECD analysis provided insights from 15 country experiences (13 LT-LEDS submitted to the UNFCCC, and two additional country strategies) (Rocha and Falduto, 2019[2]). This analysis highlights how countries formulate their vision and define their targets, as well as the institutional framework used, and the financing mechanisms and monitoring schemes in place (see Annex A for details) (Rocha and Falduto, 2019[2]).

The aim of this report is to analyse and compare the experience of three countries that have developed and communicated LT-LEDS to the UNFCCC: France (*Stratégie Nationale Bas-Carbone*), Germany (*Klimaschutzplan 2050*) and the United Kingdom, henceforth referred to as the UK, (*Clean Growth Strategy*). The report analyses the three phases undertaken in detail: a) the institutional and technical process to create the LT-LEDS; b) the strategy resulting from the process; and c) the design of specific mechanisms to facilitate implementation of the LT-LEDS. While these countries represent only a small subset of Parties to the Paris Agreement, the insights from their LT-LEDS is likely, when suitably adapted to different national circumstances and capabilities, to be helpful in unlocking the potential of LT-LEDS for a range of other countries. In addition, such insights can also inform assessments of collective progress.

This report is linked to on the OECD work on *Accelerating Climate Action: Refocusing Policies through a Well-Being Lens,* the first part was released in September 2019, which highlights that in order to be successful in accelerating climate action, a larger focus on well-being is key (OECD, 2019[5]). On the one hand, the well-being approach systematically takes into account climate considerations when developing strategies and policies across the economy, thus ensuring that non-climate actions do not compromise climate change mitigation goals. On the other hand, analysing climate policies through the lens of wider well-being makes synergies and trade-offs between climate and other well-being goals more visible, thus facilitating their management and the achievement of a *two-way alignment* (i.e. between climate and broader well-being goals).

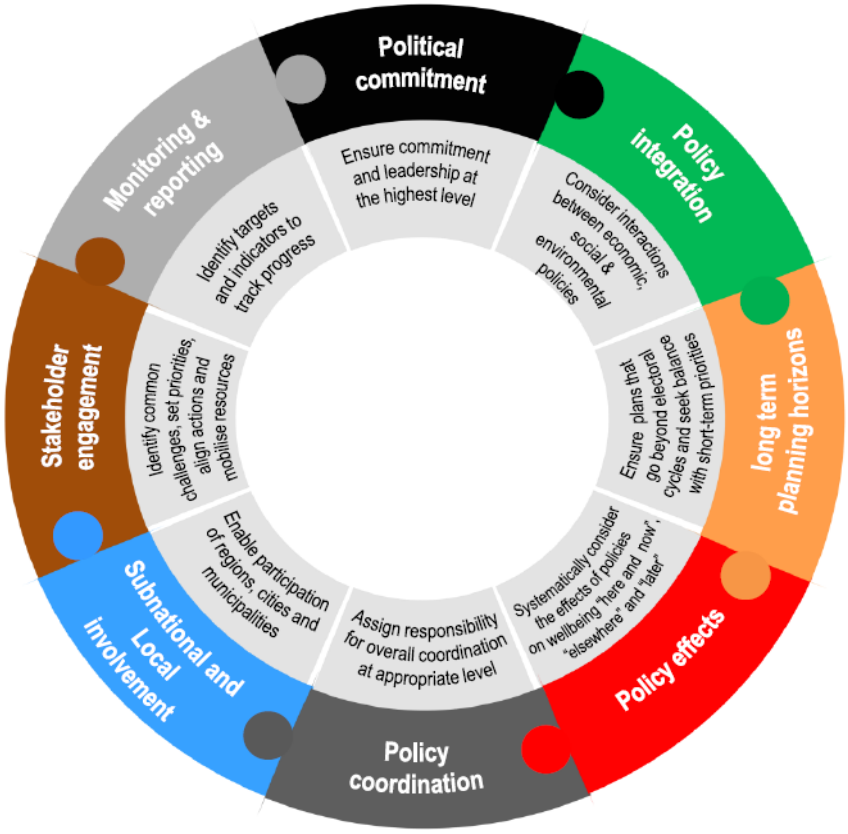
The creation of LT-LEDS provides a unique opportunity to pursue the well-being approach. This report focuses on identifying ways in which the creation of a LT-LEDS can support governments in embedding climate action in broader sustainable development goals across the economy. The case studies provide illustrations of how different elements of the process of creating the LT-LEDS, ways of formulating the strategy document, and different implementation mechanisms reflect an attempt to shift towards an adoption of a well-being lens.

2 Analytical approach and policy coherence

The development and adoption of the Sustainable Development Goals (SDGs) is an important step towards ensuring better two-way alignment between climate and broader well-being goals. Climate action (for both mitigation and adaptation) is recognised by the SDG framework as a priority (SDG 13), although the SDGs were adopted before the Paris Agreement, and climate change considerations are reflected in a wide range of the SDG goals and targets. The SDG framework also recognises that policy coherence is a central element for ensuring implementation (explicitly included in SDG 17.14 - Enhance policy coherence for sustainable development) in order to increase synergies and reduce trade-offs between different priorities. In line with this, the OECD developed a framework to foster Policy Coherence for Sustainable Development (PCSD). PCSD is defined as an approach "to systematically integrate the economic, social and environmental dimensions of sustainable development at all stages of domestic and international policy making" (OECD, 2018[6]).

This analysis builds on the PCSD framework, and in particular its primary eight building blocks identified as needed for implementing the SDGs in a coherent manner. See Figure 2.1

Figure 2.1. Policy Coherence for Sustainable Development – Building Blocks



Source: (OECD, 2018[7]).

This report adjusts these to be relevant for an analysis of the LT-LEDS (see Table 2.1 for the resulting redefinition of each of the building blocks). With particular attention to SDG 13, the analysis explores how LT-LEDS can be developed in a way that is consistent with the range of SDGs. In doing so, the report analyses three phases of strategy development in detail:

a) The institutional and technical process to create the LT-LEDS. This guides the development of the strategy document but also contributes to enhanced planning capacity and supports stakeholder engagement.

b) The long-term strategy resulting from the process. This is the key planning tool that provides clarity on *how* climate change mitigation should be embedded in wider decision-making processes. It also informs the level of ambition, the national targets as well as the policies and instruments that will be put in place to achieve them.

c) The design of specific mechanisms to facilitate implementation of the LT-LEDS. These ensure that climate change mitigation is embedded across the different relevant dimensions of decision-making (e.g., financing, timelines of actions, and so on).

The PCSD building blocks are used as a reference for analysing different country experiences in each of these three phases. This allows for the identification of key factors that can contribute to increasing the benefits associated with the creation of the LT-LEDS. At the same time, it also provides insights on how these factors can be achieved through different means.

Table 2.1. Building blocks from the Policy Coherence for Sustainable Development framework

Building Block	Definition
Political Commitment	Strong political leadership to shape national debate on how to shift towards a sustainable path over time
Policy Co-ordination	Ensuring coordinated and mutually supporting efforts across sectors
Stakeholder engagement	Engaging key stakeholders beyond government
Subnational and local involvement	Enable participation of regions, cities and municipalities
Policy Integration	Considering interactions between economic, social and environmental policies
Policy effects	Systematic consideration of the effects of policies on economic, social and environmental dimensions
Long term planning horizons	Reconciling short and long-term priorities
Monitoring and reporting	Identify targets and indicators to track progress

Source: Authors, adapted from (OECD, 2018[7]).

The three cases, France, Germany, and the UK, have a relatively long-standing history of organised policy dialogue around climate change mitigation, as well as solid planning frameworks. As highlighted throughout the report, these two elements constitute an important asset to build on when creating the LT-LEDS. Nonetheless, countries that do not enjoy the same conditions can use the development of the LT-LEDS to create them, notably by convening stakeholder dialogues and by enhancing planning frameworks and capacity to suit to the national context. Where the type of actions, analysis and/or mechanisms featured cannot be implemented, or can only be partially implemented in the short-run (e.g. due to institutional or other limitations), this report can also help identify the necessary steps over time needed to address these challenges.

Overall, this report aims to provide a set of good-practice approaches other countries can use in the development of their LT-LEDS. Table 2.1 lists a set of guiding questions that can be drawn upon when analysing the three phases of the LT-LEDS process according to the PCSD building blocks. These questions also guided the analysis in this report. The summary tables at the beginning of each phase described below also identify key factors facilitating the fulfilment of the building blocks for that phase. The issues of credibility, flexibility, and transparency are also discussed and explicitly linked to the PCSD building blocks.

Section 3compares the process of developing the LT-LEDS in France (Ministère de la Transition écologique et solidaire, 2015[8]), Germany (BMUB, 2016[9]), and the UK (BEIS, 2016[10]), and draws conclusions for other countries. Since these examples all come from developed countries with a long-standing history of environmental and climate policy, insights drawn may need to be tailored to suit different country contexts or countries with less experience in climate policy. The questions that guided our analysis are mentioned in Table 2.2.

Table 2.2. Questions to guide analysis in each phase of strategy development and implementation

LT-LEDS phase	Relevant PCSD building block	Questions
Process	Political commitment	• Is there a strong entity leading the process? • Are there solid mechanisms in place to convene different parts of the government? • Is there legal backing that makes the development of the LT-LEDS binding?
	Policy co-ordination subnational and local involvement	• How are other ministries and subnational governments involved in the design of the LT-LEDS? • How is consistency between existing strategies and the LT-LEDS ensured?
	Stakeholder engagement	• Which stakeholders were involved? • What were the mechanisms of stakeholder involvement?
	Policy integration and policy effects	• Do the scenarios for modelling integrate well-being aspects, i.e. social, environmental, economic dimensions?
	Long-term planning horizons	• Are the reduction goals underpinned by scientifically sound modelling? • Were external experts involved in creating the modelling tools?
Document	Political commitment	• Are there clear long-term mitigation goals and milestones? • Is there indication of the progress that will need to be made by different sectors? • Is there a clear allocation of responsibilities?
	Policy co-ordination	• Are there specific measures, policies, recommendations by sector? • Is there explicit reference to sectoral linkages? • How does the LT-LEDS relate to subnational legislation and power?
	Policy integration and policy effects	• Is the strategy linked to other policy priorities (e.g. the SDGs) and thematic plans (e.g. pollution, inclusion)? • Are explicit estimation of co-benefits present? • Are actions/measures/plans to cope with potential trade-offs included? • Is there a quantification of policy effects? • Are mechanisms in place to track the impact of the policy on other policy priorities? • Are there indicators to track progress? Which ones and how were they selected? • Who is collecting the data?
	Long-term planning horizons	• Are multiple possible emissions pathways included? • Is there a link to the country's NDC and a possible revision mechanisms based on lessons and outcomes of the LT-LEDS?
Implementation	Political commitment	• Are there mechanisms that show strong commitment to link other decision-making processes to the LT-LEDS? • Is there an advisory body to oversee the implementation of the LT-LEDS and a clear definition of its role? • Are there consequences for not meeting the objectives?
	Policy co-ordination Stakeholder engagement Subnational and local involvement	• Is there an inter-ministerial body for the implementation? • Who follows up on the timeline, if any? • How will stakeholders be involved when updating the LT-LEDS? • What do subnational actors do to implement the strategy?
	Long-term planning horizons Monitoring and reporting	• Is there a long-term financial plan? • Are there provisions to update the strategy? • Is there a timeline? • Are there annual reports on progress?

3 Process

Developing a LT-LEDS is an opportunity for countries to envision the future of their economy, where climate change mitigation plays a central role. Carefully designing the process to develop LT-LEDS, via a broad multi-stakeholder strategic dialogue, enables countries to maximize the benefits associated with its creation as well as to ensure policy coherence. This **process** should ultimately lead to a document with clearly outlined priorities that reflect two-way alignment (defined in Section 1), and an all-encompassing vision of the future informed by science, technological capacity and consideration of social and economic realities. Accounting for broader policy priorities in the development of LT-LEDS helps to identify the synergies and potential trade-offs between climate change mitigation and other policy goals.

While LT-LEDS on their own can serve as a robust long-term planning tool, the process of developing the LT-LEDS can also contribute to improving the technical capacity for long-term planning in climate and non-climate related areas. Transferring this knowledge to other areas in which long-term planning is required creates positive spill over and synergies among public administrations. The PCSD framework helps to pinpoint important mechanisms that enable governments to reap these benefits (OECD, 2018[6]). Moreover, the PCSD building blocks can help identify the enabling conditions, as demonstrated here with the focus on the three selected case studies. This section, as well as the next ones are structured according to the adapted building blocks of the PCSD and the guiding questions mentioned in Table 2.2.

Table 3.1. Factors supporting the process of creating the LT-LEDS

	Process of creating LT-LEDS
Political commitment	Involving the highest level of government Having previous legal backing for creating the LT-LEDS Having a long-standing process of policy debate Establishing a clearly defined entity responsible for leading the creation of the strategy
Stakeholder engagement	Having a transparent stakeholder process and a clear timeline Engaging the general public at an early stage Eliciting feedback on the (pre) final version Reviewing the stakeholder process
Policy co-ordination	Coordinating LT-LEDS with other ministries or State agencies to ensure policy consistency Building on existing (climate and non-climate related) strategies Involving subnational and local initiatives/commitments
Long-term planning	Underpinning the LT-LEDS by scientifically sound modelling Transparency with respect to assumptions and pathways Using in-house modelling to strengthen capacity
Policy integration and policy effects	Assessing goals in the LT-LEDS on other policy priorities Quantifying policy effects on climate change mitigation

3.1. Strong political commitment facilitates the creation of the LT-LEDS

Strong political commitment and leadership enhances the credibility of the LT-LEDS while garnering the public and institutional support needed to embed climate change mitigation into the broader policy framework. Analysis of the case studies identified four mechanisms that can be used to demonstrate such commitment: i) endorsement from the highest level of government; ii) legal backing that requires the government to create the LT-LEDS; iii) assigning the development of the LT-LEDS to a clearly defined and well-suited entity that leads and coordinates the process; and (iv) building on a long standing process of policy debate on climate change mitigation to facilitate co-ordination across ministries.

Endorsement from the highest level of government for the LT-LEDS demonstrates strong political leadership. For example, the head of government may be actively involved in the creation of the LT-LEDS, by initiating the public dialogue or endorsing the final strategy. While none of the selected countries directly involved the head of state or government in the creation of the LT-LEDS, in all cases, the LT-LEDS were endorsed or adopted by the highest level of government. In the UK and in France, the former Prime Minister (Theresa May) and the former President (Francois Hollande) endorsed the LT-LEDS, while the German LT-LEDS was adopted by the whole of government including Chancellor Angela Merkel (BMUB, 2016[9]).

Legal backing of the LT-LEDS, in the form of a law mandating it, facilitates its creation. In the UK, Climate Change Act was introduced in 2008 (United Kingdom, 2008[11]). In France, the Energy Transition for Green Growth Act (ETGG Act) (France, 2015[12]), builds on the Grenelle Acts (2009 and 2010), a ground-breaking law for environmental protection and sustainable development in France. The laws in both the UK and France require the respective governments to create a LT-LEDS in order to meet defined carbon budgets. The UK Climate Change Act does not legally specify sectoral targets, but instead legislates that economy-wide carbon budgets are to be set every five years at least 12 years in advance, which are legally binding. The LT-LEDS outlines a strategy compatible with an emission reduction path to stay within these budgets, but the document, in itself, is not legally binding. In Germany, the two governing parties agreed on the creation of the LT-LEDS in the coalition framework from 2013, although this document is not legally binding either (CDU, CSU and SPD, 2013[13]).

Having legal backing can enhance cooperation between ministries and potentially ease agreement on sectoral targets and measures among ministries. Moreover, it can add legitimacy to the entity in charge of the creation of the LT-LEDS when requiring input from other entities. Building on a long-standing policy debate on climate change mitigation facilitates co-ordination across ministries (or departments in the State administration in the case of local level strategies). For example, the UK benefited substantially from the policy debate emerged seriously in Parliament around 2003 with the release of the Stern Review (expert opinion) and culminated in the enactment of the Climate Change Act in 2008 (see Table 3.2 for a timeline of the LT-LEDS). This Act established broad consensus on the importance of climate change mitigation by setting an economy-wide target (i.e., the carbon budget), thereby requiring all Departments to engage in climate change mitigation to collectively meet the carbon budgets. Nevertheless, the specific contributions of each sector are not specified. In contrast, France's Energy Transition for Green Growth Act outlines crosscutting sectoral targets for the short, medium and long term as well as measures to achieve these targets. This Act provides the basis for the creation of the LT-LEDS. In Germany, the economy-wide emission reduction targets by 2030 and 2050 date back to 2010 with the publication of the energy concept (BMWi, 2010[14]). This document, while not legally binding, outlines the GHG emissions path the German government is aiming for until 2050.

The option of embedding the LT-LEDS into a framework of pre-existing climate change related actions and laws in a consistent way strengthens the credibility of the climate policy package, including the LT-LEDS. However, creating a LT-LEDS in countries that do not have long-standing preceding dialogues could also be an opportunity for initiating an all-encompassing national debate on climate change and other policy objectives.

Table 3.2. Major milestones that supported the creation and revision of LT-LEDS

	France	Germany	United Kingdom
2006			Stern Review on the Economics of Climate Change : landmark report on the urgency to act for climate change and the economic benefits of early climate actions
2007	Announcement of the Grenelle de l'Environnement - an open national multi debate around ecology and sustainable development		
2008			Climate Change Act: Setting of legally binding carbon budget 2544 Mt CO2eq for 2018-2022 1950 Mt CO2eq for 2023-2027 1725 MtCO2eq for 2028-2032 Creation of the Climate Change Committee (CCC)
2009	Grenelle I Law - Resulting from Grenelle de l'Environnement		First LT-LEDS created by Ministry of Energy and Climate Change
2010	Grenelle II Law - details the concrete measures derived from the programmes enacted under Grenelle I	Energy concept: Announcement to reduce GHG emissions by 55% by 2030 and 80-95% by 2050 (relative to 1990 levels)	
2011			Revision of LT-LEDS by the Ministry of Energy and Climate Change
2012	National debate on the Energy Transition - outcome: major strategic decisions for 4 possible trajectories for the energy transition		
2013		Decision to develop a LT-LEDS	
2014		Enactment of Climate Action Program (aims at achieving the GHG reduction targets by 2020)	
2015	Aug 2015 Enactment of the French Energy Transition for Green Growth Act: Setting of legally binding economy-wide targets: 14% by 2020 (against 2005 levels), 40% by 2030 (against 1990 levels) and 75% by 2050 (against 1990 levels) Require the government to create a LT-LEDS.	Launch of the dialogue to create the LT-LEDS	
2016	Nov 2015: Adoption of the LT-LEDS	Adoption of the final version of the LT-LEDS	Creation of the Ministry of Business, Energy and Industry (BEIS), Dissolution of Ministry of Energy and Climate Change
2017	Adoption of the Multiannual Energy Plan: monitors the energy mix trajectory with regard to the objectives of the Law		Revision of LT-LEDS by BEIS (Monitored by CCC) and Industry Strategy by BEIS (Not monitored by CCC)
2018		Creation of the commission for growth, structural change and regional development; Impact assessment of the LT-LEDS;	*25 Year Environment Plan* by Department for Environment, Food, and Agriculture (Not monitored by CCC but by Natural Capital Committee)
2019	Revision of the LT-LEDS	Results from the commission for growth, structural change and regional development. Enactment of climate action law to achieve the emissions reduction goals by 2030.	

Lacking consensus on the need for climate change mitigation in general or on sectoral contributions, in particular, may hamper the creation of the LT-LEDS. For example, in Germany, the Federal Ministry of Transport and the Federal Ministry of Agriculture reportedly refused to cooperate in the development of

the LT-LEDS for several months until the German Chancellery finally intervened (Spiegel Online, 2016[15]).

While endorsement from the highest level of government was important, in all three countries the creation of the LT-LEDS was assigned to a specific ministry, department or devoted agency that then collaborated with other ministries and stakeholders as discussed in the forthcoming sections. Germany and France tasked this to the Ministries of Environment (Germany: Federal Ministry for Environment, Nature Conservation, Building and Nuclear Safety; France: Ministry of Ecology, Sustainable Development and Energy), while in the UK, the revision of the LT-LEDS was delegated to the Department of Business, Energy and Industrial Strategy (BEIS). BEIS then assigned the creation of the LT-LEDS to the Clean Growth & Carbon Budgets team. In Germany, for example, the LT-LEDS was developed notably by the 'Climate policy' division, which was responsible for coordinating both the inputs from other divisions of the ministry and from other ministries and stakeholders.

All three entities have the capacity and the know-how to develop the LT-LEDS, but their scope and mandate within the government differs. The BEIS integrates economic affairs with climate change issues, rendering it a very powerful Department. Contrariwise, the Ministry for Environment, Nature Conservation, Building and Nuclear Safety[2] (BMUB) in Germany was reportedly blocked several times by the Ministry of Economic Affairs and Energy. For example, the latter apparently vetoed against the timely publication of the LT-LEDS before the COP22 in Marrakesh in 2016 (Süddeutsche Zeitung, 2016[16]).

3.2. Stakeholder engagement as a central pillar for initiating national dialogue for the LT-LEDS

Stakeholder engagement is a central pillar of a national dialogue on a country's LT-LEDS both related to climate change mitigation, but also to other policy goals. Wider stakeholders, including environmental groups, trade unions, business associations, and the general public, have specialised knowledge that is valuable for the government. Incorporating this knowledge and addressing the concerns of these stakeholder groups in the process of creating the LT-LEDS embeds climate change mitigation within broader societal dialogue and agreements. This helps to anticipate and resolve trade-offs while enhancing the political support and acceptance of the final document and the strategy itself.

In the three countries studied for this analysis, a range of stakeholders were involved, both in the creation and in the follow-up of the LT-LEDS. Both Germany and France organised several workshops with key stakeholders, including trade unions, business associations, civil society groups and subnational governments as part of the LT-LEDS process. In France, stakeholders were also heavily involved in the creation of a reference scenario that outlines the transformation of the economy towards a sustainable low carbon-economy and quantitatively underpins France's LT-LEDS. The UK opted for a targeted approach and consulted relevant stakeholders for specific questions related to the LT-LEDS as needed. However, none of the countries actively engaged younger citizens in the process of creating LT-LEDS. Given a growing awareness amongst youth, as evident by the Fridays for Future movement, countries should consider how to engage with these audiences and incorporate their preferences into the LT-LEDs. In France, the Citizens' convention on climate (Convention citoyenne pour le climat), created in October 2019 and composed by 150 citizens designed through a lottery, have 3% of members between 16 and 17 (Convention Citoyenne pour le Climat, 2019[17]). The engagement of youth in this citizens' convention will be the opportunity to incorporate their voice and proposals for future laws and when revising the LT-LEDS. In Germany, younger citizens are also engaged in initiatives not directly linked to the LT-LEDS process (see Box 3.1).

The experience from Germany, France and the UK points to four conditions that can facilitate stakeholder engagement, although not all four prevailed in all three countries. These include: i) transparency and a clear process and timeline to broaden participation; ii) the involvement of the general public at early stages, helping to kick-start the national debate; iii) eliciting feedback on the final draft document to enhance

political support; and iv) reviewing the stakeholder process to continuously improve the process for future iterations or other long-term strategies.

A clear timeline for the major steps in the consultation process during the creation of the LT-LEDS clarifies the opportunities for stakeholder engagement and ensures transparency, while broadening participation to include a diverse spectrum of public opinion. For example, in Germany, the government released an input paper that outlined the general structure of the German LT-LEDS (milestones, sectors, programme of measures). This also spelled out the process for stakeholder engagement, including the timeline for major stakeholder engagement opportunities. Moreover, the German government set up an online platform that provided information on the status of strategy and upcoming opportunities for stakeholder engagement, thereby ensuring transparency and broad participation.[3]

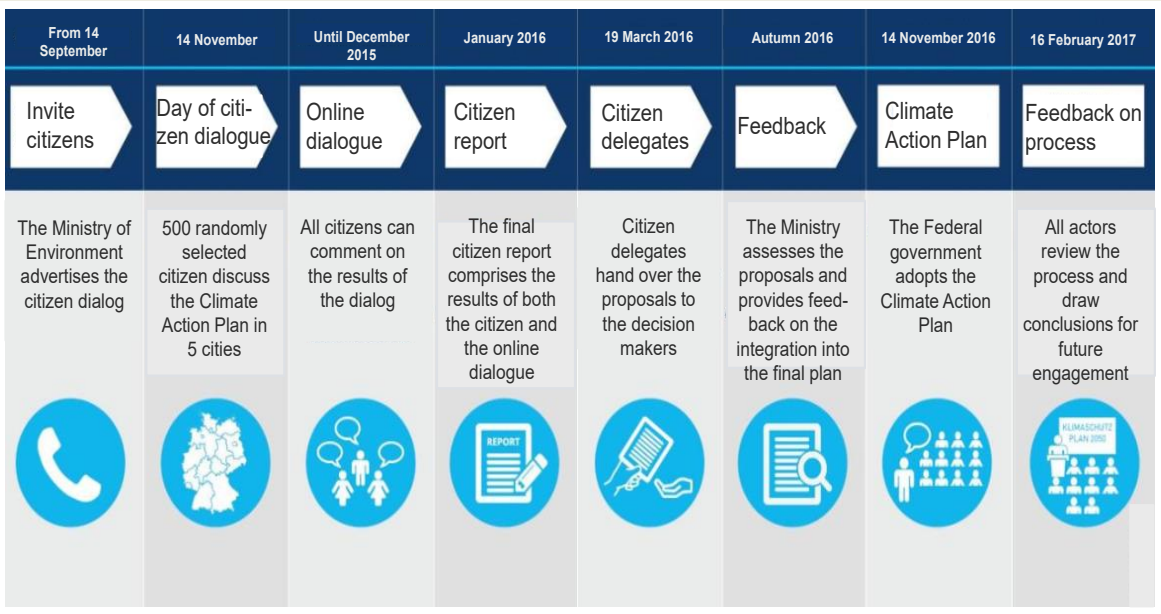
Involving key stakeholders, including associations and the civil society, at early stages is best practice for kick starting a national debate on a country's long-term vision while enhancing public support and political acceptability of the LT-LEDS. Not including key stakeholders in the early stage of developing the LT-LEDS increases the risk of narrowing the LT-LEDS process to a primarily an analytical exercise of climate mitigation scenarios. This could result in a missed opportunity for initiating a national debate on a country's long-term vision.

In the UK, members of the civil society provided comments on an ad hoc basis during the creation of the LT-LEDS, but are more actively involved in the implementation of the LT-LEDS. In contrast, French and German citizens could provide inputs during the creation of the LT-LEDS, but the magnitude and the time-scale of this involvement varied substantially. France conducted a month-long online public consultation in the early phase of developing the LT-LEDS, while Germany initiated a broad and sophisticated public dialogue with citizens that cumulated in a "citizen report". This report provided the basis to the final version of the German LT-LEDS (Box 3.1). In fact, 52 out of the 77 programme of measures in the final version of Germany's LT-LEDS where also proposed in the "citizen report".

Box 3.1. The German Dialogue with Citizens

Involving citizens was a central pillar for Germany in the development of its LT-LEDS. The German government opted for a new and sophisticated approach to engage citizens with the aim to gain broad support from across the society. Figure 3.1 outlines the major steps of citizen participation.

Figure 3.1. Timeline of the German citizen dialogue



Source: Authors, based on (BMU, 2018[18]).

Since 14 September 2015, citizens were randomly recruited by telephone for the participation in the dialogue. Random selection was chosen to make the pool of participating citizens as representative as possible of German society. Over 60,000 people were called, of whom about 2,500 were interested in taking part. Well above 500 actually registered themselves, with roughly 500 citizens participating on the day of the citizen dialogue. They met in 5 different cities (Hamburg, Essen, Leipzig, Nuremburg and Frankfurt) to discuss possible mitigation strategies and ultimately proposed 97 strategic measures. All citizens could comment via online dialogue on these proposals.

Youth representatives (below age of 18) could not participate in the German Dialogue with Citizens. This was a missed opportunity since this population group is likely to be most affected by the upcoming effects of a changing climate. Their voice and opinion is, thus, a key element of a broad stakeholder dialogue to create a LT-LEDS. In contrast to the German Dialogue with Citizens, youth representatives are frequently invited for other German stakeholder events addressing environmental issues. In fact, in the run up to COP23 in Bonn, Germany organised a dedicated Dialogue ("Our Climate; Our Future"), inviting exclusively citizens between age 16 and 25 to discuss climate-relevant policies and strategies.

In January 2016, the outcome of the citizen dialogue, including the online consultation resulted in the final version of the 'citizen report'. The citizen delegates and representatives of associations, municipalities and federal states then merged their suggestions, with those of the citizens clearly marked. Together, they handed over this merged report to the then Minister for the Environment, Barbara Hendricks, on 19 March 2016. After assessing the proposals from the dialogue process and

providing oral feedback to the all delegates, the Ministry for the Environment incorporated 52 out of the 97 strategic measures proposed by the participants into the final version of the LT-LEDS. The German government adopted the LT-LEDS on 14 November 2016, exactly one year after the day of the citizen dialogue.

On 16 February 2017, the Ministry for the Environment organised a final conference which aimed at reviewing the stakeholder engagement process, in particular the involvement of citizens. The Ministry commissioned an external consultancy that interviewed major actors in the stakeholder process and summarized the insights in a final evaluation report. The insights of this report can inform engagement processes in the future.

Source: Authors, based on (BMU, 2018[18]).

As stated earlier, eliciting feedback and comments from key stakeholders on the (pre) final version of the strategy helps to strengthen political support in the implementation of the strategy. Germany released a final draft of the LT-LEDS in early September 2016 eliciting comments from key stakeholders (NGOs, trade unions, business associations, subnational and local governments) within one month. These comments were incorporated in the final version of the LT-LEDS, published in November 2016. In contrast, the UK and France chose to consult the public only on the final completed version of the document. Inputs from the consultation will be taken into account when the strategy is updated, potentially in 2020.

Reviewing the stakeholder engagement process after the fact can reveal valuable insights that help to improve the process when updating the LT-LEDS, and can also be useful for non-climate related long-term strategies. Germany commissioned an external consultancy, Prognos, to evaluate the stakeholder engagement. The consultancy gathered feedback from all stakeholder groups by analysing their documents submitted as well as by interviewing representatives of the respective groups. Most stakeholder groups evaluated the process chosen by the German government as very positive, but some potential for optimising the process was identified (Prognos, 2017[19]). For example, stakeholders reported that their expectations of the importance of the dialogue had been too high. Providing more clarity on the role of the dialogue upfront could have better managed stakeholders' expectations. This and other findings will feed into the design of the stakeholder process for updating the LT-LEDS and can also provide valuable insights for stakeholder engagement for other non-climate related long-term strategies. For example, in France, in response to a major social uprising against the increase of carbon taxation as envisioned in the LT-LEDS (details in section 4), the Citizens' convention on climate (Convention citoyenne pour le climat*)* had been put in place (see further details in paragraphs above). Its role is to formulate proposals and measures for the fight against climate change[1], in a social justice perspective (Convention Citoyenne pour le Climat, 2019[17]).

3.3. Policy coordination with different actors across sectors

Policy coordination with other ministries ensures the incorporation of technical knowledge of sectoral experts, adding to the credibility of the LT-LEDS. It also helps identify potential trade-offs and synergies between the LT-LEDS and other sectoral strategies. Based on the three case studies, three ways to coordinate policy, ultimately enhancing policy coherence are: i) involving other ministries as well as subnational and local governments and initiatives to broaden the scope and enhance political support; ii) building on pre-existing sectoral, regional and urban strategies.

Involving different ministries in the creation of the LT-LEDS broadens the scope of the strategy by incorporating their expertise (and economic sectors). Broadening the scope beyond climate mitigation also facilitates a national strategic dialogue on a country's long-term vision with respect to both climate change

[1] The proposals and measures for a reduction of GHG emissions reduction by at least 40%.

mitigation and other policy priorities. Involving other ministries as well as different levels of government also enhances credibility because it promotes ownership of the LT-LEDS. All three countries involved a range of ministries in the creation of the LT-LEDS in one way or another. France involved relevant ministries in the modelling of the reference scenario that underpins the LT-LEDS (see section 3.4), by creating a Steering Committee, co-chaired by the Ministry of Ecology, Sustainable Development and Energy and the Agency for the Environment and Energy Efficiency (ADEME). The Steering Committee was composed of experts from relevant ministries and industry (energy, transports, construction, agriculture, forestry, waste management, etc.). Similarly, the BEIS in the UK used inputs from other Departments, which have their own resources and tools for climate change mitigation, as basis for the potential sectoral targets in the UK's LT-LEDS. In Germany, other ministries[4] - Federal Ministry of Economic Affairs and Energy, Federal Ministry of Food and Agriculture, Federal Ministry of Transport and digital Infrastructure provided substantial input throughout the creation of the LT-LEDS, highlighting their priorities. For example, competitiveness concerns – a major topic of the Ministry of Economic Affairs and Energy – are mentioned frequently in the final version of the LT-LEDS (see Table 3.3).

Table 3.3. Collaboration between ministries when creating the LT-LEDS

	France	Germany	UK
Who lead the creation of the LT-LEDS?	Ministry of Ecology, Sustainable Development and Energy	Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety	Department of Business, Energy and Industrial Strategy
Who was part of the steering committee?	Co-chaired by the Ministry of Ecology, Sustainable Development and Energy, and the Agency for the Environment and Energy Efficiency (ADEME)	No steering committee has been established	No steering committee has been established
Which other ministries or agencies have been involved?	Relevant sub-Ministries of the Ministry of Ecology, Sustainable Development and Energy (Transports, Industry, Forestry, Waste Management, Industry); Ministry of Agriculture and Food Ministries of Economic Affairs and Education are consulted but not co-authors of the LT-LEDS	Ministry of Economic Affairs and Energy, Ministry of Food and Agriculture; Ministry of Transport and digital Infrastructure	Department of Food and Agriculture, Department of Business, Energy and Industry, Department of Transport

Engaging subnational entities helps build political support for the LT-LEDS. In France, territorial authorities from the Conseil National d'Evaluation des Normes as well as overseas territories were extensively involved in the creation of the reference scenario that underpins the LT-LEDS. Moreover, France incorporated the existing mitigation strategy at the subnational level (regional level: Schéma Régional d'Aménagement, de Développement Durable et d'Egalité des Territoires; local level: Plan Climat Air Energie Territorial) into its LT-LEDS, thereby accounting for subnational policy initiatives and reduction targets thus improving policy coherence across levels of governments. In Germany, the federal states (Länder) and local authorities engaged throughout the creation of the LT-LEDS. They participated in the citizen dialogue as well as in stakeholder workshops commenting on each iteration of the German LT-LEDS. In addition, several existing and prospective local and subnational climate actions are mentioned in the final version of the LT-LEDS, suggesting that their impact on GHG emission reductions has been considered at least to some extent when defining the reduction targets. In contrast, the UK clearly distinguished between national and local areas of action. For example, power is in the authority of the national government while most agricultural policies are enacted at the subnational level. Since UK's LT-LEDS focuses on areas under the control of the national government, other climate action areas are omitted since these are in the purview of local authorities. For example, agriculture is overlooked in the UK's LT-LEDS since it's covered regionally. Likewise, Scotland has a LT-LEDS but there is no coordination between the UK's strategy and Scotland's (expert interview).

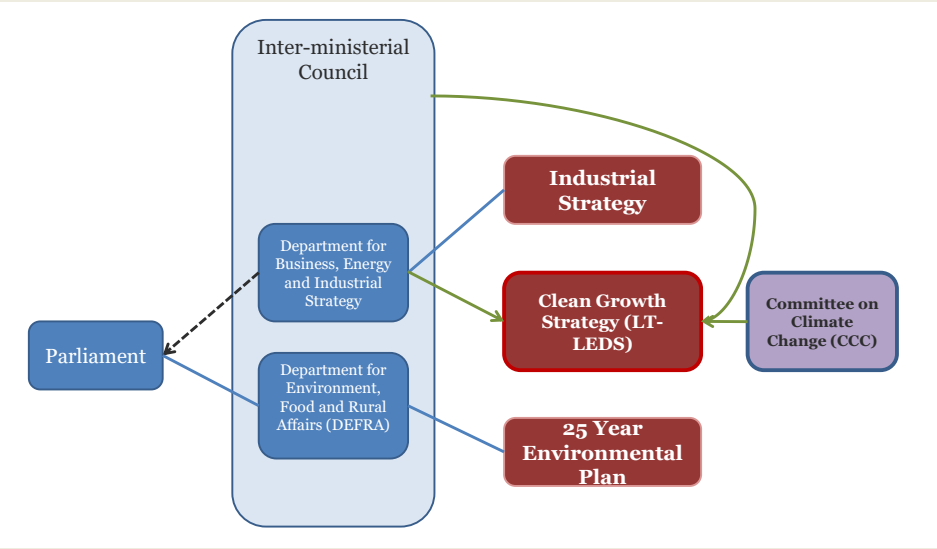
Building on existing climate or energy-related strategies enhances credibility, promotes time consistency, and ensures that priorities set by the LT-LEDS are consistent with sector specific conditions. All countries

took into account existing climate or energy strategies when creating their LT-LEDS. For example, Germany used the targets from the energy transformation (Energiewende) and the energy efficiency strategy as building blocks for the calculation of the sectoral reduction targets for some sectors. France incorporated into its LT-LEDS the Multiannual Energy Plan, which is the second outcome of the Energy Transition for Green Growth Act and aims at monitoring the existing energy policies. The UK's LT-LEDS draw future linkages with the 25 Year Environment Plan created by Department for Environment, Food and Rural Affairs, and published few months after the LT-LEDS (Box 3.2).

Box 3.2. Links between the UK's LT-LEDS and other strategies

The LT-LEDS (Clean Growth Strategy) has two sister documents: the Industrial Strategy and the 25 Year Environment Plan. The Industrial Strategy is an economy-wide vision for the direction of the economy; it is not a strategy on how to decarbonise the industrial sector. The 25 Year Environment Plan monitors the natural assets and ecosystem services in the UK. The Industrial Strategy and the LT-LEDS are created and monitored by the Department of BEIS, while the 25 Year Environment is created and monitored by the Department for Environment, Food and Rural Affairs (DEFRA). The Industrial Strategy and the 25 Year Environment Plan are monitored by two different non-governmental bodies, the Industrial Strategy Commission and Natural Capital Committee, respectively. As stated before, the Committee on Climate Change monitors the LT-LEDS.

Figure 3.2. Links between documents



Note: Blue represents governmental bodies, red represents documents, and purple represents non-governmental bodies. Green arrows represent a "monitoring" function and black dash means the body is producing an annual report on progress on the Clean Growth Strategy.
Source: Authors.

Developing the LT-LEDS is an opportunity to lay out a broad long-term vision that encompasses climate change mitigation, but also other important policy areas. The UK's BEIS seized this opportunity by creating its LT-LEDS hand-in-hand with the Industrial Strategy for which it also has responsibility. This exploited the synergies between strategies and ensured a complementary context. In fact, the UK's LT-LEDS highlights that early action on low-carbon growth is an opportunity for the UK's economy since it may allow UK firms to benefit from first-mover advantages in the development and manufacturing of high tech low-

carbon technologies. In parallel, the UK's Industrial Strategy includes four action points for the upcoming decades, one of which is clean growth (the objective of the LT-LEDS).

3.4. Long-term planning and modelling to demonstrate the feasibility of the interim and long-term targets

Underpinning the emissions reduction targets and emission pathways of the LT-LEDS with scientifically sound modelling demonstrates the feasibility of the LT-LEDS targets. Furthermore, it creates technical know-how for future iterations of the LT-LEDS or for the creation of other long-term strategies. Both transparency in the underlying model assumptions and the use of state of the art methods further increases the credibility of the targets and pathways in the LT-LEDS.

The following conditions facilitate robust and informative long-term planning: i) the use of science-based modelling tools to enhance credibility; ii) the use of in-house models to build capacity; and iii) transparency in the assumptions and limitations of the models to enhance credibility.

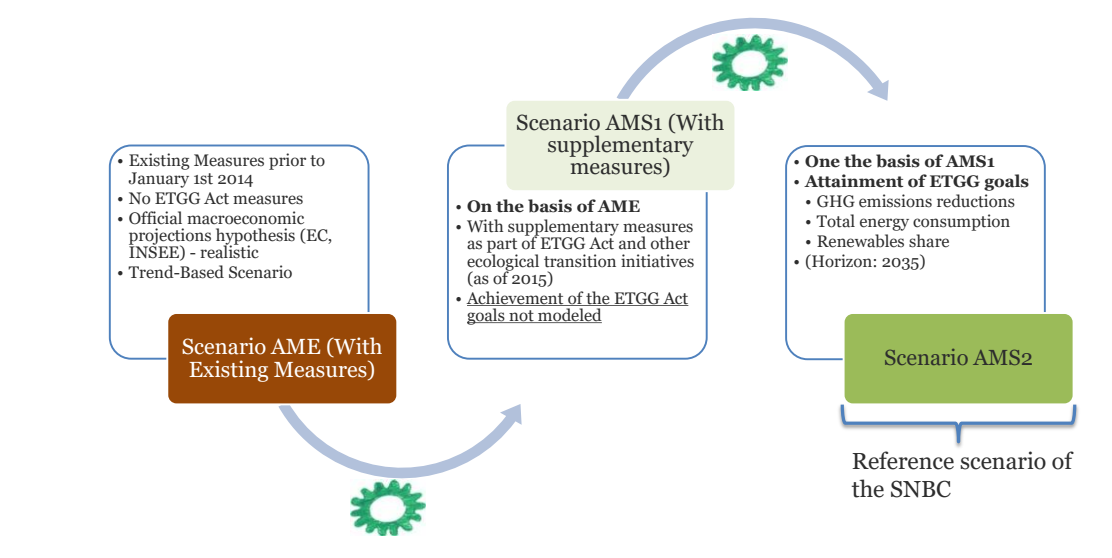
Using science-based modelling tools demonstrates the technical feasibility of the economy-wide emission reduction targets, thereby enhancing the credibility of the LT-LEDS. All three countries determined economy-wide GHG reduction targets in a political process, using information derived from modelling exercises. After setting the targets, the three countries verified the feasibility of emission reduction targets using bottom-up sectoral models. These models typically incorporate assumptions about aggregate socio-economic variables (population, GDP growth, etc.) as well as sector-specific variables (e.g. energy intensity, carbon intensity, demand) to project emissions paths. These assumptions are based on a critical review of current and expected technological options for the sectors (Box 3.3 on France's reference scenario).

All case study countries used sectoral models to break down the economy-wide targets into sectoral targets or indications, but the approaches of using science-based modelling tools differ. The UK and France predominantly used existing in-house sectoral models developed in co-operation with external research institutes. These models already existed before the creation of the LT-LEDS to determine the emissions path in the UK and the carbon budgets until 2028 (France). France developed a central reference scenario based on sector-specific models (or specific types of gas) used by other ministries and provided by external modelling firms, to ensure consistency of the results across ministries and sectors. The UK combined relevant ministries' sectoral models into one model. For example, the possible emission pathway for the transport sector used the UK's National Transport model while BEIS's Dynamic Dispatch Model was employed for the power sector. Germany assessed its aggregate and sectoral targets based on existing scenarios from the scientific literature and commissioned one study from a research institute, which included modelling exercises. The sectoral targets of Germany's LT-LEDS are in line with the findings from the literature but it remains unclear how exactly Germany determined its sectoral targets by 2030. This weakens transparency and ultimately the credibility of the LT-LEDS. However, Germany carried out an ex-post impact assessment of the sectoral goals to assess the feasibility of the goals and to evaluate the impact on non-climate related goals (see Section 3.5).

Box 3.3. France Scenario Reference Building

The Reference Scenario developed for France's LT-LEDS, the so-called AMS2 (Avec Mesures Supplémentaires 2), reflects the most plausible GHG emissions path, including sectoral measures and emissions, and is used as a reference to build the LT-LEDS. Even if other trajectories in terms of GHG emissions reduction were possible, the choice of the reference scenario relied on a thorough reflection led by the Steering Committee, and backed by wide sensitivities testing to ensure robustness and realism. It shows the extent of the efforts that would need to be made, both across sectors and at sectoral levels, to achieve the climate mitigation ambitions that are outlined by the LT-LEDS. The AMS2 is the result of a successive modelling exercise leading, from existing measures (as of 1st January 2014), to the achievement of the Energy Transition for Green Growth Act objectives (see Figure 3.3), as well as a broad discussion involving key national stakeholders (trade unions, business associations, civil society), but also experts from industries and relevant ministries (see section 3.3). Furthermore, the reference scenario is consistent with plausible future macro-economic conditions, as official projections from the European Commission and INSEE[1] were used as inputs of the model. The Steering Committee leading the elaboration of the reference scenario supervised a series of stress testing to ensure robustness of the modelling outcome.

Figure 3.3. Steps for developing France's Reference Scenario



Note: Existing Measures refer to measures existing before January 1st 2014.

At the time of its elaboration, the AMS2 constituted a reference for guiding purposes. As part of the revision of the French LT-LEDS, which is aimed to be validated and officially published in 2019[2], a new scenario (AMS2+) will be defined with updated quantifications and newly proposed complementary measures, based on the modelling (conducted by ADEME) of the reinforcement of some measures and the introduction of new ones, outlining the necessity to increase the ambition to reach the targets of the Law.

Source: Authors, based on (Ministère de la Transition écologique et solidaire, 2015[8]) and (ADEME, 2017[20])

[1] Institut National de la Statistique et des Études Économiques.

Involving external experts, including research institutes or consultancies in the modelling can enhance the credibility of the modelling and of the LT-LEDS. External research institutes experienced in sophisticated modelling understand the intricacies of modelling while applying state-of-the art methods. This underpins the LT-LEDS by a more robust and scientifically sound analysis and ultimately enhances credibility. In all cases, external consultants were involved in the modelling exercise. Germany's underlying models were exclusively developed by external experts while France and UK developed their scenarios in co-operation with external research institutes or modelling firms.

Sound scientific standards and transparency with respect to the assumptions underlying the modelling exercise can strengthen credibility. All countries used state of the art modelling tools and ensured transparency regarding the underlying assumptions and model description. In some cases, the models also provide information on non-climate mitigation related dimensions such as distributional consequences and impacts on employment. The next section discusses the integration and quantification of these dimensions.

3.5. Policy integration by considering interactions with other policy objectives

Assessing the impact of climate change mitigation goals laid out in the LT-LEDS on other policy dimensions informs policy makers and stakeholders about synergies and potential trade-offs of decarbonising the economy. Putting the LT-LEDS in a broader framework of sustainable development reveals potential synergies that can leverage the ambition of climate change mitigation, but also points to trade-offs to be addressed. While all LT-LEDS examined in this report mention potential synergies and trade-offs, only France quantifies the impact of the LT-LEDS on other policy objectives in an ex ante assessment. The French estimate predicts that the LT-LEDS will have a positive impact on economic growth while reducing household energy bills through improvements in energy efficiency.

Germany conducted the impact assessment of the sectoral goals in 2018 (discussed more in detail in Section 4), two years after the publication of the LT-LEDS. This assessment quantified the impact of the sectoral goals by 2030 on other policy priorities, including competitiveness, employment, cost of housing, and local air pollution (Öko-Institut e.V. et al., 2018[21]). The 2018 impact assessment stated that achieving the sectoral goals is related to, inter alia, reduced levels of local air pollution and positive impacts on economic growth, value added and net employment. Employment gains in some sectors outweigh employment losses in others, which need to be carefully addressed with.

[2] Still not legislatively validated at the date of the publication of this report.

4 Document

The content of the document is a reflection as well as a continuum of the LT-LEDS' development process. A LT-LEDS elaborated through a well-coordinated procedure and broad stakeholder engagement, and which is built on sound expertise and which integrates long-term planning, will be a robust and credible document. Analysing the documents developed by the three case study countries reveals a set of common elements that contribute to meeting the aforementioned objectives. Table 4.1 shows the key shared elements identified, and within these the main commonalities as well as differences.

Table 4.1. Main elements of LT-LEDS

Element	Commonalities across countries	Differences
Context setting	▪ Overview of historical emissions by sector ▪ Background on the Paris Agreement ▪ Long-term 2050 target and intermediate targets ▪ Key objectives/action items in each sector	▪ Historical GHG emissions included in the first chapter (FRA, UK) or chapter 5 (with measures, GER) ▪ Comparison of absolute emissions with other countries (FRA, UK) ▪ Economy-wide action items (FRA) ▪ Comparison with G7 (UK) ▪ Key indicator for tracking (UK) ▪ Embedded into EU and international climate policy (GER)
Vision	▪ Appears in the first few chapters of the document ▪ Presents the LT-LEDS as an economic opportunity to modernise, innovate and maintain competitiveness in a future sustainable world	▪ Level of detail in the vision (FRA being the most detailed) ▪ Emphasis of multilateral approach (GER)
Pathway/Scenario to a low-carbon economy	▪ Selected one pathway to reduce GHG until 2050 for GER as well as FRA, and to 2032 in UK linked to the carbon budgets already approved and subject to forthcoming recommendations	▪ FRA and UK included details on the modelling of the pathway unlike GER ▪ UK added 3 "extreme" pathways until 2050
Policy recommendations and measures	• Outline the recommendations, action items and policies for each sector • Link these to other existing strategies, where relevant	• FRA and UK included needed investment • FRA and GER include cross-sector actions • Aligning non-climate policies with mitigation goals (GER) • Level of detail of these recommendations and measures o Detailed and numerous policy recommendations (FRA) o General policy actions and areas of intervention for the future (UK) o Strategic measures without much detail on concrete climate policies (GER)
Monitoring the implementation of the strategy	▪ Include indicator(s) to track progress ▪ Assign responsibility for implementation between and across government ▪ Outline how strategy is going to be updated	▪ UK includes a timeline ▪ FRA includes a wide range of indicators and a monitoring process

4.1. Political commitment: expressing vision and means

Countries illustrated political commitment in the LT-LEDS by defining (1) a future vision along with long-term targets, (2) providing a clear indication of the responsibilities across sectors, (3) defining responsibilities between levels of government, and (4) providing the means on how to achieve these objectives.

4.1.1. Setting clear targets in terms of emissions reductions and their implications

Vision

Setting out a clear vision in the strategy of the major changes needed to reach climate ambitions is key. It is important that the vision is described through a clear narrative that shows the level of ambition and the magnitude of the transformative shift in order to add credibility. All three countries developed and incorporated a clear vision of which changes are needed to reach their emissions reduction goals in their documents, and also made links to other policy priorities rather than focusing exclusively on climate change mitigation objectives.

France's strategy establishes that it has embarked on an energy transition which aims to put the country on a green and sustainable growth pathway. Alongside reducing GHG emissions, the strategy is meant to create better jobs and improve the quality of lives, while restoring as well as protecting biodiversity. Major transformations across all sectors of the economy are set out (transport, buildings, energy, industry, agriculture, forestry). The overall energy production and consumption system is expected to be modernised, investments will be massively oriented towards energy efficiency, renewable energies and clean technologies, and innovation and entrepreneurship will be important drivers for growth.

Germany's LT-LEDS establishes the goal of extensive greenhouse gas neutrality by mid-century. Given this net-zero target, the long-term strategy provides a framework for all stakeholders, including investors and firms. According to the document, acting quickly on climate change will also enhance the competitiveness of German firms in a low-carbon world. Moreover, the transformation is seen as an opportunity for economic growth that will position German firms to export high-quality environmental goods. The document highlights that the process needs to be smooth and avoid structural breaks, in particular, for the coal-dependent regions.

The UK's LT-LEDS is at the heart of the government's National Industrial Strategy, a national plan to boost overall productivity and increase earning power throughout the UK. The LT-LEDS aims to transform the whole economy and modernise all sectors (industry, buildings, transport, power, agriculture and forestry) while ensuring climate neutrality and economic growth. Large green finance investments are expected to support technological innovation, modernisation of buildings, transport and power sectors, while protecting households and businesses from energy costs (BEIS, 2017[22]).

Target

Setting specific long-term GHG emission targets in the LT-LEDS provides a clear signal on what the desired future will look like. These targets can be set in either absolute or relative terms, i.e., in terms of the total quantity of GHG emission reduction compared to a base year or the volume per unit of GDP. Setting absolute targets ensures credibility and certainty over time, whereas relative targets can weaken the political signal on a country's actual commitment, but gives more flexibility in achieving targets in the light of other priorities and trends, such as income and population growth.

All three countries set absolute targets in their LT-LEDS, backed by modelling exercises. For example, the UK Climate Change Act from 2008 outlines legally-binding carbon budgets. Based on modelling exercises, absolute targets have been derived from these carbon budgets and outlined in the UK's LT-LEDS. The

legally binding carbon budgets set against the 1990 levels are: 2544 Mt CO2eq for 2018-2022 (- 37% vs 1990 levels), 1950 Mt CO2eq for 2023-2027 (-51% vs 1990 levels), 1725 Mt CO2eq for 2028-2032 (-57% vs 1990 levels). The absolute emissions reduction targets illustrate the level of commitment of reaching climate mitigation ambitions. In the LT-LEDS, the UK set a 2050 target to reduce GHG emissions by 80 % below 1990 levels, in line with the Climate Change Act. Advice and recommendations for determining the carbon budgets are provided by the Climate Change Committee (CCC), which is an advisory and monitoring body created in 2008 as part of the Climate Change Act.

France's Energy Transition for Green Growth Act outlines legally binding GHG emissions reduction targets. France's LT-LEDS outlines successive reduction of emissions in the short, medium and long term; which are also in line with the EU's emissions reduction targets. France aims to cut its GHG emissions by 14%[5] by 2020 (against 2005 levels), 40% by 2030 (against 1990 levels) and 75% by 2050 (against 1990 levels) so-called "factor 4"[6]. In addition, France adopted 5-year carbon budgets (except for the first one that is four years), which are based on the reference scenario. The budgets are set to 442Mt CO2eq for 2015-2018, 399 Mt CO2eq for 2019-2023 and 358 Mt CO2eq for 2023-2028[7]. However, in February 2019, a new law Proposal was presented to the Economic, Social and Environmental Council (national consultative Assembly), outlining amendments regarding the "Factor 4" target, and suggesting, inter alia, to replace the -75% GHG emissions cut by 2050 by a different target: achieving carbon neutrality by 2050. In addition, the Proposal also plans to push the reduction by 50% of the share of nuclear power in total energy production to 2035 instead of 2025 as initially enshrined in the law. This goal is intended to be outlined in the revised LT-LEDS as well as the new law to be adopted in 2019.

Germany's LT-LEDS sets out reduction targets aiming at extensive greenhouse gas neutrality by 2050 (BMUB, 2016[9]). GHG emissions should be reduced by 80 to 95% by 2050 relative to 1990 levels. The intermediate targets are GHG emission reductions of at least 40% by 2020, at least 55% by 2030 and at least 70% by 2040 (relative to 1990 levels). While none of these are legally binding in nature, the German Government is currently preparing a climate action law that may enable legal action by state and non-state actors if the targets are not met.

4.1.2. Providing a clear indication for mitigation in different sectors

Providing a clear indication of how emissions in different sectors are projected to evolve enables countries to increase the credibility of achieving the overall target. Nonetheless, the language used and the approach can create flexibility which is also needed for enhancing credibility given the long-term horizon. Indeed, discretion within rules (in this case sectoral goals) allows for timely adaption to new information (i.e., technological breakthroughs) and shocks. However, too much discretion can make targets vulnerable to political change (Nemet et al., 2017[23]). The three case study countries opted for different ways to face this. In France, sectoral carbon budgets and the corresponding sector specific targets are derived from the total national carbons budget available: 2015-2018, 2019-2023, and 2024-2028. Other non-GHG emission targets were added, such as the number of energy efficient homes built each year (e.g. 330,000 annually for 2015-2016 period), or the number of electric cars deployed (1.9 million by 2030). Sectoral budgets are reviewed annually and adjusted if needed. In case of major changes, additional revisions and adjustments are possible. The breakdown by sector (and by type of gas) has been determined by experts on the steering committee and informed by sector models. Sectoral targets were introduced to provide guidance rather than to set binding targets (Ministère de la Transition écologique et solidaire, 2015[8]). Nevertheless, the sectoral breakdown of the budget is a central tool used for monitoring progress across sectors, providing early warnings of the risk of not meeting the national carbon budget, while helping identify corrective measures (see Table 4.2).

Table 4.2. France's sectoral carbon budgets: Emissions (Annual Average – Mt CO_2Eq)

	1990	2013	1st carbon budget	2nd carbon budget	3rd carbon budget
Transport	121	136	127	110	96
Residential / Tertiary	90	99	76	61	46
Manufacturing Industry	148	88	80	75	68
Energy Industry	78	57	55	55	55
Agriculture	98	92	86	83	80
Of which N_2O	*44*	*40*	*37*	*35*	*34*
Of which CH_4	*42*	*39*	*38*	*38*	*37*
Waste management	17	20	18	15	13
Of which CH_4	*14*	*17*	*16*	*12*	*11*
Total annual average emissions	**552**	**492**	**442**	**399**	**358**
Of which CO2	*400*	*367*	*323*	*288*	*257*
Of which N2O	*69*	*60*	*57*	*54*	*51*
Of which CH4	*71*	*44*	*42*	*41*	*40*
Of which fluorinated gases	*12*	*21*	*20*	*16*	*10*

Source: Authors, adapted from (Ministère de la Transition écologique et solidaire, 2015[8]).

Germany has set a narrow range of targets for each sector in the LT-LEDS. Target ranges are provided for 2030, and thus correspond to only one of the intermediate domestic milestones (rather than to several of them as in the French case). The LT-LEDS's total reduction of greenhouse gas emissions of at least 55% by 2030 (relative to 1990), is broken down by economic sectors: Energy: 62-61%, Buildings: 67 – 66%, Transport: 42 – 40%, Industry: 51 – 49%, Agriculture: 34- 31%. The LT-LEDS mentions a comprehensive impact assessment that was carried out in 2018, the result of which will be discussed in section 4.3.

In the case of the UK, the Clean Growth Strategy does not include binding sectoral targets but provides indicative ones based on BEIS's modelling. The Clean Growth Strategy specifies potential developments across sectors based on the 2032 Pathway (see Table 4.3). Estimates of these emission levels (for 2032 and for the 2028-2032 period) assume implementation of current policies as well as additional policies that would be required to meet the 5th carbon budget. Additional policies for each sector are based on a marginal abatement cost curve, which aims at developing a cost efficient pathway to meet the carbon budgets (assuming current market, technological and structural conditions). The methodology is described in the *Impact Assessment* supporting document. This analysis is complemented with information on existing barriers to different actions, and considerations on the rate at which low carbon options could be adopted, as well as on the time that making key decisions could take.[8] The inclusion of these sector-specific emission levels aims to provide a sense of how they could evolve, but the strategy explicitly acknowledges that these levels correspond to only one possible pathway of meeting the carbon budget.

It is worth mentioning that in all three cases, indication of sector-specific future emissions targets are provided for the medium term: until 2028 (France), 2030 (Germany) or 2032 (UK), even when a national target for 2050 is provided.

Table 4.3. UK indicative sectoral budgets – 2032 Pathway (Mt CO_2Eq)

		2032	Fifth Carbon Budget (2028-2032)
Business and Industry	Traded	54	283
	Non-Traded	30	158
	Total	**83**	**441**
Homes	Traded	0	1
	Non-Traded	58	301
	Total	**58**	**302**
Transport	Traded	2	10
	Non-Traded	81	435
	Total	**83**	**446**
Power	Traded	16	82
	Non-Traded	0	0
	Total	**16**	**82**
Natural Resources	Traded	0	0
	Non-Traded	41	215
	Total	**41**	**215**
Public sector	Traded	0	1
	Non-Traded	4	22
	Total	**4**	**23**
Total	Traded	72	377
	Non-Traded	213	1132
	Total UK emissions	**285**	**1509**
	Assumed UK share of EU ETS allowances		590
	UK Net Carbon Account (non-traded emissions plus UK share of EU ETS allowances)		1722

Note: Emissions over the fifth carbon budget are cumulative over the period 2028-2032, whereas the 2032 figure in the corresponding column are projected in that year alone.
Source: Authors, adapted from (BEIS, 2017[22]).

4.1.3. Defining responsibilities

The strategy should also explicitly assign responsibilities across all levels of government and to state and non-state actors alike, including sectoral agencies, local authorities and citizens. Importantly, a clear allocation of responsibilities can enhance political commitment since it provides a clear overview of who is accountable for which target and for implementing the necessary policies. This demarcation of responsibilities can, of course, be adapted over time in the light of developments in the national and sub-national administrative structures.

In general, in decentralised countries the responsibility for implementing climate action falls to a larger extent on local authorities, sub-national governments or federal states, provided that the transfer of responsibilities is matched with a transfer of funds and the creation of local capacity. Even then, some guidance and support from national governments is central to implementing the strategy (as discussed in the next section on implementation). Conversely, in centralised countries, local authorities need more direct technical and financial support from the government. The central government plays a more prominent role in implementing the necessary actions to meet the LT-LEDS targets since a wider set of decision-making powers on local issues are assigned to the central government.

4.1.4. Means to achieve ambition

In addition to setting goals and providing guidance to different ministries and levels of government LT-LEDS can outline cross-cutting and overarching policies to facilitate the achievement of the ultimate objectives set in the strategy.

France's LT-LEDS outlines a broad range (23 in total) of cross-cutting policy recommendations that are formulated around the following actions (note that none of these have been passed into law):

- Reducing carbon footprints and placing this objective at the heart of decision-making (e.g. integrating life-cycle analysis in public projects, notably in transport and buildings);
- Reorienting investments (by raising awareness among institutional stakeholders on the impact of their investment choices, e.g. through life-cycle analysis as a selection criteria for projects, and gradually increasing the price of carbon);
- Managing land sustainably (e.g. by enhancing urban planning and in this way bringing residential developments closer to jobs and leisure facilities);
- Supporting regional project initiatives (e.g. the creation of Positive Energy Territories for Green Growth initiative, which are considered as champions as part of the ecological and energy transition - discussed in Section 5);
- Conducting research and innovation (e.g. creating renewable energy excellency research streams);
- Promoting education and involving citizens (e.g. by including climate change in schools programmes). Some policy recommendations have been announced to be adopted in the French Law. For example, the French government presented to the Senate in July 2019 its "Economic Circular Law" proposal.

In addition, cross-cutting policies that can help establish a policy framework conducive for climate action, such as carbon pricing, removal of environmentally harmful and inefficient subsidies, and regulations are outlined in the French and German LT-LEDSs. In particular, the German government documented in its LT-LEDS the following overarching policies:

- Improving the national system of taxes and levies to make it climate-friendly and eliminating environmentally harmful subsidies;
- Promoting and providing incentives for climate-friendly investments;
- Putting in place efficient financial markets to encourage climate-conscious investment decisions;
- Assessing societal progress and putting well-being and SDGs as a priority when defining climate change mitigation policies;
- Promoting Research and Development as a driver of innovative climate action;
- Fostering international co-operation on climate action, notably with respect to carbon pricing.

The UK Clean Growth Strategy presents "action items". However, details on the implementation of each action item are open for interpretation by experts and stakeholders. For example, developing green finance is one of the key drivers for green growth in the UK. Therefore, one action item aims to accelerate Clean Growth by setting up a Green Finance Taskforce, which will provide recommendations for public and private investment to meet carbon budgets as shown in Table 4.4. The Green Finance Taskforce is responsible for disbursing funds in the most adequate way and on a case by case basis, which is why the description on how this disbursement is to be made is intentionally left general.

The Green Finance Taskforce will also work with the British Standards Institution (technical standards for products and services) to develop a set of voluntary green and sustainable finance management standards. Further, it will work with mortgage lenders to develop green mortgage products that take

account for the lower lending risk and enhanced repayment associated with more energy efficient properties (BEIS, 2017[22]).

Table 4.4. Financing of the LT-LEDS in the UK

Government investments in clean growth technology 2015-2021

	Forecast Clean Technology Innovation Spend £ million (across Innovate UK, Research Councils, BEIS, DfT, DfID, Defra)			
	Basic & Applied Research	Technology Development	Technology Demonstration	Total
Innovation in Smart Systems (including energy storage)	175	43	47	**265**
Innovation in the Power Sector (including renewables)	209	276	154	**638**
Innovation in Homes (including heat and energy efficiency)	100	31	53	**184**
Innovation in the Transport Sector (including electric vehicles and batteries)	296	413	132	**841**
Innovation for Business and Industry, including carbon capture, usage and storage (CCUS)	57	47	58	**162**
Innovation in Natural Resources	69	30	0	**99**
Cross-sector Clean Tech Innovation (including for entrepreneurs)	234	62	91	**387**
Total (£ million)	**1140**	**902**	**534**	**2576**

Note: According to the UK LT-LEDS: "All figures are indicative and are subject to competitive bidding processes across sectors and value for money tests."
Source: Authors, adapted from (BEIS, 2017[22]).

The three LT-LEDS analysed highlight the importance of carbon pricing for the transformative shift needed to tackle climate change and move towards a sustainable economy. Other policies are also recognised as necessary for reaching the set level of ambition, including fostering Research, Development and Innovation. Putting in place carbon prices, whether through carbon taxes or emissions trading schemes, internalises the external costs of emissions and incentivises actors to reduce emissions. It also redirect investments and innovation towards low-carbon activities, and encourages the phase-out of fossil fuel based ones.

In France's LT-LEDS, information regarding the establishment of a tutelary value for carbon are outlined. The tutelary value is a carbon price which is a reference value for investments across all sectors of the economy (excluding ETS), determining the socioeconomic cost for the investor and the society per tonne of CO2 avoided. This reference value acts as a price-signal (or "carbon price guide"), so that investors can choose to direct their funding through projects whose abatement costs are below this value. The French government had put in place a Carbon Pricing Commission[9] in 2008 whose mandate was to conduct a study to identify the trajectory that the tutelary value for carbon should take in order to fit the ambitions

outlined as part of the Grenelle de l'Environnement. The Commission came up with a value of 100€/tCO2 by 2030, enacted by the Energy Transition for Green Growth Act in 2015 as the reference trajectory for carbon pricing. However, in its LT-LEDS, France is also calling for a reform, through higher carbon price guide, which would lead more efficient EU ETS[10] market. In 2018 and as part of the Finance Law Project 2018 (Sénat, 2018[24]), this trajectory was updated by the Minister of Ecological and Inclusive transition at that time, Nicolas Hulot, who found the ambition of the carbon price insufficient. In this new carbon price trajectory, a price of 86€ was expected to be reached in 2022, while the 2030 target of 100€/tCO2 was maintained.

Furthermore, as part of the revision of the LT-LEDS that was expected to occur in 2019, a more ambitious trajectory, 250€tCO2 by 2030 has been determined by the Commission as the one that better reflects the urgency to reach GHG reductions ambitions. The LT-LEDS also calls for a continuous increase of domestic taxes on fossil fuels. After the implementation of the first rise (+11.5% as of January 2019), a major social uprising (the Gilets Jaunes movement) took place, as a large portion of the population would be negatively impacted by higher fuel prices. This resulted in an erosion of public support for the government which decided to freeze the carbon tax trajectory until further notice. In order to overcome the crisis, a national debate ("Grand Débat") took place in early 2019, aiming to gain consensus at the national level on a range of topics including carbon taxation and public expenditures.

The German LT-LEDS states that carbon pricing is a central pillar for the German and European climate policy, and calls for a stronger price signal from the EU ETS. The German government did so by emphasising the need for a strong price signal in the discussions around market stability reserve that removes the surplus of allowances in the EU ETS to stabilise the permit price.

The UK's LT-LEDS reiterated the government's commitment to implement carbon pricing in emissions-intensive sectors. As a pioneer in carbon pricing, the country launched the UK ETS in 2002, as a pilot for the EU ETS in 2005. Since the EU ETS suffered from low permit prices, the UK introduced the Carbon Price Support in 2013. This is a national mechanism to supplement the EU ETS and requires UK power generators to pay a minimum carbon price referred to as the Carbon Price Floor (£16 in 2013, £18. until 2021). The UK LT-LEDS also mentions the Climate Change Levy (a tax on energy delivered to non-domestic users in the UK) whose rate will increase in 2019. The levy increased the price of electricity by 45% to 0.00847 GBP per KWh and natural gas by 67% to 0.00339 GBP per KWh. This is aimed at unlocking energy efficiency in the business and industry sectors. As part of Britain's exit from the EU, it is unclear whether the country will continue to participate in EU ETS, but the strategy states that it remains committed to using carbon pricing as a central tool for emissions reductions.

4.2. Policy co-ordination to harness the potential of all sectors of the economy

In addition to stating a clear vision and setting clear emissions reduction targets and actions, outlining sectoral policies that can contribute to achieving such goals is also relevant. Sound policy co-ordination across all sectors of the economy confers credibility, demonstrates that targets are attainable through concrete measures across government, and ensures that such measures are embedded in existing sectoral schemes and plans. It is important that sector-specific policies and actions be adaptable, to a certain extent, to provide flexibility to adapt to changing conditions. Even though there is a potential trade-offs between the flexibility and robustness of a strategy, this can be addressed by developing sound revision mechanisms (see section 5).

In France, sectoral policies under the LT-LEDS support implementation of the Energy Transition for Green Growth Act by highlighting expected future developments in each sector, informed by analyses on emission

drivers (e.g., number of cars in the case of transport). The LT-LEDS outlines 44 policy recommendations[3] for transitioning to a low carbon economy across sectors: Transport, Residential-Tertiary, Agriculture, Forest-Timber-Biomass, Industry, Energy Production, and Waste. These recommendations link the LT-LEDS to existing sectoral plans. For example, actions in the transport sector, such as the development of shared mobility, link to existing plans such as the Urban Transport Plans (PDU – Plan de Développement Urbain)[11] which include objectives related to the shift to a low-carbon economy. The PDU is in turn linked to other territorial plans: the Territorial Cohesion Plans (SCOT – Schéma de Cohérence Territorial), Inter-Municipal Local Development Plans Incorporating Transportation (PLUi-D - Plan Local d'Urbanisme intercommunal Déplacements), Territorial Climate-Air-Energy Plans (PCAET).

In addition, France's LT-LEDS builds on the Multiannual Energy Plan, which sets guidelines in terms of energy security supply, renewable energy, energy storage and networks, clean mobility, competitiveness and protection of consumers, and assessment on the evolution of skills. Such guidelines are useful to guide policies especially if a comprehensive list of policies is not provided.

The German LT-LEDS provides a roadmap for each sector of the economy listing needed 'strategic measures' to reach the targets. These strategic measures include, inter alia, setting up the commission for growth, structural change and regional development (a commission that determines the timeline and the policy package for the German coal exit) whose results were presented to the German government early 2019; a roadmap towards a carbon-neutral building stock with increasingly demanding energy standards for new buildings; a strategy for road transport addressing GHG emissions from cars, light and heavy duty vehicles and infrastructure; a research and development programme in co-operation with the German industrial sector, focussing on carbon capture and utilisation. Some of these strategic measures are already in place (e.g. EU ETS, Renewable Energy Act) or have been developed after the publication of the LT-LEDS (e.g. the recommendations of the commission for growth, structural change and regional development). Similar to France, the LT-LEDS links to several existing sectoral plans such as the Green Paper on Energy Efficiency, Strategy on Energy Efficiency in Buildings, Building Rehabilitation Programme, Energy-Efficient Urban Redevelopment, National Cycle Paths Plan, and Waste Prevention Programme.

The UK's LT-LEDS provides a package of measures for each sector, so-called "policies and proposals". An example of such a measure include, but are not limited to: unlocking business opportunities for energy efficiency, improving people's homes and reducing heating and electricity bills, accelerating take up of ultra-low emissions vehicles. The document first outlines the ambition for each sector, identifies the opportunities, and then provides objectives. Links to other sectoral plans are outlined in the LT-LEDS, such as the Energy Savings Opportunity Scheme (already in place), the Industrial Energy Efficiency scheme (to be created), and the Zero Emission Road Transport Strategy (July 2018) to achieve carbon neutrality in transport.

4.3. Long-term planning and certainty for the future

Including feasible pathways in the LT-LEDS illustrates aspirations on how to reach national long-term mitigation targets, and helps ensure credibility and transparency. However, these pathway(s) should be linked to existing national strategies and international targets to enhance coherence with other national priorities and pre-existing measures. Otherwise, there could be competing or misleading objectives and strategies.

All countries include one central pathway in the LT-LEDS up to the 2030s even where the process of creating the LT-LEDS considered multiple or alternative scenarios. Including multiple pathways in the strategy could create confusion in terms of the allocation of responsibility and capacity to reach ambition,

[3] To be revised as part of the update of the strategy that is expected to occur in 2019.

but allows for more flexibility to reach the economy-wide reduction target in the light of currently uncertain developments (e.g. in technologies). After the 2030s, countries therefore set out alternative pathways to 2050 and subsequent revisions of LT-LEDS will need to clarify the desired pathway beyond 2030.

In France, after a sound process of defining, choosing and stress-testing possible pathways, the LT-LEDS selected a single pathway ("reference scenario" outlined in section 3.4). The horizon of this scenario is 2035, but the carbon budgets are for 2028 to provide milestones along the way. Similarly, the UK included one pathway up to 2032, informed by sectoral models from the relevant departments. Past 2032, the UK modelled three "extreme worlds" where the 2050 target (80% below 1990 levels) is reached via an electrification pathway, a hydrogen pathway, and an emissions removal pathway.

- In the **electrification pathway**, electricity is the main source of energy in 2050. Gas boilers are replaced with electric heating, industry moves to cleaner fuels, and cars become electric. Altogether this means, the UK uses around 80 percent more electricity than today, and virtually all of it comes from clean sources (renewables and nuclear). In this pathway, Carbon Capture, Utilisation and Storage (CCUS) is not used in the UK by 2050.
- In the **hydrogen pathway**, hydrogen is used to heat homes as well as to fuel many vehicles. Existing gas infrastructure is adapted to suit hydrogen purposes, and add hydrogen fuelling stations to the existing network. A large new industry of hydrogen production is built using natural gas and CCUS.
- In the **emissions removal pathway**, sustainable biomass power stations are used in tandem with CCUS technology. Carbon is removed from the atmosphere by plants (biomass) as they grow and, when the biomass is used to generate electricity, emissions are captured and stored instead of returning to the atmosphere. There is still a significant clean transition in other sectors but successful innovation in emissions removal allows more time for some of these changes.

This approach allowed the UK to identify the type of technologies needed in the future regardless of which scenario is actually realised or dominates in future. The exercise also identified decisions that can be taken now, which would be valid in any of the extreme scenarios so-called "no regrets" options. The reductions across sectors corresponding to each extreme scenario is included in the Annex of the LT-LEDS.

In Germany, the LT-LEDS refers to the impact assessment carried out in 2018. This impact assessment showed two different pathways for achieving the sectoral targets by 2030:

- In the **high energy efficiency pathway**, all sectors experience higher efficiency improvements relative to a business as usual scenario to reach the 2030 targets. For example, in the buildings sector, most of the emissions reductions result from efficiency improvements instead of using renewable energy for space heating. The transport sector is assumed to witness large efficiency improvements of cars' internal combustion engines whereas the industry sector benefits from improvements in material efficiency as well as fuel switching (biomass and power to heat).
- In the **high renewable pathway**, all sectors are exploiting their potential for the use of renewable energy. For example, there is an increasing electrification of the car fleet which is fuelled by electricity from renewable energies. Similarly, the industry sector uses more electricity requiring a more stringent deployment of renewable energy sources, notably solar PV and wind.

Moreover, several studies underlying the LT-LEDS produced different scenarios (e.g. different pathways under low-growth/high growth assumptions and taking into account different technological options), but none of these pathways is explicitly illustrated in the strategy itself.

It is important for the LT-LEDS to relate to the NDCs under the Paris Agreement. The short-term (NDCs) and long-term (LEDS) targets must be aligned to avoid being off-track in the future trade-offs in 2030 and 2040. If NDCs are off track and unambitious, it will be harder to reach the goals and scenario outlined in the LT-LEDS in the future. The development of LT-LEDS is also an opportunity to revise NDCs. At present, among the three case studies, only Germany does not specifically link its LT-LEDS to the NDC[12], and their

of a reduction of GHG by 55% by 2030 relative to 1990 is fairly close to the European NDC and the Effort Sharing agreement among EU Member States. France highlights in its LT-LEDS that the second and third carbon budgets relate directly to the EU NDC, and outlines, for the first carbon budget, a breakdown between ETS and non-ETS emissions[13]. The UK mentions NDCs in the document but only to illustrate that greater action is needed. How the targets relate is not specified.

4.4. Policy integration, policy effects and monitoring

In order to ensure credibility and effectiveness of the policy framework, countries must clearly outline in their LT-LEDS the overall outcomes of their climate change mitigation strategies. Thus, integrating climate change mitigation policies into other relevant thematic plans, defining ways to avoid potential trade-offs that could arise, and establishing a sound monitoring mechanism that includes consideration of the effects on sustainable development and socioeconomic priorities is crucial.

4.4.1. Integrating climate change mitigation to other thematic plans

Linking the LT-LEDS to other thematic plans helps countries to identify synergies and trade-offs between climate change mitigation and other policy priorities. Exploiting the synergies while identifying and properly addressing the trade-offs associated with the interim and long-term goals of the LT-LEDS can enhance the credibility of the overall framework. All three countries linked the LT-LEDS to pre-existing thematic plans, but the degree of linkage varies in terms of the number and depth. In some cases, there is only a very shallow linkage between the LT-LEDS and other plans, e.g. when plans are simply mentioned without further explanation of actions to be taken. This may reduce the credibility of the strategy since it is difficult to understand how these plans will actually be integrated. Linking too many plans without clarity on how these complement and feed into each other can also create complexity and challenges in understanding the linkages and the applicability of these plans.

The UK created its LT-LEDS in tandem with the Industry Strategy and links the LT-LEDS to the 25 Year Environment Plan. The UK's Industrial Strategy includes four priorities: placing the UK at the forefront of the artificial intelligence revolution, maximising the benefits from the global shift to clean growth, becoming a leader in shaping mobility, and harnessing the power of innovation. As can be seen, the Industrial Strategy and the LT-LEDS are mutually reinforcing. For instance, in order to tackle fuel poverty, the UK government has put in place the Energy Company Obligation scheme, which will help contribute to the targets set by the Clean Growth Strategy in the residential sector by providing incentives to energy suppliers to install energy-efficient systems in low-income British households. The 25 Year Environmental Plan sets broader environmental goals such as improvements in water and air quality[14], of which mitigation is one part. The LT-LEDS references the 25 Year Environment Plan where this applies.

Similarly, France linked the LT-LEDS to other thematic plans that are related, inter alia, to sustainable development and air quality. The most relevant are the Schéma Régional d'Aménagement, de Développement Durable et d'Egalité des Territoires (SRADDET) and the Plan Climat-Air-Énergie Territorial (PCAET) considered central tools for linking the LT-LEDS to other existing thematic plans:

- SRADDET is an integrative and strategic regional planning tool that outlines medium and long-term objectives in terms of sustainable development that must integrate, inter alia, the recommendations of the LT-LEDS. It shifts authority from the national to the regional level in a number of policy areas, such as the protection and enhancement of the environment, the rehabilitation of degraded areas, the management of major equipment and infrastructure, as well as the implementation of services of general interest.
- PCAET is a mandatory plan for inter-communalities[15] with autonomous tax systems of more than 20000 inhabitants. Its aims to include under the short/medium and long term, GHG emissions reduction, energetic dependence reduction, air quality, biodiversity, and climate vulnerability

through adaptation policies. The goal of the PCAET is to put in place coherent policies, across all sectors, in terms of climate change mitigation and adaptation.

Germany also links the LT-LEDS to pre-existing thematic plans, such as the Alliance for Affordable Housing and Buildings, which aims at ensuring affordable housing especially for low-income families. In the industrial sector, the LT-LEDS makes reference to the Act on the Prevention of Harmful Effects on the Environment Caused by Air Pollution, Noise, Vibration and Similar Phenomena as a regulatory framework to ensure that facilities are built and operate in an energy efficient way.

The specification of synergies with other policy priorities may also depend on the narrative of the plan. All three countries specified benefits and priorities related to other policy goals, but only Germany's LT-LEDS makes a clear reference to the Sustainable Development Goals (SDGs).The document explicitly mentions that Germany's energy transition must be in line with the strategy for sustainable development set out by the government: "Climate action is an important principle, but it is not the only long-term principle guiding the German government's policies. When deciding how to transition to a greenhouse gas-neutral economy and society, it will be particularly necessary to take the management rules, targets, and other requirements of the government's sustainability strategy into account" (BMUB, 2016[9]). The German LT-LEDS specifically mentions potential synergies with the SDGs. For example, having a climate-neutral building sector would reinforce SDG 11, "make cities and human settlements inclusive, safe, resilient and sustainable". Moreover, the LT-LEDS also refers to potential trade-offs between climate mitigation and other SDGs. It refers to the competition of land-use between food production (SDG 2), biodiversity (SDG 15) and the production of agricultural biofuels, concluding that bioenergy from waste and residues rather than cropland will be the predominant source of biofuels in the future. In total, the German LT-LEDS explicitly mentions SDGs 2, 5, 9, 10, 12, 13, 14, 15, and 16[16]. The German impact assessment of the sectoral targets by 2030 carried out in 2018 shows that achieving the 2030 targets brings gross employment benefits (SDG 8) and substantially reduces the levels of local air pollution thereby improving health outcomes (SDG 3). Moreover, the report of the Commission for growth, structural change, and employment highlights that financing projects in the coal regions must be in line with the SDGs, emphasising the promotion of a carbon-neutral economy (SDG 13).

In France and UK, the LT-LEDS mention – but does not provide significant detail on - a wide range of other benefits that go beyond a positive effect on economic growth: a more inclusive society, less pollution, better indoor and outdoor air quality, less noise, better health, less operational risks resulting from fossil fuel extraction, and more biodiversity.

4.4.2. Anticipating with potential trade-offs

All countries face trade-offs between the mitigation goals set out in the LT-LEDS and other policy priorities, including competitiveness, employment, alleviating fuel poverty and conflicts of land-use. All cases analysed refer to measures on how to attenuate these effects if not in the LT-LEDS itself, then in accompanying documents.

In the case of Germany, the Commission for Growth, Structural Change, and Employment was established in June 2018. Composed of representatives from trade-unions, business associations, subnational and national governments, and scholars the Commission will develop a strategy for the transformation needed in the coal regions in Germany (North Rhine-Westphalia, Lausitz and the Central German Coalfield). The commission published in January 2019 a recommended timeline for the coal exit and a suggested mix of instruments targeting economic development, infrastructure investments, structural change, social compatibility and climate action.

France specified the need to put in place compensatory measures in its LT-LEDS. The energy cheque ("Chèque Energie"), introduced by the Ministry of Ecological and Inclusive Transition is cited as an example of compensatory measures in the document. The energy cheques streamlined the previous social tariffs

structure for gas and electricity, replacing them in January 2018, improving targeting of low-income households. They are conceived to help low income households to pay their energy bills, whatever the type of energy; they can also be used for retrofitting works improve dwellings' energy efficiency. This new measure increased government budget for the fight against energy poverty by EUR 270 million between 2017 and 2018 (+57%).

4.4.3. Sound monitoring mechanisms embedded in a wider sustainable development perspective

The integration of the LT-LEDS into wider sustainable development goals can be supported by including measures of potential impacts on both climate change mitigation and other dimensions of well-being in the document. The effectiveness of an LT-LEDS requires a clear monitoring of GHG emissions, mitigation actions and support (Singh, Finnegan and Levin, 2016[25]).

Article 12 of the Paris Agreement encourages all countries to communicate information related to their climate change mitigation actions, including emissions inventories and support. Over the years, the arrangements for national reporting have evolved into a comprehensive and universal monitoring verification and reporting (MRV) framework adopted at COP13 in 2007 and adapted separately for developed and developing countries. This framework provides the basis for a standardised and universal reporting framework.

Institutional arrangements for monitoring the effects of LT-LEDS should be clearly outlined in the document, and based on a selection of relevant indicators that are specific to the strategy and measurable. All three countries monitor the progress of their strategies with respect to GHG emissions in sectors.

Monitoring systems can also track the effects (e.g., synergies and trade-offs) of the LT-LEDS and climate policies on other policy priorities. In particular, tracking trade-offs associated with the low-carbon transition at an early stage highlights potential tensions with other policy priorities, enabling governments to adjust their LT-LEDS or to enact specific measures targeting these trade-offs.

Among the three countries, the indicator system of France is the most elaborated, and the strategy outlines a dashboard composed of 184 indicators, categorised into "results", "context", and "policy recommendation follow-up" indicators, reported to the Energy Transition Experts Committee (CETE) and published by the government biannually (see section 5.1 for more details).

- Results indicators include direct results regarding national targets, carbon footprint, sectoral and national emissions, level of investments, etc.
- Context indicators comprise socio-economic, climate, environmental and technology indicators that describe both conditions relevant for results indicators (e.g. the harshness of winter) as well as effects on other policy priorities (e.g. supply and demand for green jobs, population exposed to energetic vulnerability, etc.).
- The indicators related to the monitoring of policy recommendations estimate: (a) the level of integration in public policies of each recommendation of the LT-LEDS (transversal and sectoral), (b) "pilot" indicators for each recommendation (e.g. occupation rate of private cars, number of electric charging stations, or number of retrofitted homes as part of the programme against energy poverty "Habiter mieux").

Germany does not explicitly mention any indicators, but it refers to the annual Climate Action reports as the main monitoring tool. In these reports started in 2014, the German government uses indicators to track GHG emissions by economic sector and to inform the government on progress made towards the interim target. Moreover, the reports attempt to quantify the impact of the Climate Action Programme 2020 by using an ex-ante estimate of policy effects and by ex-post evaluation. The ex-ante estimate of policy effects is based on economic modelling, i.e. how future emissions will evolve after enacting specific climate

policies. Enacted policies are also evaluated ex-post by measuring their impact on actual emission reductions. The results of both the ex-ante estimate and the ex-post evaluation will feed into the next update of the LT-LEDS.

In the UK, the LT-LEDS illustrates a set of indicators, on an overall basis but also across sectors, that could illustrate how the 2032 pathway is performing. Besides overall GHG emission and GHG emissions by sector, there is one key indicator, which is the Emissions Intensity Ratio. This equals the amount of GHG (tonnes of carbon dioxide equivalent) per unit of GDP. Other indicators including emissions per capita, final energy consumption intensity of GDP, or energy use per households complement the key indicators.

In order to accurately evaluate the achievements of goals, the use of indicators to track progress should be based on sound data collection and analysis, and should ideally be reported to a central body, i.e. the parliament or the government. In the case of the three selected countries, a mix between a centralised and a decentralised approach for data collection is used. Sub-national authorities are in charge of data collection for the different sectors and territories. This data is submitted to a central authority, e.g. the respective Ministry in charge of the LT-LEDS or national environmental agencies, which aggregate the submitted data and complement it with their own sources.

In France, the data collected as part of the monitoring and reporting system is reported to the Ministry of Ecological and Inclusive Transition (MEIT). The collected data originate from several sources. Results indicators are for example collected from statistical studies and from the statistical department at the MEIT, Inter-professional Technical Centre for Atmospheric pollution (CITEPA), the I4CE (Institute for Climate Economics), or the AGRESTE (Statistics and prospectives publication department, Ministry for Agriculture and Food). Context indicators can originate from the INSEE, the national statistical Agency or the national electricity companies (Electricité de France or Réseau de Transport d'Électricité). Policy recommendations indicators originate from several sources and databases which include but are not limited to: ADEME, the Commissariat Général au Développement Durable in the MEIT, the World Bank, the OECD, or the Caisse des Dépôts.

In Germany, the Länder are responsible for collecting and providing most of the environmental data. Some of that responsibility is passed on to local authorities. The German LT-LEDS explicitly highlights the value of analysing precise georeferenced environmental data which can contribute to transparency when implementing measures. It also stresses the importance of data that is available at the local level, notably to monitor local climate action, but also to track progress of the LT-LEDS locally. The German government will also strengthen the harmonisation of decentralised data records for all of Germany and making the data available electronically.

4.4.4. Quantifying and communicating effects on socioeconomic and other environmental priorities

Estimating the effects of the LT-LEDS on socioeconomic and environmental priorities helps identify and pre-emptively address impacts. To do so, requires a thoughtful selection of indicators. This, in turn, enhances the political acceptability and credibility of the LT-LEDS by demonstrating that climate change mitigation will not come at the expense of other socioeconomic and environmental objectives. Only France quantifies policy impacts in its LT-LEDS. For example, its indicators related e.g. to energy vulnerability and energy expenditures of households could in the future, if timely monitored and interpreted, allow to detect risks of social uprising such as the Gilets Jaunes. Germany does not quantify policy effects as part of the LT-LEDS, but the Deep Decarbonisation Pathways Project for Germany provides some estimates in terms of energy security, jobs, social and environmental impacts. Moreover, the German LT-LEDS announced that it will commission an impact assessment of the sectoral targets by 2030 outlined in the LT-LEDS to shed light on the impacts of the strategy on dimensions such as competitiveness, employment, etc. the results of which are presented below. In the UK, expected future impacts of the LT-LEDS are not included in the document, but historical effects of mitigation on a subset of socioeconomic priorities is mentioned.

France used two models (NEMESIS and THREEME) to assess macroeconomic impacts (e.g. number of jobs created) of the LT-LEDS compared to a trend-based scenario based on existing measures (Ministère de la Transition écologique et solidaire, 2015[8]). According to the two models, GDP is expected to be boosted by EUR 25 billion per year over the period 2014 to 2035. Over this period, 108,000 additional jobs per year will be created according to NEMESIS, while THREEME estimates this number to be around 350,000 jobs per year (Ministère de la Transition écologique et solidaire, 2015[8]). A peak in GDP growth is expected to occur in 2020 (+3.1%) according to the NEMESIS model. Other positive effects were detected: lower production costs due to energy savings for first movers in the low-carbon technology. However, there will be expected job losses in the sectors dependent on fossil fuel. In order to ensure that no one is left behind, the LT-LEDS set measures to facilitate a professional transition for employees in the sectors towards the emerging green economy.

The French LT-LEDS also quantifies positive social impacts. Equitable distribution is at the heart of the social impacts looked at by the government. However, the rise in fuel tax, a measure set as part of the LT-LEDS, was perceived as an unfair additional cost for the working class population, as their salaries stagnate and their social allowances are cut, leading thereby to the Gilets Jaunes movement (Mauger, 2019[26]). For example, for housing, in the long term, investments by the home owner for renovation will be compensated by future savings on households' energy bills. Furthermore, an average assessment of citizens' savings over time across levels of income has been conducted. Additionally, in the transport sector, the impact of the modal shift was estimated for each type of household and analysed by income level. As stated above, these distributional impacts assessments could be done in a more regular way to ensure in a timely manner that most vulnerable people are not impacted by the energy transition and climate policies. Furthermore, other environmental challenges and public health issues were quantified in the LT-LEDS such as the decrease of environmental damages due to extraction, more sustainable transport and better distribution of the infrastructure; also improvements in air and water pollution, indoor air quality; noise and atmospheric pollution; respiratory health, etc.

The UK Clean Growth Strategy set the scene for what could be the effects of the climate actions on other policy priorities, built on prior efforts to tackle climate change. For example, more than 430,000 jobs were created in low carbon businesses as of 2015. In terms of the social perspective, it was estimated that on average, driving a new car in the UK bought in 2015 will reduce fuel bill by GBP 200 per year, compared to a new car bought in 2000, due to technological advancements for automotive engines (e.g., fuel efficiency) (BEIS, 2017[22]).

The German impact assessment of the LT-LEDS, shows that meeting the sectoral targets by 2030 has a positive impact on the value added, the gross domestic product and on employment, but highlights that employment gains in some sectors are offset by employment losses in others. It also stresses that the German industry is likely to experience lower electricity and energy prices due to the positive impact of renewable deployment on electricity wholesale markets. Finally, the assessment also finds positive impacts on environmental dimensions, notably lower levels of local air pollution. In 2019, the German government adopted the Climate Action Programme 2030 that lays out a set of measures to achieve the 2030 goals, notably the introduction of a carbon price in non-EU ETS, starting at EUR 10 in 2021 and rising to EUR 35 by 2025.

Table 4.5. LT-LEDS's characteristics for ensuring policy coherence

	Characteristics
Political commitment	• Establishing a clear vision of major changes to be pursued • Having a clearly established long-term GHG target (in absolute terms) and intermediate milestones • Providing clear indication for future sectoral emissions • Identifying responsibilities from different actors
Policy co-ordination	• Clearly outlining sectoral measures and policies and building on existing sectoral plans
Long-term planning	• Having a concrete vision of the desirable future through a clear narrative for the short, medium and long term • Reconciling short term and long term commitments by referring to the NDCs • Having multiple pathways that shows different possibilities through time
Policy integration, policy effects, and monitoring	• Linking the strategy to other thematic plans related to other policy priorities • Outlining links to SDGs or other policy priorities • Quantifying the policy effects including of co-benefits • Including actions and measures to cope with potential trade-offs • Providing a clear framework for monitoring the implementation of the LT-LEDS which includes both indicators for tracking progress in mitigating emissions as well as for capturing effects in terms of other policy priorities

5 Implementation

The objective of LT-LEDS is to ensure that GHG emissions reductions are met, and that climate change considerations are systematically incorporated in decision-making processes. Ensuring policy coherence in the Process (Section 3) and Document (Section 4) phases, facilitates the capacity to implement the strategy and mainstream climate change into decision-making. Nonetheless, designing specific mechanisms that can further support implementation is also important. Identifying mechanisms developed for this purpose is the focus of this section. Table 5.1 summarises approaches used in France, Germany and the UK. These are further elaborated below, and the implications of countries' choices on the credibility, flexibility, transparency and temporal consistency of the LT-LEDS discussed.

Table 5.1. Creating policy coherence in the implementation stage

PCSD Building Block	Implementing the LT-LEDS
Political Commitment	• Creation of an independent (non-governmental) advisory body • Creation of permanent government unit to monitor progress • Clearly defined consequences for failure to meet objectives
Policy Coordination + Stakeholder engagement + Subnational and local involvement	• Creation of inter-ministerial body to integrate the LT-LEDS across the economy • Mechanisms to ensure that other decisions reflect priorities in the LT-LEDS • Specification of responsibilities across ministries • Specification of responsibilities between levels of government
Long-term planning horizons + Monitoring and reporting	• A timeline of implementation • Update of LT-LEDS every five years in line with Paris Agreement • A financing plan for the LT-LEDS • Annual reporting on progress either by government or one of the bodies mentioned above

5.1. Commitment to implementing LT-LEDS

Embedding climate change into decision-making processes across the economy is more likely if there is clear political commitment to implement the LT-LEDS – i.e. going beyond the inclusion of this objective in the political discourse. Without a serious commitment, different actors may ignore or delay the inclusion of climate change mitigation into their priorities. Mechanisms that can facilitate implementation include the creation of an independent advisory body, a unit within government to track progress, and the introduction of punitive measures, in legal terms, in case of failure.

France and the UK created independent advisory bodies for monitoring the implementation of the LT-LEDS and, since they are politically independent, they can, in principle, assess the implementation of the LT-LEDS objectively. Moreover making the analyses and conclusions from the Committee on Climate Change public holds the government accountable to meet its commitments. So having such bodies contributes to making the political commitment to the LT-LEDS more credible.

The Energy Transition Experts Committee (CETE) and the Climate Change Committee (CCC) are legally mandated by the 2015 Green Growth Transition Act and the Climate Change Act in 2008 in France and the UK respectively (France, 2015[27]) (United Kingdom, 2008[28]). The CCC offers advice to the government on the overall level of ambition as well as setting and meeting the five-yearly carbon budgets. It also provides wider guidance by: monitoring the UK's progress in reducing emissions as well as achieving carbon budgets and targets; conducting independent analysis into climate change science, economics and policy; and engaging with a wide range of organisations and individuals to share evidence and analysis. In principle, the CETE evaluates the implementation of the *Programmation Pluriannuelle de l'Energie* (PPE), which is one of the principle pilots of energy transition in France. Moreover, at the end of November 2018, President Macron announced the creation of an *Haut Conseil pour le Climat*, an independent body under the authority of the Prime Minister with the mission to guide the government in terms of ecological transition. As of May 2019, the *Haut Conseil pour le Climat* officially replaced the CETE for the monitoring of the implementation of the strategy.

In addition, the CCC is required by law to publically release an annual report (United Kingdom, 2008[28]) while the CETE releases a biannual report, making the implementation of the LT-LEDS transparent to all actors (France, 2015[27]). All yearly progress reports and analyses by the CCC can be found on their website.[17] The CCC is comprised of eight mitigation experts. Expertise is drawn from think tanks (e.g., Institut du Développement Durable et des Relations Internationales) and universities (e.g., Université de Grenoble or Imperial College London) (Committee on Climate Change, 2018[29]). However, the CCC differs in that it funds an additional 30 staff to support the work of the CCC, and includes former ministers as members of the committee (Committee on Climate Change, 2018[29]). For example, the chairman of CCC in the UK is Lord Deben who acted as the Secretary of the State for the Environment from 1993 to 1997 (Committee on Climate Change, 2018[29]).

Another way to illustrate credible commitment to implementation is by forming a unit within government to deliver the LT-LEDS and monitor its implementation. The underlying objective of such a unit is to embed climate change mitigation into decision-making across ministries, providing credibility to the LT-LEDS by constantly monitoring progress. The UK created the Clean Growth and Carbon Budgets Team in 2016 within the Department of Business, Energy and Industry (BEIS, 2018[30]). The team is comprised of around 12 members who provide a centralised coordinating function for the LT-LEDS across the UK Government. This complements the advisory body since this body can execute the recommendations from the CCC.

In the UK, there are clearly defined consequences for failure to meet the carbon budgets which is judicial review. This helps to raise the legitimacy of the Clean Growth and Carbon Budgets Team, and the credibility of the commitment to implement the strategy. Moreover, the Climate Change Act and the CCC can help resolve the time inconsistency problem, in analogy to a Central Bank, it ensures that climate change cannot be stopped depending on the political leader's preferences they are bound to mainstream climate change mitigation across the economy. The Climate Change Act in the UK states that failure to meet carbon budgets could result in judicial review of the government (United Kingdom, 2008[28]). While a government facing judicial review for failure to mitigate may be seen as unrealistic, this happened recently in the Netherlands in 2018 (see Box 5.1). While the UK met its first three carbon budgets, the likely overshoot of the fourth and fifth carbon budgets as signalled by the CCC, suggests that a judicial review could take place (CCC, 2018[31]).

The UK incorporated elements to introduce a modicum of flexibility in the Climate Change Act. For example, the Secretary of State may decide to transfer up to 1% of a carbon budget to compensate for gaps in previous budgets. In addition, the Secretary of State may decide to carry forward the whole or part of any amount of additional reduction in the previous period to the present one. Before the Secretary of State can do either of these actions, the Secretary must consult national authorities and the CCC.. However, the Secretary of State cannot change the carbon budgets or the 2050 target. This still needs Parliamentary approval.

Neither Germany nor France specify any consequences for failure, beyond effects on reputation. However, Germany enacted its climate law, the Climate Action Law in November 2019. The law commits current and future governments to achieve the reduce GHG emissions by 55% by 2030 relative to 1990. In addition, the law determines sector-specific reduction targets. If a sector is not on track to meet the reduction targets, the respective ministry is obliged to present an action plan to the government that stipulate how these targets can be achieved (Bundesregierung, 2019[32]). Since both countries specify milestones, it is nonetheless possible to highlight if the government is in breach of its obligations. This is, however, a weaker sign of commitment to implementing the LT-LEDS than the clearly specified consequences set out in the case of the UK. In France, neither the Government nor the regions or territories encounter predefined legal consequences for not meeting the targets. However, NGOs may prosecute the State for inaction of the government with regards to climate change mitigation.

Box 5.1. Dutch government taken to court over insufficient climate mitigation

In the Netherlands, an environmental group, Urgenda Foundation, and 900 citizens sued the government for not taking sufficient action to prevent climate change. A court created legal order to force the Dutch government to accelerate carbon emissions cuts in October 2018. Appeal court judges ruled that the severity and scope of the climate crisis demanded greenhouse gas reductions of at least 25% by 2020 – measured against 1990 levels – higher than the 17% reduction planned by the administration. The government must now decide whether to appeal to the supreme court in the Netherlands, or explain how it will nearly double the entire amount of greenhouse gas emission cuts it has made since 1990 within one year.

Source: (Urgenda Foundation v. Kingdom of the Netherlands, 2018[33]).

5.2. Defining who, when, and how to embed climate change mitigation in decision-making

Facilitating the implementation of LT-LEDS by specifying who is responsible for what, when and how further embeds climate change into decision-making. All three case studies rely on the existing distribution of power within the country to implement the LT-LEDS. As noted in Section 4.2, France devolved greater power to territories with its enactment of the NOTRe (Nouvelle Organisation Territoriale de la République) Law in 2015 (France, 2015[34]). By consequence, the implementation of France's LT-LEDS relies on subnational and local involvement. In contrast, the LT-LEDS in the UK is more centralised. The Department of Business, Energy, and Industry (BEIS) as well as the Clean Growth and Carbon Budgets Team, were created to ensure that the LT-LEDS and the recommendations from the CCC are streamlined (as explained in Section 3).

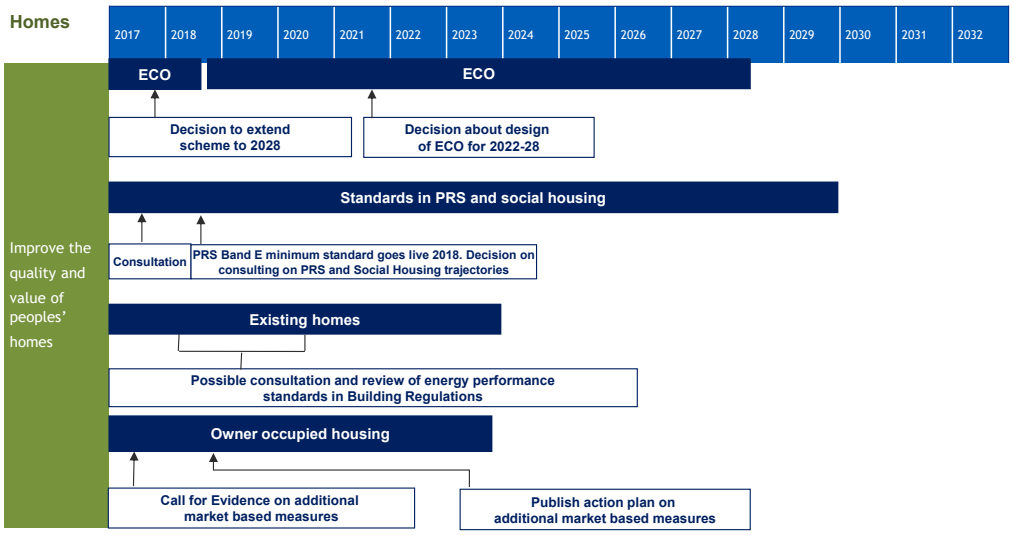
In France, the Ministry of Ecology, Sustainable Development and Energy placed a call for projects to create 200 "positive energy regions" to foster climate-friendly planning across the economy. As of April 2016 and thanks to extension to wider territories, nearly 400 territories had been awarded EUR 500,000 each, with the possibility of receiving up to EUR 2 million in additional support from the EU depending on the quality of the projects. Priority actions include reducing energy consumption in buildings and public spaces, reducing GHG emissions from transport, developing a circular economy and sustainable waste management, producing local renewable energy, and preserving biodiversity. Thus, even in a highly decentralised country, it is necessary to provide guidance, incentives and financial and technical support to support the implementation of the overall strategy in different territories. The decentralisation adds

flexibility and enables innovation adapted to local needs. However, it carries an additional burden of oversight to ensure the goals of the LT-LEDS are met.

In contrast, the UK places the onus on ministries to embed climate change mitigation into decision-making processes. An inter-ministerial council was created to ensure implementation in addition to the unit mentioned above (i.e., Clean Growth and Carbon Budgets Team). It is a joint council between Department of BEIS and DEFRA (Department for Environment, Food and Rural Affairs) in addition to members from Housing, Transport, Health and Treasury. The council provides a forum for discussing the findings of the Clean Growth and Carbon Budgets Team, for example, if a given sector is not meeting set emission reduction targets. Recognising that Departments have a range of objectives, of which decarbonisation may not be a priority, the inter-ministerial council helps to streamline the LT-LEDS, and embed climate change mitigation priorities across the economy in addition to the recommendations provided by the CCC. This facilitates the coordination across sectors and allows specialists to discern how to best embed climate mitigation into their priorities. At the same time, it is less flexible to local needs. As a result, the details of how mitigation objectives are achieved is up to the individual stakeholders in the different sectors, leaving the implementation flexible.

Even though there is flexibility on the details, the UK still includes a timeline for implementation up to 2032, which is the end of the fifth carbon budget. Figure 5.1 is an example of the timeline for the specific action item - Improve the quality and value of peoples' homes - which includes public consultations, calls for evidence, and deadlines for action plans. The left column outlines the action item, the white boxes are the tasks to be completed, and the blue boxes are the sectoral areas impacted or government programme involved. Annex B in the LT-LEDS adds further detail by including a table specifying the responsible ministry for each action item and the overall objective (see Table 5.2 for an example). Therefore, even though the details of implementing the LT-LEDS is open, there is still a timeline of deliverables and expectations.

Figure 5.1. Example of implementation timeline - UK



Note: ECO stands for Energy Company Obligation, a UK government scheme for energy efficiency and emissions reduction, as well as energy poverty. PRS is the Private Rented Sector, a type of housing in the UK where properties are owned by private individuals or companies. Owner Occupied Housing are homes owned by the households that live in them.
Source: (BEIS, 2017[22]).

Table 5.2. Embedding climate mitigation action into decision-making

Example of action item by department - UK

	Improving our homes	
	Description	Timing
BEIS	Publish a call for evidence on additional measures to encourage energy performance, particularly amongst owner occupiers.	Published alongside the LT-LEDS
BEIS	Publish a call for evidence on how to reform and streamline the Green Deal framework to make the "Pay as You Save" system more accessible to businesses, while ensuring adequate protection for consumers.	Published alongside the LT-LEDS
BEIS	Work with industry to implement the independent industry led Each Home Counts review to improve quality and standards for all retrofit energy efficiency and renewable energy installations.	2017
BEIS/HMT	Work with mortgage lenders to incorporate energy efficiency into their lending decisions, and look at incentives and other levers that could encourage home-owners to invest in energy efficiency improvements	2017
BEIS	Explore ways in which we could make it easier for innovative approaches or products to be installed under our consumer-facing schemes such as the Energy Company Obligation.	2017
BEIS	For privately rented homes, from April 2018, landlords of the worst performing properties will need to improve those properties to a minimum of EPC E before they can be let; lowering bills for some of the most vulnerable private tenants.	2017
BEIS	Consult on ECO's operation through to 2022	2018
BEIS	Reform the RHI to focus the scheme towards long-term decarbonisation through greater uptake of technologies such as heat pumps and bio methane (biogas to grid).	2017
BEIS	Continue to work with suppliers to ensure that people are provided with tailored advice when a smart meter is installed.	2017
BEIS	Alongside this Strategy, the Government has published Boiler Plus, improving standards for the 1.2 million new boilers installed in England every year and ensuring control devices are included with every installation so people can control comfort in their own homes for less from April 2018.	Spring 2018
BEIS	Replace the existing, telephone-only Energy Saving Advice Service with a digitally led-service working closely with the Each Home Counts implementation, offering tailored advice on improving the energy performance of people's homes	Spring 2018
BEIS/DCLG	Issue a Call for Evidence seeking views on further triggers points for Energy Performance Certificates (EPCs) to be updated, as well as wider views on how EPCs could be further improved, in light of new sources of data and capabilities	Spring 2018

Source: Authors, adapted from (BEIS, 2017[22]).

Clearly demarcating who is responsible for what and when adds legitimacy and accountability. The CCC or the Clean Growth and Carbon Budgets Team in BEIS can use this timeline to monitor progress in implementing the strategy.

In Germany, the LT-LEDS lays out different strategies for different economic sectors, thus, partially allocating responsibilities. For the Programme of Measures to implement the LT-LEDS, the respective ministries are responsible for further developing the details of these strategies under the co-operation of the German Bundestag[18] and in collaboration with other stakeholders, notably the Climate Action Alliance,

a consortium encompassing representatives of groups from all parts of society, the Länder and local authorities. Moreover, the German government delegates the monitoring, reporting and verification to the national environmental agency, which is responsible for the preparation of climate action reports. These reports were introduced in 2014 in order to track progress towards meeting the German emission reduction target by 2020. The German government uses and adjusts this existing vehicle to monitor progress regarding achieving the 2030 targets. In addition to the climate action reports, the German government commissions the preparation of climate projection reports to external research institutes. These reports are required by the European Union and inform about Member States' emission trajectories based on current and proposed policies by Member States to ensure that countries are meeting the climate targets by 2030.

5.3. Planning for implementation now and in the future

Embedding climate change into decision-making in the long-term means adapting to changing circumstances. Technology is rapidly developing and often hard to predict. Therefore, the priorities set in 2018 may not adequately reflect the priorities in 2032. France, Germany, and the UK plan to revise the LT-LEDS every five years in line with the NDC cycle under the Paris Agreement. This additional flexibility adds to the strategy's robustness.

An additional element that will help foster the technological innovation and deployment needed is a long-term financing plan. As mentioned in Section 4, the UK setup the Green Finance Taskforce to decide how to best allocate and mobilise funds outlined in the LT-LEDS. In May 2018, the Taskforce released its first report to the UK Government on how to distribute this funding, in the interest of aligning with the objectives outlined in the LT-LEDS (Green Finance Taskforce, 2018[35]). For example, the Green Finance Taskforce (2018[35]) recommended that:

- The Government and the City of London established a new Green Finance Institute under the Green Finance Initiative, which could host a Green Fintech Hub. Additionally, the Government and the new Institute should deliver a joint strategy on green finance.
- Companies and investors should use the framework from the Taskforce on Climate-related Financial Disclosures to develop their financial, corporate governance and stewardship disclosures, and the UK Government should conduct a review of disclosure in 2020 to monitor and encourage market adoption amongst both issuers and users.

The report includes a number of additional recommendations that go into further detail on how to take them forward, including timelines and responsibilities. The Green Finance Taskforce has also suggested a set of research tasks to strengthen the analytical evidence underpinning the recommendations.

France delivers on its commitment to financing the LT-LEDS via its initiative on green budgeting. France released a "Voies et Moyens" (The Ways and Means Report) showing an assessments of tax revenues and expenditures, by type of tax, programme, and beneficiary. This included information on revenues from energy and environmental taxes from relevant national programmes, and on fossil fuel subsidies for some sectors. In addition, as part of the National Budget law ("loi de finances"), a "Transversal Policy Document" that called for climate action was released by the Ministry of Ecological and Inclusive Transition, summarising the climate expenditures across all sectors (e.g. aviation, research, forestry, etc.) (Ministry of Ecological and Inclusive Transition, 2019[36]). This transparency illustrates the government's commitment to the low-carbon transition and to embedding climate change mitigation into its processes.

The German LT-LEDS explicitly states that the LT-LEDS is a strategic document that outlines the vision and strategies for Germany in the short, medium and long term without predetermining public budgets. Instead, the measures of the LT-LEDS will be funded from the individual budgets of the respective ministries in the respective years. However, the climate change law that is going to be enacted in 2019 may be more precise on long-term financial commitments of the German government for the implementation of the LT-LEDS.

Annex A. Insights from the range of existing LT-LEDS

As of October 2019, 13 countries had submitted their LT-LEDS to the UNFCCC. In addition, other countries, including Indonesia and United Arab Emirates considered in this section, have developed their strategies domestically outside of the UNFCCC context (Rocha and Falduto, 2019[2]). This section summarises and analyses these 15 LT-LEDS along a number of important dimensions, and how they are articulated differently across countries. These dimensions are:

- Vision and targets;
- Institutional setup, legal framework and stakeholder engagement
- Sectoral coverage and GHG targets
- Linkages with NDCs, SDGs and other well-being and economic goals
- Resourcing the strategy and monitoring and implementation

Table A B.1 and Table A B.2 in the Annex B provide an overview of the LT-LEDS of the 15 countries, respectively on their vision and substance, and the governance, institutional setup and stakeholder engagement.

Vision and targets

Among the analysed LT-LEDS, nine expressed a clear ambition to embark on a low-emission transition pathway. Indonesia and the UK have outlined a vision encompassing both climate change mitigation and economic development (Rocha and Falduto, 2019[2]). The Republic of the Marshal Islands, Mexico, Fiji, and Indonesia include in their vision a range of other societal goals such as eradication of poverty or good health (Rocha and Falduto, 2019[2]).

In addition, 13 out of 15 LT-LEDS outline quantifiable targets in terms of GHG emissions reductions, and three countries aim for net-zero carbon emissions by mid-century. Most countries expressed their reductions targets in terms of percentage compared to a base year, and the Czech Republic and Benin are the only countries that set an absolute target in terms of Mt CO_2eq (Rocha and Falduto, 2019[2]). Furthermore, some countries set minor quantitative and qualitative milestone targets. Mexico has, inter alia, a target to achieve, in a 10-year timeframe, “zero percent rate of carbon loss in original ecosystems”. Other sub-sectoral targets, such as increasing the share of renewables of improving energy efficiency have been specified by countries such as Fiji and the United Arab Emirates. The Republic of Marshal Island and Benin also included qualitative targets for climate resilience and adaptation (Rocha and Falduto, 2019[2]).

Institutional setup, legal framework and stakeholder engagement

There is a limited amount of information regarding the legal framework and institutional setup underlying the LT-LEDS. In some countries such as Mexico and France, the law mandates the creation of an LT-LEDS (Rocha and Falduto, 2019[2]), (Ministère de la Transition écologique et solidaire, 2015[8]). Other countries, such as Benin, conferred a legal status to their strategy (Rocha and Falduto, 2019[2]). In the UK,

the emissions reduction targets outlined in the LT-LEDS are legally binding (Rocha and Falduto, 2019[2]). In terms of institutional setup, the configuration varies considerably across countries. For example, Germany have assigned a dedicated taskforce within the Ministry of Environment, while Mexico and the United Arab Emirates have mandated an inter-ministerial body to develop the LT-LEDS (Rocha and Falduto, 2019[2]).

The process of stakeholders' engagement is mentioned in eleven LT-LEDS, even if detailed information on how it has been convened is not provided directly in the document. In most of the cases, stakeholder consultation took form in terms of series of workshops that informed the strategy, and indication on whether these consultations will continue after the submission of the LT-LEDS is not always clearly outlined (Rocha and Falduto, 2019[2]).

Sectoral coverage and GHG scenarios

All strategies adopt a multi-sector approach for the decarbonisation of the economy, with the energy, agriculture, forestry and land use, waste, transport and buildings being covered depending on the magnitude of their respective emissions. For example, the Marshall Island strategy focuses on cooking and lighting, noting that industry is not a relevant emitter. Certain countries such as Germany and the US have elaborated dedicated sectoral strategies, e.g. for buildings or transport (Rocha and Falduto, 2019[2]).

Most of the LT-LEDS include GHG projections analysed in terms of BAU and "with measures" scenarios. In addition, many developing countries include conditional and unconditional scenarios, foreseeing the feasibility of their policies depending on the available financial resources and technical capacity (Rocha and Falduto, 2019[2]).

Linkages with NDCs, SDGs and other well-being and economic goals

There are few explicit linkages with NDCs, SDGs and other socio-economic goals in analysed LT-LEDS. Eight strategies mention the country's NDCs, but only two countries (Marshall Island and Fiji) firmly draw linkages to their NDCs. For example, the Marshall Islands' LT LEDS states that that the strategy aims to guide targets to be set in future NDCs. In addition, only five LT-LEDS outline a connection with the SDGs, mostly in general terms, and co-benefits are outlined in the form of simple listing. The UAE has drawn a map linking the actions for climate change mitigation and adaption, to the achievement of related SDGs. Indonesia is the only country that put an economic growth goal, equal to 6% per year between 2019 and 2045 (Rocha and Falduto, 2019[2]).

Resourcing the strategy and monitoring and implementation

In most of the countries, the financing of the LT-LEDS is not formally discussed, either in terms of national budget allocation or climate finance. However, at least five LT-LEDS provide estimates information on funding strategy and costs, with varying level of details. For example, Mexico recall the creation of the Climate Change Fund as part of its General Climate Change Law, whose aim is to help financing green projects in relevant areas. Moreover, Germany has established priority areas of action, such as incentivising climate-friendly investment, and the need to increase transparency for climate-related risks for investors to be willing to invest (Rocha and Falduto, 2019[2]).

In terms of monitoring progress of the LT LEDS, almost all countries provide information on MRV (Monitoring, Reporting and Verification) or M&E (monitoring and evaluation) processes. For example, Mexico and Benin assert that a system for MRV and/or M&E is being developed. Fiji's monitoring tools will include performance indicators that will track progress of policies and their impact in terms of GHG emissions and related co-benefits (Rocha and Falduto, 2019[2]).

Annex B. Analysis of selected LT-LEDS

Table A B.1. Overview of selected countries' Long-Term Low-emission Development Strategies (LT-LEDS) Part 1

Vision and substance

Country	Title of the Strategy	Underlying Vision / Purpose of the Strategy	Timeline	Target(s)	Sectoral Coverage	GHG projections / low-emission scenarios	Adaptation	Linkages with NDC and/or SDGs
Canada	Canada's mid-century long-term low-greenhouse gas development strategy	Informing the conversation about how to achieve a low-carbon economy and outlining potential abatement opportunities and main challenges.	2050	• 80% reduction in GHG emissions compared to 2005	Energy; Forests; Agriculture; Waste.	**YES – to 2050** "Low greenhouse gas"; "current technology", and "new technology" scenarios.	**NO** Adaptation measures and/or priorities are not included in the strategy.	• No explicit linkage to NDC; • No explicit linkage to SDGs.
Germany	Climate Action Plan 2050	Providing guidance to all areas of action to achieve domestic climate targets.	2050	• 80-95% reduction in GHG emissions compared to 1990	Energy; Buildings; Transport; Agriculture; Forestry and other land use.	**YES – to 2030** One scenario with measures.	**NO** Adaptation measures and/or priorities are not included in the strategy. Reference is made to the German Strategy for Adaptation.	• No explicit linkage to NDC; • SDGs will provide guidance for the implementation of the strategy.
Mexico	Mexico's Climate Change Mid-Century Strategy	Ensuring people's right to access clean energy, good health and safe environments without affecting the planet.	2050	• Reaching at least 50% of energy generation from clean sources in 40 years; • Achieving 50% emissions reduction compared to	Energy; Industry; Transport; Agriculture; Forestry and other land use; Waste	**YES – to 2050** "Baseline", "NDC policy" and "NDC more ambitious" scenarios.	**YES – key component** Measures for climate change adaptation and institutional processes to increase adaptability and resilience of the country to climate change.	• The strategy builds upon NDCs targets and measures; • No explicit linkage to SDGs.

Country	Title of the Strategy	Underlying Vision / Purpose of the Strategy	Timeline	Target(s)	Sectoral Coverage	GHG projections / low-emission scenarios	Adaptation	Linkages with NDC and/or SDGs
				• 2000 in 40 years; • Several other milestones and targets				
United States[4]	United States Mid-Century Strategy	Demonstrating that the United States can meet the growing demands on its energy system and lands while achieving a low-emissions pathway, maintaining a thriving economy, and ensuring a just transition for Americans whose livelihoods are connected to fossil fuel production and use.	2050	• Achieving at least 80% GHG emissions reductions by 2050	Energy; Transport; Buildings; Industry; Forestry and other land use;	**YES – to 2040** "Current policies" and "expanded ambition" scenarios.	**NO** Adaptation measures and/or priorities are not included in the strategy.	• No explicit linkage to NDC (strategy was submitted before NDC); • No explicit linkage to SDGs.
Benin	Stratégie de développement à faible intensité de carbone et résilient aux changements climatiques[5]	Achieving a low-emission development strategy, resilient to climate change, and integrating climate-relevant considerations in the strategic policies of the country.	2025	• Reinforce resilience of local communities; • 12Mt GHG reduction and 163Mt GHG sequestered by 2025; • Reinforce protection of vulnerable commu	Energy; Agriculture; Forests and other land use; Buildings; Health; Water.	**NO**	**YES – key component** Measures for climate change adaptation and institutional processes to increase adaptability and resilience of the country to climate change.	• Strategy in line with NDC objectives; • The strategy recognises and considers the SDGs.

[4] The "United States Mid-Century Strategy for Deep Decarbonization", released in 2016 by a previous administration, is no longer being implemented by the United States. (Rocha and Falduto, 2019[2]).

[5] "Low Carbon and Climate Resilient Development Strategy" ((Rocha and Falduto[2])'s translation).

Country	Title of the Strategy	Underlying Vision / Purpose of the Strategy	Timeline	Target(s)	Sectoral Coverage	GHG projections / low-emission scenarios	Adaptation	Linkages with NDC and/or SDGs
				nities.				
France	Strategie Nationale Bas-carbone[6] (under revision)	Outlining the approach France intends to adopt to meet its GHG emissions reduction targets and set in motion the transition to a sustainable, low-carbon economy. Prescriptive for the public sector.	2050	• 75% reductions in GHG emissions.in 2050 compared to 1990 • 5-year carbon budgets until 2028	Transport; Buildings; Agriculture; Forestry; Industry; Energies; Waste.	**YES – to 2050** "Trend-based" and "reference" scenarios.	**NO** Adaptation measures and/or priorities are not included in the strategy. Reference to the National Climate Change Adaptation Plan.	• Second and third carbon budgets are in line with the EU NDC; • No explicit linkage to SDGs (strategy was drafted before SDGs were adopted).
Czech Republic	Climate Protection Policy of the Czech Republic[7]	Determining an appropriate mix of cost-effective policies and measures in key sectors that will lead to achieving the greenhouse gas reduction targets.	2050	• Reduce national emissions by 2020 by at least 32 Mt CO_2-eq in comparison with 2005; • Reduce national emissions by 2030 by at least 44 Mt CO_2-eq in comparison with 2005; • Pursue the	Energy; Industry; Transport; Agriculture; Forestry and other land use; Waste	**YES – to 2030 and 2050** "Existing measures" and "additional measures" scenarios. Eight simplified scenarios of possible development until 2050.	**NO** Adaptation measures and/or priorities are not included in the strategy. Reference to separate Adaptation Strategy and National Adaptation Plan	• No explicit linkage to NDC; • No explicit linkage to SDGs. •

[6] "National Low Carbon Strategy" ((Rocha and Falduto[2])'s translation).

[7] Only the executive summary is available in English (Rocha and Falduto, 2019[2]).

Country	Title of the Strategy	Underlying Vision / Purpose of the Strategy	Timeline	Target(s)	Sectoral Coverage	GHG projections / low-emission scenarios	Adaptation	Linkages with NDC and/or SDGs
				indicative level of 70 Mt CO_2-eq of emissions in 2040; Pursue the indicative level of 39 Mt CO_2-eq of emissions in 2050.				
United Kingdom	The clean growth strategy	Accelerating the pace of "clean growth", i.e. deliver increased economic growth and decreased emissions.	2050	• Sets out plans and proposals to meet the 'carbon budgets' set to date – which require a 57% reduction in GHG emissions, relative to 1990 levels over the period 2028-32. • Sets out scenarios for meeting the 2050 target (an 80% reduction on 1990 levels – at the time of writing). • Sets	Energy; Business & Industry; Housing; Transport; Agriculture; Forestry & Land Use; Waste	**YES – to 2032** "Existing policy" and "2032 pathway" scenarios.	**NO** Clean Growth Strategy focuses on mitigation but references the UK National Adaptation Plan.	• No explicit linkage to NDC; • No explicit linkage to SDGs. •

Country	Title of the Strategy	Underlying Vision / Purpose of the Strategy	Timeline	Target(s)	Sectoral Coverage	GHG projections / low-emission scenarios	Adaptation	Linkages with NDC and/or SDGs
				out indicative sectoral pathways to 2032 alongside a range of sector-specific goals, ambitions and policies.				
Ukraine	Ukraine 2050 Low Emission Development Strategy	Determining strategic directions for Ukraine's economy sustainable development based on the national priorities accordant transition to low-emission growth trajectory.	2050	• De-carbonisation of the energy system; • Increase in the volumes of carbon absorption; • Reduction in GHG emissions such as methane gas and nitrogen oxide.	Energy; Industrial Processes	**YES – to 2050** "BAU" and "with measures" scenarios.	**YES - marginal component** Adaptation to be a key priority in the long term.	• No explicit linkage to NDC; • No explicit linkage to SDGs.
Republic of the Marshall Islands	Tile Til Eo 2050 Climate Strategy "Lighting the way"	Outlining a long-term pathway for RMI to achieve its objectives for net zero emissions and 100% renewable energy, as well as to facilitate adaptation and climate resilience in a way that ensures the future protection and prosperity of the country and its women, men	2050	• Reaching net zero carbon emissions by 2050; • Reaching 100% renewable energy; • Facilitating adaptation and climate	Electricity; Waste; Transport and Cooking and Lighting.	**YES – to 2032** "Moderate enhanced ambition", "intermediate significant enhanced ambition" and "lighthouse enhanced ambition" scenarios.	**YES - key component** Measures for climate change adaptation and recommends the development of a National Adaptation Plan.	• The strategy is also intended to inform and provide recommendations for targets to be included in future NDCs; • No explicit linkage with SDGs.

Country	Title of the Strategy	Underlying Vision / Purpose of the Strategy	Timeline	Target(s)	Sectoral Coverage	GHG projections / low-emission scenarios	Adaptation	Linkages with NDC and/or SDGs
		and youth.		change resilience.				
Fiji	Fiji's Low Emission Development Strategy 2018-2050	Strengthening the global response to climate change, sustainable development and eradication of poverty, consistently with the call issued by the IPCC SR 1.5°C.	2050	• Reaching net zero carbon emissions by 2050 across all sectors of the economy; • The strategy also includes several sector-specific quantitative targets.	Energy; Transport; Agriculture; Forestry and other land use; Waste.	**YES – to 2050** "BAU Unconditional", "BAU Conditional", "High Ambition" and "Very High Ambition" scenarios.	**YES - key component** Detailed set of crosscutting adaptation strategies and actions.	• Strong correlation between the country's NDC implementation Roadmap and LT-LEDS' pathways. • M&E LEDS process will include monitoring progress towards achievement of NDC and SDGs.
Japan	The Long-term Strategy under the Paris Agreement	Proclaiming a "decarbonised society" and "achieving a virtuous cycle of environment and growth". The strategy also lays out sector-specific visions (e.g. "renewable energy will become an economically self-sustained and decarbonised main power source").	2050	• 80% reduction in GHG emissions by 2050; • Realizing decarbonisation as early as possible in the second half of this century • For some areas, sub-sector-specific targets (e.g. 85% reduction in consumption	Energy; Industry; Transport; Forestry and other land use; Community and living (covering various sectors including residential, agriculture) "	**NO**	**YES - marginal component** Examples of policy measures aimed at enhancing resilience and adaptation to climate change.	• No explicit linkage with NDC. • Efforts to maximise co-benefits with SDGs in the transition to a decarbonised society;

Country	Title of the Strategy	Underlying Vision / Purpose of the Strategy	Timeline	Target(s)	Sectoral Coverage	GHG projections / low-emission scenarios	Adaptation	Linkages with NDC and/or SDGs
				and production of HFCs by 2036).				
Portugal	Roadmap for carbon neutrality 2050	Identifying the main decarbonisation vectors in all sectors of the economy, the policy and measures options and the emission reduction path to achieve carbon neutrality.	2050	• Reach carbon neutrality by 2050	Energy; Industry; Transport; Agriculture; Forestry and other land use; Waste; Residential and Services.	**YES – to 2050** "Off-track", "Peloton" and "Yellow Jersey" scenarios.	**YES – marginal component** The importance of adaptation is recognised. The strategy makes reference to the National Climate Change Adaptation Strategy (ENAAC 2020).	• The strategy is developed in accordance with the EU NDC. • The strategy recognises that achieving carbon neutrality will contribute to the achievement of selected SDGs.
Indonesia	Low Carbon Development : A Paradigm Shift Towards a Green Economy in Indonesia*	Identifying development policies that maintain economic growth, alleviate poverty and help meet sector-level development targets while simultaneously helping Indonesia achieve its climate objectives.	2045	• 43% reduction in GHG emissions by 2030 • GDP growth of 6% per year between 2019-2045 • Other sector-specific quantitative targets.	Energy; Agriculture; Forestry and other land use	**Yes, to 2045** "Base Case", "LCDI Moderate", "LCDI High" and "LCDI Plus" scenarios.	**YES - key component** Detailed set of crosscutting adaptation strategies and actions.	• The strategy builds on NDC targets; • Linkages with SDG Road Map are clearly explored.
United Arab Emirates	National Climate Change Plan of the United Arab Emirates*	Identifying strategic priorities, covering both mitigation and adaptation, to consolidate UAE's climate action.	2050	• Manage GHG emissions while sustaining economic growth; • Increase climate resilien	Not specified	**NO**	**YES - key component** Detailed set of crosscutting adaptation strategies and actions.	• The strategy builds on NDC targets; • Linkages with SDGs are recognised but not analysed / examined throughout

Country	Title of the Strategy	Underlying Vision / Purpose of the Strategy	Timeline	Target(s)	Sectoral Coverage	GHG projections / low-emission scenarios	Adaptation	Linkages with NDC and/or SDGs
				ce by minimising risks and improving adaptive capacity; • Advance the UAE's economic diversification agenda through innovative solutions; • Additional sector-specific quantitative targets.				the strategy.

Note: The strategies are listed in order of submission to the UNFCCC, from least to most recently submitted; the strategies marked with an "*" are long-term low-emission strategies that have not been submitted/communicated to the UNFCCC.
Source: (Rocha and Falduto, 2019[2]).

Table A B.2. Overview of selected countries' Long-Term Low-emission Development Strategies (LT-LEDS) Part 2

Governance, institutional setup and stakeholder engagement

Country	Legal Framework	Institutional Setup	Stakeholder Engagement	Vision for resourcing the strategy	Revision Plan	MRV or M&E processes
Canada	No information available	No information available	YES Focus on indigenous communities.	Partially The strategy provides costs estimates for some measures.	No information available	No information available
Germany	No information available	Dedicated team. (Climate Policy Division within the Ministry of Environment).	YES Consultations with randomly selected citizens and other key stakeholders.	Partially The strategy lays out directions to fund the implementation of the strategy (e.g. need for raising climate-friendly investments, improving transparency concerning climate risks to steer investments).	YES (The strategy envisions periodical review and adjustment of policies it contains, but does not specify a timeframe).	YES Climate action reports to be prepared every year.
Mexico	Existing legal framework supporting LEDS. General Law on Climate Change provides the mandate to craft comprehensive long-term climate policy.	Dedicated body. Two bodies: the Interministerial Commission on Climate Change and the National Institute for Ecology and Climate Change.	YES Advisory Councils on Sustainable Development in all states; Workshop with over 80 experts from NGOs, academic community, and the private sector; Nation-wide online consultation process.	Partially The strategy points out areas where investments are needed (e.g. need to enhance investments in renewable energies).	No information available	M&E and MRV processes under development.
United States[8]	No information available	No information available	No information available	NO	No information available	No information available
Benin	Existing legal framework supporting LEDS. The strategy is considered to be a legal document.	Dedicated body. National Committee on Climate Change; General Directorate on Climate Change.	FORESEEN A committee composed of representatives from ministries, key stakeholder and local communities will be set-up.	Partially The strategy lays out general directions to fund the implementation of the strategy.	YES (The strategy envisions periodical review and adjustment of policies it contains, but does not specify a timeframe).	M&E and MRV processes under development.
France	Existing legal framework supporting LEDS. Supported by the Energy Transition for Green Growth Act.	Dedicated bodies National Committee on ecological transition (existing body gathering various stakeholders); Experts committee on energy transition	YES Organisation of workshops with key stakeholders.	Partially The strategy lays out general directions to fund the implementation of the strategy.	YES The strategy will be revised every 5 years starting in 2019	YES Provision of indicators to be monitored annually.

[8] The "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. (Rocha and Falduto, 2019[2]).

Country	Legal Framework	Institutional Setup	Stakeholder Engagement	Vision for resourcing the strategy	Revision Plan	MRV or M&E processes
		(new body, provides advice to the government and parliament on the elaboration and implementation of the strategy)				
Czech Republic	No information available	No information available	YES Consultations with stakeholders included in the Inter-ministerial Working Group on Climate Change Issues. Public consultation as part of the strategic environmental assessment.	YES The strategy provides estimates of expected funds from bilateral and multilateral foreign development co-operation. It also sets targets on increasing levels of climate finance. Finally, it estimates costs and revenues of the EU ETS.	YES The strategy specifically mentions first evaluation by the end of 2021 and update by the end of 2023.	YES MRV linked to EU mechanism on monitoring and reporting of GHG emissions.
United Kingdom	Existing legal framework supporting LEDS. Legally binding emissions reduction target within the 2008 Climate Change Act, supported by carbon budgets set every 5 years in secondary legislation.	No information available	No information available	Partially The strategy provides sectoral investment estimates.	No information available However, the strategy highlights that some targets will be reviewed. Requirement under the Climate Change Act 2008 to set out plans and proposals for meeting carbon budgets, after each carbon budget is set.	M&E process under development. The Clean Growth Inter-Ministerial Group, in charge of monitoring the implementation of the strategy, has been reinstated. The UK will also report annually on emissions intensity ratio, to measure performance.
Ukraine	Existing legal framework supporting LEDS. Concept for Implementation of the State policy on Climate change up to 2030. Other national laws and development plans support the implementation of the strategy.	No information available	No information available	NO	YES (The strategy envisions periodical review and adjustment of policies it contains, but does not specify a timeframe).	No information available
Republic of the Marshall Islands	No information available	Dedicated body. (The production and implementation of the strategy is	YES A Partnership Dialogue engaged a range of key	NO The strategy however contains recommendations	YES (5 years)	M&E process under development.

Country	Legal Framework	Institutional Setup	Stakeholder Engagement	Vision for resourcing the strategy	Revision Plan	MRV or M&E processes
		overseen by the TTE committee, comprising of key stakeholders. The Government energy planning division has served at the Secretariat to the Committee).	international stakeholders who will be crucial to the realization of the goals of the 2050 Strategy. The outcomes of future dialogues will be used to inform the implementation of the strategy.	for the establishment of a long-term finance strategy.		
Fiji	Existing legal framework supporting LEDS. Detailed overview of the country's legal and institutional framework supporting the LT-LEDS process (e.g sector-specific regulations and policies).	Dedicated body. (The Climate Change and International Co-operation Division (CCICD) has led the preparation of the strategy).	YES Establishment of a Fiji LEDS Steering Committee composed of 14 government ministries and agencies; The CCICD convened three National Stakeholder Workshops.	NO	YES (4 years) (The Steering Committee will review and –if needed— revise NDC and/or LEDS).	M&E process under development. Performance indicators to (a) track specific policies and actions implemented; (b) track GHG emission reductions; (c) track impact of policies in creating co-benefits and (d) track means of implementation and support.
Japan	No information available	No information available	YES Holding a meeting on a Long-Term Strategy under the Paris Agreement, consisting of experts from various fields such as financial, business, and academic sectors. Holding a public consultation.	Partially The strategy lays out directions for policy measures intended to promote Green Finance (e.g. mobilising finance through climate-related financial disclosures TCFD).	YES (6 years) The Government will revisit the policy measures flexibility about every 6 years with reference to situations, and review the strategy as may be required. Details on the review / revision process are not included in the document.	No information available
Portugal	Existing legal framework supporting LEDS. The Strategic Framework for Climate Policy (QEPiC) establishes an "integrated, complementary and articulated framework of climate policy instruments".	No information available	YES Cycle of technical workshops and thematic events to discuss scenarios and decarbonisation of society. The preliminary results of the plan were divulged for public consultation for a period of three months.	YES The strategy provides an estimate of aggregate amount of investment needed by 2050 as well as detailed sector-specific estimates and estimates of investment needed in new mitigation technologies. The strategy also	YES (10 years)	YES The Interministerial Commission for Air, Climate Change and Circular Economy will be in charge of monitoring progress towards carbon neutrality.

Country	Legal Framework	Institutional Setup	Stakeholder Engagement	Vision for resourcing the strategy	Revision Plan	MRV or M&E processes
				provides an overview of European, national and private sector financing instruments that can be used.		
Indonesia	Indonesia	No information available	YES No additional information	YES Average investment needs for the implementation of different scenarios.	No information available	M&E process under development
United Arab Emirates	No information available	Dedicated body The Council on Climate Change and the Environment (CC&EC) is an inter-ministerial, inter-emirate governance body.	No information available	Partially Set of general recommendations to steer green finance.	No information available	YES The UEA Council on Climate Change and the Environment will monitor progress of the strategy – no further details.

Note: The strategies are listed in order of submission to the UNFCCC, from least to most recently submitted; the strategies marked with an "*" are long-term low-emission strategies that have not been submitted/communicated to the UNFCCC (Rocha and Falduto, 2019[2]).
Source: (Rocha and Falduto, 2019[2]).

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Notes

[1] The 2050 pathway platform is a multi-stakeholder initiative launched at COP 22 by High-Level Climate Champions to support countries seeking to develop long-term, net zero-GHG, climate-resilient and sustainable-development pathways. It is a platform for collective problem-solving for a broad array of actors; cities, states, and companies; to engage in long-term low-emissions planning, and support of the national strategies.

[2] In 2018, the German Ministry was renamed to Federal Ministry for Environment, Nature Conservation and Nuclear Safety.

[3] The online platform could be found under http://www.klimadialog2050.de/ (not active anymore).

[4] For example, the Federal Ministry of Economic Affairs and Energy, the Federal Ministry of Food and Agriculture, and the Federal Ministry of Transport and digital Infrastructure.

[5] Consistent with European Union objectives.

[6] Factor 4 is a commonly used in France to mean that allowed emissions will be divided by 4 comparing to 1990 level (-75%).

[7] The upcoming updated LT-LEDS will contain carbon budgets for 2029-2033 period.

[8] http://www.legislation.gov.uk/uksi/2016/785/impacts.

[9] Chaired by Alain Quinet, General Inspector of Finances.

[10] European Union Emissions Trading Scheme.

[11] The PDU is an integrative mobility planning tool (includes all modes of transport and parking) mandatory for agglomerations of more than 100000 inhabitants, backed by the NOTRe Law (that devolutes more power to the territories) and progressively reinforced through successive legal adjustments since its inception in 1982. Key elements of the PDU include the fulfilment of mobility needs, safety, environment protection, GHG emissions reductions and health. The PDU is a central tool for environment protection and the fight against air pollution by promoting less polluting transport modes, and tracks climate change mitigation through the periodic evaluation (5 to 10 years) of avoided and emitted GHG and other atmospheric pollutants.

[12] Consideration of Nationally Determined Contributions is not relevant for California as an individual State.

[13] France is bound by European commitments regarding the non-ETS sectors as part of the EU efforts sharing.

[14] For example, one target in the 25 Year Environment Plan is: Reducing the damaging abstraction of water from rivers and groundwater, ensuring that by 2021 the proportion of water bodies with enough water to support environmental standards increases from 82% to 90% for surface water bodies and from 72% to 77% for groundwater bodies.

[15] Federation of municipalities, Agglomeration Communities, urban communities, metropolis.

[16] SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture
SDG 5: Achieve gender equality and empower all women and girls.
SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
SDG 10: Reduce inequality within and among countries.
SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable.
SDG 12: Ensure sustainable consumption and production patterns.
SDG 13: Take urgent action to combat climate change and its impacts.
SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

[17] https://www.theccc.org.uk/.

[18] German Federal Parliament.