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REPORT

EU

2017

THIS REPORT WAS FINANCED BY:

MaxiMiseR

STRATEGIES FOR A LOW CARBON EU BY 2050

PLANNING TO SUCCEED

How to build strong 2050 climate and energy development strategies

WWF EUROPEAN POLICY OFFICE

Author:

Adam White, *Senior Research Coordinator*
Email: awhite@wwf.eu

Contributors:

Imke Lübbeke, *Project Director - MaxiMiseR / Head of Climate and Energy Unit*
Email: iluebbeke@wwf.eu

Jane Wallace-Jones, *Project Manager - MaxiMiseR*
Email: maximiser@wwf.eu

Leia Achampong, *Climate policy officer*
Email: lachampong@wwf.eu

Alex Mason, *Senior Renewable Energy Policy Officer*
Email: amason@wwf.eu

Sarah Azau, *Senior Communications Officer*
Email: sazau@wwf.eu

Andrea Crasselt, *Communications Consultant*
Email: acrasselt@wwf.eu

June 2017

Rue du Commerce 123 - 1000 Brussels
Website: **www.maximiser.eu**
Twitter: **@MaxiMiseREU**

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EXECUTIVE SUMMARY

Good 2050 climate and energy strategies are essential both for tackling climate change and for securing the well-being and prosperity of people and planet.

It is therefore important to ensure these strategies are as strong as possible. The MaxiMiseR project has identified ten essential elements of a good 2050 climate and energy strategy:

1.	**Ambition**	Keep global temperature rises below 2°C (pursue 1.5°C limit)
2.	**Scope**	Be fully cross-sectoral, covering all parts of society and the economy
3.	**Actionable**	Describe existing and new policies and measures to be taken
4.	**Integration**	Take account of all relevant strategies and plans
5.	**Political commitment**	Secure leadership at the highest political level
6.	**Monitoring**	Provide a clear framework for monitoring, reporting and verifying
7.	**Public transparency**	Make key information public at all stages of 2050 strategy development
8.	**Stakeholder participation**	Engage all stakeholders in the development of a 2050 strategy
9.	**Analytical basis**	Undertake modelling and sensitivity analysis with peer review
10.	**Review**	Ensure regular review of analytical basis, policies, measures, targets

INTRODUCTION

The importance and value of 2050 strategies that seek to cut greenhouse gas emissions while also ensuring well-being and prosperity have been acknowledged by policy makers, advocates, and businesses for many years. This recognition has seen a number of countries produce such strategies, which have become an important element in international climate agreements. However, there is no formal multi-lateral or international guidance as to what such strategies should contain or how they should be developed. While this is an important deficit that should be corrected, it is somewhat mitigated by a strong body of independent papers. This literature can, collectively, provide a helpful guide to the makers of these strategies because they uniformly identify a number of essential elements of a successful 2050 climate and energy development strategy.

MAXIMISER

This report is part of the MaxiMiseR project (see Annexe 3 and **www.maximiser.eu** for more details). This LIFE and MAVA funded project aims to ensure that the climate and energy development strategies produced by EU Member States are as strong as possible. The project also aims to foster learning on effective strategies between EU countries and the wider international community. As such, this guidance is principally aimed at policy makers in the EU, both in national governments and in EU institutions, but should also be relevant to those outside of the EU.

This paper will introduce policy makers to this literature and draw from it to set out what the MaxiMiseR project considers to be the essential elements of a successful 2050 climate and energy development strategy. A full literature review and bibliography is also included (Annexe 1) to provide options for further reading.

This paper aims to be a starting point for policy makers who are seeking to either develop their country's first 2050 decarbonisation plan, or to strengthen their existing plan. It makes clear that 2050 strategies should not only be about cutting emissions, but should also address sustainable development more broadly. Having set out the legal basis of climate and energyn development strategies, both at EU and international level, the paper, most importantly, identifies 10 essential elements of 2050 strategies.

Terminology and definition - 2050 climate and energy development strategies:

The strategies that set out a country's goals and means for continuing their development in a way that cuts their emissions have been interchangeably known as *low-emission development strategies*, *low-carbon development strategies*, and *low-carbon growth plans*. The MaxiMiseR project refers to them as 2050 climate and energy development strategies. Below is the project definition of these plans:

> *A climate and energy development strategy is a country's plan for cutting its greenhouse gas emissions while securing the well-being and prosperity of its citizens. The Paris Agreement aims to keep the global temperature rise this century well below 2 degrees and drive efforts to limit the temperature increase even further to 1.5 degrees Celsius above pre-industrial levels. The strategy should set clear goals to at least 2050 and explain how they will be achieved. It should be based on the best scientific understanding and on a transparent process involving stakeholder participation.*

Why 2050 climate and energy development strategies matter

2050 strategies can help to secure a country's sustainable development (see textbox) by providing a means to address the complex, interdependent, structural and long-term challenges posed by climate change. Furthermore, they can help to secure the public's engagement in, and support for, the changes that need to happen and the actions that need to be taken.

A clear example of the benefit of cross-sectoral, 2050 strategies is provided by the questionable strategy of switching from coal to gas fired power plant for electricity generation. As gas power stations produce around half of the emissions of their coal equivalents, medium-term emissions reduction targets can be met by building new gas plants and shutting coal plants.

2050 STRATEGIES AND SUSTAINABLE DEVELOPMENT

Sustainable development is defined as *'development that meets the needs of the present, without compromising the ability of future generations to meet their own needs'* and is an understanding that should be central to all 2050 strategies. Most recently, this concept of sustainable development has been formalised in the United Nations' 17 Sustainable Development Goals. These goals are integrated and indivisible; their balance of the three dimensions of sustainable development – the economic, the social and the environmental – should be reflected in 2050 strategies.

As such, a true climate and energy development strategy should be a strategic plan to assist a country in shifting to a development path that will deliver a low carbon and climate resilient economy – achieving sustainable development based on the socio-economic and development priorities of the country. 2050 strategies should avoid the false dichotomy between a 'climate-first' approach and a 'development-first' approach.

However, these gas plants will have an economic life-time of around 40 years, and so any new plant could still be operating in 2070 – by when the EU will need to be emitting almost no emissions. If by 2070 – by which point the EU will need to have almost zero emissions. If by 2070 these gas plants continue to operate without Carbon Capture and Storage (CCS), they could be the cause of failing to meet a longer term target. Planners could assume the availability of CCS but this would remain a risky strategy. What if CCS remains commercially unviable? What if the storage of emissions is limited – should it not be prioritised for industrial practices where the removal of fossil fuels is more difficult than it is in power generation?

Decisions taken today can resonate for decades, significantly impacting our chances of cutting emissions quickly enough. Widely supported cross-sectoral strategies that are consistent, coherent, resilient and robust are needed to ensure we meet the final objectives with as little risk of failure as possible. High-quality 2050 climate and energy development strategies can meet this need. Once they are in place, policy makers can have greater confidence that their short and medium term decisions will reinforce, rather than undermine, the long-term goal.

The legal basis for climate and energy development strategies

2050 strategies in international agreements

The initial proposal to introduce 2050 strategies was put forward by the European Union (EU) in 2008. It highlighted how information on planned low-carbon pathways can help to inform the international community about funding needs and priorities and to help gauge the level of global climate change action. The concept has been included in the negotiating texts under the UNFCCC since the run up to the 15th Climate Change Conference of the Parties in Copenhagen in 2009 (COP15) and is part of both the Copenhagen Accord and the Cancun Agreement, which recognize that a 2050 strategy is indispensable to achieve sustainable development objectives.

In the Paris Agreement of December 2015, Parties to the UNFCCC, including EU Member States, agreed in article 2.1.a to:

> *"Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels".*

And in article 4.19 to:

> *"...formulate and communicate long-term low greenhouse gas emission development strategies, mindful of Article 2 taking into account their common but differentiated responsibilities and respective capabilities, in the light of different national circumstances."*

The Paris Agreement is supported by a decisions document. UNFCCC Decision 1/CP.21. In paragraph 35, Chapter 3 ("Decisions to give effect to the [Paris] Agreement"), the Conference of the Parties:

> *"Invites Parties to communicate, by 2020, `to the secretariat mid-century, long-term low greenhouse gas emission development strategies in accordance with Article 4, paragraph 19, of the Agreement, and requests the secretariat to publish on the UNFCCC website Parties' low greenhouse gas emission development strategies as communicated".*

2050 strategies in EU law

Currently, EU legislation explicitly refers to this international recognition. The Monitoring Mechanism Regulation (MMR) (Regulation 523/2013) states in Article 4 that:

> *"Member States, and the Commission on behalf of the Union, shall prepare their low-carbon development strategies in accordance with any reporting provisions agreed internationally in the context of the UNFCCC process (...)".*

And in Article 13.b that:

> *"By 15 March 2015, and every two years thereafter, Member States shall provide the Commission with (...) updates relevant to their low-carbon development strategies referred to in Article 4 and progress in implementing those strategies".*

Most recently at EU level, the European Commission has tabled proposals for a Regulation on the Governance of the Energy Union (European Commission, 2016) to supersede the MMR. The proposed regulation includes an article (Article 14) on Long-term low emission strategies, which states:

> *"Member States shall prepare and report to the Commission by 1 January 2020 and every 10 years thereafter their long-term low emission strategies with a 50 years perspective to contribute to: (a) fulfilling the Union's and the Member States' commitments under the UNFCCC and the Paris Agreement to reduce anthropogenic greenhouse gas emissions..."*

The current European Commission proposals refer only to 'long-term low emission strategies' and excludes the word 'development', which was previously present. As these proposals go through the EU's law making process, this absence of *development* should be corrected. While the EU is not a bloc of developing countries, all nations will need to become more efficient, cleaner, and safer in order to tackle climate change. Without the explicit inclusion of developmental elements in strategies to cut emissions, they risk being reductionist – centred too narrowly on cheap mitigation without considering the full value of related socio-economic and environmental developmental benefits.

The EU is also proposing long-term strategies which run for 50 years - that is, to 2070. Strategies to 2050 are preferable, in line with the Paris Agreement.

2050 strategy guidance

Observers have reported that at each stage in International and European deliberations on the role and need for 2050 strategies; negotiating countries have resisted the adoption of formal guidelines laying down what these strategies should include or how they should be developed. This absence of guidance on 2050 strategies is so pronounced that, as noted above, there is not even a legally accepted definition of such strategies.

States have been vocal about their aversion to guidance, fearing it would push them into a 'one size fits all' approach that does not reflect their particular national context. While the MMR implementing regulation specifies the format, timing, and structure of reporting elements[1] it does not specify the content that should be reported on, deferring instead to "any provisions agreed internationally". However, the Paris Agreement, which sets a level of ambition but leaves signatories to set out how they will help to achieve it through plans know as 'Nationally Determined Contributions', maintains this preference by countries not to be bound to a strict planning and reporting framework. The Guidance provided in this paper is not offered as a template for a binding framework. Instead, it represents the best practice for the content and processes of a 2050 strategy.

However, the body of independent literature providing guidance on the content and production of climate and energy development strategies has consistently highlighted a number of elements that should be included. This literature is set out in Annexe 1, and forms the basis of this guidance.

This literature review is supplemented by the recommendations WWF has made following its assessment of EU Member States' 2050 strategies (see Annex 2) using a tool commissioned from the Ecologic Institute.

1 EIONET Central Data Repository – The European Environment Agency, General help on the Monitoring Mechanism Regulation (MMR), http://pam.apps.eea.europa.eu/, accessed May 2017.

10 ESSENTIAL ELEMENTS OF A LONG TERM CLIMATE AND ENERGY DEVELOPMENT STRATEGY

In order for 2050 strategies to realise their full potential to help tackle climate change while securing the well-being and prosperity of both people and the planet, they should contain the following elements, as identified by both the literature (Annexe 1) and the MaxiMiseR evaluation tool (Annexe 2). A number of these elements are already reflected in EU law, such as requirements to report on national projections of anthropogenic greenhouse gases (MMR Art 14), and climate change mitigation policies and measures (MMR art 13). However, others are not.

1.	**Ambition**	Keep global temperature rises below 2°C (pursue 1.5°C limit)
2.	**Scope**	Be fully cross-sectoral, covering all parts of society and the economy
3.	**Actionable**	Describe existing and new policies and measures to be taken
4.	**Integration**	Take account of targets/policies of neighbouring countries
5.	**Political commitment**	Secure leadership at the highest political level
6.	**Monitoring**	Provide a clear framework for monitoring, reporting and verifying
7.	**Public transparency**	Make key information public at all stages 2050 strategy development
8.	**Stakeholder participation**	Engage all stakeholders in the development of a 2050 strategy
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1. Ambition

Climate and energy development strategies should state how they will help to deliver the globally agreed aim of holding temperature rise to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C. [2] This level of ambition is a significant increase from the previously agreed global aim of keeping the average temperature rise below two degrees.[3] Plans of how to reach the more stringent temperature limits should be informed by the forthcoming (Sept 2018) Intergovernmental Panel on Climate Change (IPCC) special report on global warming of 1.5 °C.[4]

The global aim of keeping global warming below 2°C was interpreted by the IPCC as requiring developed countries as a group to reduce emissions by 80 to 95 % by 2050 compared to 1990 levels. The European Council adopted this target in October 2009.[5] The target was given some technical underpinning by the European Commission in two communications, A *Roadmap for moving to a competitive low carbon economy in 2050*[6] and an *Energy Roadmap 2050.*[7]

Just as the temperature limit has been tightened, so it should be expected that the emissions reductions targets of all countries will also increase. The EU has particular incentives to lead the way in accelerating the reduction of greenhouse gas emissions (see text box), not least because temperatures across Europe are projected to continue increasing faster than the global average.

2050 strategies at both EU and Member State level should clearly reflect the increased global ambition for limiting global warming, including through more ambitious targets for cutting emissions by 2050. Greenhouse gas emissions reduction targets should also be supported by separate targets on renewable energy shares; energy efficiency; the phase- out of subsidies for fossil fuels; and the phase- out of the use of fossil fuels; sustainable infrastructure, and sustainable financial and investment flows. The 2050 strategies should set out how the chosen policies and measures will deliver the targets, including analysis of delivery risk and its mitigation.

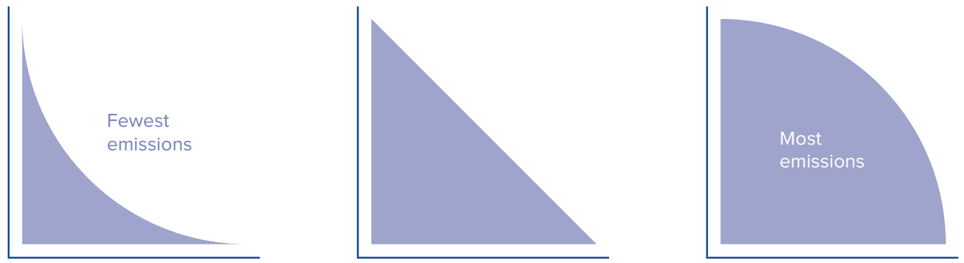
It is particularly important that the European Commission lead the way in this area as it updates its 2050 climate and energy roadmaps. Those EU Member States who have submitted 2050 strategies to the EU have typically matched their 2050 goals and underlying analysis to those developed at EU level (WWF 2017). In order to ensure that efforts to cut emissions remain in line with the latest climate science, EU and Member State targets should be reinforced by a review and ratchet up mechanism activated at least every five years, to allow for accelerated emission cuts as needed.

CLIMATE CHANGE IN EUROPE:

According to the European Environment Agency, European land areas in the decade between 2006 and 2015 have warmed by around 1.5°C since the pre-industrial age, and 2014 and 2015 were jointly the warmest years on record in Europe. Since 2003, Europe has experienced several extreme summer heat waves (2003, 2006, 2007, 2010, 2014 and 2015). Annual precipitation has increased in most of northern Europe, in particular in winter, and has decreased in most of southern Europe, in particular in summer. These climatic changes are already having notable social, economic, and environmental impacts, including loss of life and assets though extreme temperatures, drought and flooding (EEA 2017).

Setting the trajectory towards ambitious long-term targets

The EU's existing 2050 target is expressed in terms of a level of reduction that needs to be achieved by that date (80-95% compared to 1990). However, as important as setting an ambitious long-term target for cutting emissions is the need to control the rate of emissions released along the way. The figure shows how the amount of pollution released between a given start point and end point, represented by the blue shape, can vary significantly. The fewer total emissions released, the lower the concentration of emissions in the atmosphere, and the smaller the impact on global temperature. Therefore, it is the both the target and the trajectory of emissions reductions towards it, and hence



2 United Nations Framework Convention on Climate Change, The Paris Agreement, overview webpage http://unfccc.int/paris_agreement/items/9485.php, accessed February 2017

3 United Nations Framework Convention on Climate Change, The Cancun Agreements, overview webpage http://cancun.unfccc.int/, accessed February 2017

4 https://www.ipcc.ch/report/sr15/

5 Council of the European Union, Presidency Conclusions, 30 October 2009, http://ec.europa.eu/regional_policy/sources/cooperate/baltic/pdf/council_concl_30102009.pdf, accessed February 2017

6 Communication from the Commission to the European Parliament , the Council, The European Economic and Social Committee and the Committee of the Regions, A Roadmap for moving to a competitive low carbon economy in 2050 COM(2011) 112 final, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0112&from=EN

7 Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions, Energy Roadmap 2050 COM/2011/0885 final - http://eur-lex.europa.eu/legal-content/EN/ALL/;ELX_SESSIONID=pXNYJKSFbLwdq5JBWQ9CvYWyJxD9RF4mnS3ctywT2xXmFYhlnlW1!-868768807?uri=CELEX:52011DC0885

the total emissions released, that defines what happens to the climate. An emissions reduction trajectory can be set through interim targets (for example, every five years), or through a more 'mechanical' tightening mechanism such as the EU ETS linear reduction factor. Whichever approach is taken, the important thing is to define the total volume of emissions that can be emitted, that is, the 'carbon budget'. Countries should reflect on the volume of emissions that can be released regionally, nationally, and globally if the agreed temperature limits are to be met.

Much of the literature on this issue highlights the UK example, which was the first country to set legally binding carbon targets, supported by a system of carbon budgets for successive five-year periods[8] and accompanied by a detailed long-term emissions reduction strategy called "The Carbon Plan".[9] By providing a trajectory towards a 2050 target (in blocks five-years long), the UK's carbon budget approach places limits on the total volume of emissions, ensures regular progress is being made and provides a level of predictability for firms and households to plan for, and invest in, a low-emission economy. The UK government sets carbon budgets based on advice from an advisory body – the Committee on Climate Change – and using criteria set out in the Climate Change Act of 2008.[10] A number of other countries have since then developed their own versions of this approach. The Republic of Ireland has adopted a Climate Action and Low Carbon Development Act 2015 which requires the government to produce, every five years, a national low carbon transition and mitigation plan.[11] France has adopted an Energy Transition for Green Growth law which provides a legally binding framework that establishes carbon budgets and asks external experts to review measures in relation to these carbon budgets.[12]

Carbon budgets that set a maximum quantity of emissions for a five year budgetary period can help to ensure that action towards the final 2050 target is not delayed. Delays in taking action to reduce greenhouse gas emissions imply higher total economic costs in the long-term (see for example the Stern Review, 2006) Delays can also lead to missing the target altogether given possible limits on the amount of money available for investment in emissions cutting projects in later years. When developing their 2050 climate and energy development strategies and 2050 targets, EU Member States should draw on the world leading carbon budget experience of the UK.

8 https://www.gov.uk/guidance/carbon-budgets and https://www.theccc.org.uk/tackling-climate-change/reducing-carbon-emissions/carbon-budgets-and-targets/

9 The United Kingdom Government, The Carbon Plan – reducing greenhouse gas emissions, https://www.gov.uk/government/publications/the-carbon-plan-reducing-greenhouse-gas-emissions--2, accessed March 2017

10 The Climate Change Act 2008 - http://www.legislation.gov.uk/ukpga/2008/27/contents, accessed February 2017

11 Government of Ireland, Climate Action and Low Carbon Development Act 2015, http://www.irishstatutebook.ie/eli/2015/act/46/enacted/en/pdf, accessed May 2017

12 Insert reference to WWF LCDS evaluation paper

2. Scope

2050 strategies should cover all sectors of its country's economy and society and, thereby, all of a country's emissions[13] – including those produced and/or absorbed through land use, land use change, and forestry (LULUCF). Only by covering all sectors can a 2050 strategy take full account of a country's particular context and the different synergies and trade-offs that might be available to it. Viewed a different way, an economy and society wide approach can help to avoid overlapping or even conflicting activities that could arise from working in silos on sector specific approaches.

Analysis of all emissions sources and sinks — including the interfaces and trade-offs among agriculture, land use, energy supply, residential, commercial and industrial energy use, transport, and waste management — can be challenging to carry out, particularly for countries with lower capacity and resources in this area. Therefore, the European Commission and / or Member States with proven capacity in long-term planning should provide assistance to their less well equipped counterparts and share examples of best practices.

However, such a comprehensive approach does not necessarily mean writing new strategies for each sector of an economy. Instead, a 2050 strategy can build upon existing sector strategies. In the UK, the Low Carbon Transition Plan was supported by a series of related government publications focused on sectoral strategies that were published at the same time, including the UK Low Carbon Industrial Strategy, the UK Renewable Energy Strategy, and Low Carbon Transport: A Greener Future (IEA and OECD 2010). If a 2050 strategy is building upon existing sectoral strategies, there should still be a clear and detailed overarching record of all policies and measures, across the economy and society, that are expected to deliver the strategy's targets. Such an approach can help countries to best address their particular circumstances. However, given that the large majority of emissions come from the energy sector, this will have to be a priority for action in all strategies.

An approach that covers all sectors should also acknowledge those who face particular challenges. Such sectors or organisations should not be ignored, and must be dealt with firmly and fairly. Effectively addressing these challenges will be crucial to securing a just transition to low-emissions development. 2050 strategies should set out how low emission development can help to provide in-

13 The gases covered under the Kyoto protocol (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride, nitrogen trifluoride), and short-lived climate pollutants such as black carbon

vestors with the confidence they need to invest in new into new technologies, business models, or even activities. This should be done through the use of policies and measures that foster innovation and limit the potential for the lock-in of technologies that do not provide the best solutions.

In addition to addressing challenged sectors and fostering innovation for a just transition, effective 2050 strategies will also need to address the social consequences and opportunities of decarbonisation. Regions and sectors that still rely on carbon-intensive activities will need clear plans for cushioning the social impact of decarbonisation through training and re-skilling programmes that catalyse and accompany the transition by maximising quality employment across the economy.

While national 2050 strategies will focus on national targets, policies and measures, they should also take into account emissions for which they have some responsibility but which are not released on their territory. Such emissions would include those from international shipping and aviation, as well as the emissions that are embedded in the goods that a country imports.

Finally, a 2050 strategy should either include a full national climate change adaptation strategy, as Lithuania's does, or it should clearly link to a separate adaptation strategy. Given that climate impacts are already being felt in the EU, 2050 strategies should set out, as a minimum, how they will be delivered despite the challenges posed by a changing climate.

3. Facilitating implementation - making 2050 strategies actionable

2050 strategies must demonstrate that they can feasibly and sustainably be put into action. They should do this by indicating the direction of the overarching policies and measures that will be put in place to deliver the ultimate and intermediate objectives. All stakeholders should have the information they need to decide on the steps they should be taking to contribute to the achievement of the strategy.

These overarching policies and measures should address emissions across the whole economy to provide a coherent and consistent climate policy framework, with clear timelines and updates on the status of their implementation. While providing a clear sense of direction, a 2050 strategy should also account for the possible need for adjustment to reflect changing circumstances, such as new technology breakthroughs. Therefore, more detailed policies and measures will need to be developed for the short and medium term, and 2050 strategies should set out how they will be tested to ensure that all policies and measures support the delivery of the 2050 strategy's objectives. Ideally, a 2050 strategy should be supported by regularly updated plans setting out what will be done over the coming year and five years to ensure their delivery.

A 2050 strategy's enabling policy framework must also address any barriers, be they legal, institutional or behavioural, to the delivery of the 2050 strategy's objectives. Well-developed climate policies that are aligned across government and which effectively address barriers can help generate political will across different areas and levels of government – increasing the chances of their successful implementation. This support and success can be further enhanced if 2050 strategies clearly highlight the co-benefits of adopted policies and measures - for example the improved air quality and health that results from closing coal fired power plants. The success of a 2050 strategy's policies and measures is more likely if it is made clear which entities are responsible for their delivery, and it is essential that one ministry or agency have the task of coordinating actions. The assignment of responsibility for a 2050 strategy's policies and measures should not only happen across national government level; responsible parties should also be identified at regional, municipal, and local levels.

As noted above under the 'scope' section, the development of policies and measures should also identify the interactions between them, including the maximisation of synergies and the minimisation of trade-offs. Part of this inter-connected policy making should also involve the identification of priority policies and measures, including those that are required to unlock the potential of further policies and measures that are subsequently implemented. For example, the success of 'on the ground' mitigation policies will depend, to a large extent, on the capacity of the individuals and organisations tasked with delivering them – making capacity building an essential element of a 2050 strategy's policies and measures. The sequencing of short and medium term policies and measures to

deliver a 2050 strategy's objective should be clearly set out by the relevant national policy makers. The French 2050 strategy provides a strong example of how to make such a strategy actionable.

Financing the delivery of a 2050 strategy

Implicit in the need for LEDs is the understanding that the challenges posed by climate change require an almost unprecedented re-direction of social and economic activities, with the consequent adoption of investment and financing measures. To that end, the Paris Agreement sets the objective to *"make all financial flows consistent with a pathway towards low-emissions, climate-resilient development".*[14]

The very scale of the finance required to support the transition to a low-carbon and climate-resilient economy means that 2050 strategies should highlight multiple sources of climate finance and investment from both public and private sources. Such resourcing of the transition will only become available if a 2050 strategy offers market actors the certainty and predictable regulatory and economic frameworks they need to be confident to invest.

Private capital is the largest source of funds for climate action at the global level but its full potential is not yet realised because the financial system and specific products and services to address credit, financial and liquidity risks still require improvement. Public finance remains, therefore, a key driver and governments should encourage and support the delivery of a low emission and climate resilient economy by reducing the risks of investments and by maximising low carbon opportunities for investors. Member States can turn LEDs into opportunities for attracting investors, by including 'capital raising plans' in LEDs where they detail how they will pull together public and private financial flows to reach LEDs objectives.

An important part of getting the financial flows needed to drive low emissions development is understanding how current public spending and private finance are addressing or contributing to climate change. France provides a strong example of financial transparency by making climate reporting mandatory for investors. In July 2015, French lawmakers adopted an amendment to France's Energy Transition Law (which also underpins its 2050 strategy) that requires large investors to make annual disclosures on (1) the extent to which they have integrated environmental and especially climate-related considerations into their investment policies; (2) the greenhouse gas emissions embodied in their investments; (3) how they contribute to meeting French and international climate objectives; and (4) how much of a financial risk they face because of climate change. Such a move is intended to both help increase demand for 'climate metrics' and to "set the international standard" making it easier for other countries to adopt similar rules.

The systematic tracking of domestic climate-related financial flows (also called climate finance "landscapes") is also becoming more well-known. Climate finance landscapes can complement other policy assessment tools as well as project assessment tools and thus help to align financial flows with EU and national objectives expressed in 2050 strategies or in other plans such as Intended Nationally Determined Contributions (INDCS), National Energy and Climate Plans (NECPs) and National Adaptation Plans. Landscapes of climate finance are comprehensive studies mapping financial flows dedicated to climate change action and the energy transition. Initially developed by the Climate Policy Initiative (CPI), the Landscape methodology has been applied globally as well as domestically in European countries such as Germany, France and Belgium, and the European Environment Agency is planning similar work at EU level. It is a powerful process for supporting the development, enforcement and strengthening of national climate and energy policy: other Member States should follow suit and systematically track domestic climate-related financial flows.

14 Institute for Climate Economics and European Environment Agency, Landscapes of Domestic climate finance in Europe – Supporting and improving climate and energy policies for a low-carbon, resilient economy, http://www.i4ce.org/wp-core/wp-content/uploads/2016/12/EEA_workshop.pdf, accessed April 2017

4. Integration - national 2050 strategies support each other

The importance of ensuring that 2050 strategies are integrated into other policy fields, governance levels and national planning strategies is covered in chapter 2 of this report, on scope, and chapter 5, on political commitment. This is also the case for their alignment with broader economic, social and environmental objectives. A 2050 strategy should clearly demonstrate how its implementation will interact with the efforts and objectives of neighbouring countries.

Understanding the climate objectives, policies, and measures of neighbouring countries is particularly important in the EU. Member States often have contrasting approaches, despite common membership. For example, the east to west neighbours France, Germany and Poland each see significantly different roles for nuclear power, renewables, and coal power. Despite the setting of EU climate and energy objectives, the strict application of the principle of subsidiarity in EU policy making means that different Member States should not be assumed to have policies and measures that are easily integrated with those of their neighbours.

Unfortunately, few parts of the literature on guidance for 2050 strategies have specifically addressed the development of 2050 strategies by countries that are members of supranational organisations such as the EU. Nevertheless, the practice of cooperation between EU Member States, such as through electricity system balancing, has shown the potential benefits of acting together. The EU institutions and the Member States should, therefore, pay particular attention to the need to ensure that one country's 2050 strategy can be supported by that of their neighbours. This should be ensured through a thorough and transparent consultation process with governments, as well as with a wide range of non-governmental stakeholders in the neighbouring countries concerned. The European Commission's recent proposals for National Energy and Climate Plans (NECPs) set out a good example of how this should be done by EU Member States. However, NECPs are only currently required to cover the period up to 2030, and this requirement should also be part of 2050 planning.

5. Political commitment

2050 climate and energy development strategies require the commitment and leadership of politicians at the highest political level, not least in order to drive coordination and ensure implementation across different key ministries. While the importance of a high-level political decision to start the process and give it initial direction might be well understood, it is also important to recognise that this engagement can be maintained throughout the process, for example though a ministerial level working group. Such a group, comprised as it would be of a few people, who have a broad appreciation of government policy, could be used to unblock any sticking points in the development and/or implementation of their national 2050 strategy.

Political leaders and decision-makers at the highest levels will find it easier to engage with 2050 strategies that take a sustainable development approach and are not focused on decarbonisation for its own sake. As such, one of the most effective ways of securing high level political support for 2050 strategies is through the clear identification and effective promotion of the co-benefits of taking action to reduce emissions. Various European Commission impact assessments have shown these to include improvements in GDP, the creation of jobs, and reduced health impacts of air pollution. Support can also be built by identifying a 2050 strategy as a, if not the, key part of national economic development policies. Finally, given the consistently high levels of public support for preventing dangerous climate change,[15] political commitment can also be maintained and/or increased through regular stakeholder consultation.

A national 2050 strategy should also be insulated from changes in ruling administrations by its legal existence and supporting framework, including independent bodies, being enshrined in law when they are established. The climate change acts of the UK, and Denmark highlighted above are useful examples of laws which set long-term (2050 or beyond) emissions reductions targets in legislation. This legal protection should include the need to review, update and implement an existing or revised national 2050 strategy. Where appropriate, the supporting policies and measures, such as sectoral targets, or goals for efficiency and renewables, and the policies intended to achieve them, should also be enshrined in law. This is the case, for example, in the UK where the Climate Change Act 2008, which established the Committee on Climate Change and the setting of national carbon budgets, was supported by all major political parties. In May 2017, the Swedish government followed the UK by proposing a new climate policy framework consisting of a climate law, climate targets, and the establishment of a Climate Policy Council. These proposals are supported by six out of seven political party leaders. The more technically sound the basis for a 2050 strategy, the more likely it is to maintain broad political support over time.

Because of the importance of political commitment, and the complex challenge of securing that across political parties and across decades of development, it could be valuable for a 2050 strategy development team to include political economy[16] specialists, who are often not included in such exercises. Their role would be to ensure that the technical analysis behind a 2050 strategy is used effectively in political decision making by, for example, distilling possible trade-offs and informing how to deal with possible opposition to change. It is important to remember that there is no one-size-fits-all approach to successful low-emission development planning, and that the process must take into account the unique socio-political, economic, and cultural circumstances of each country. Thorough analyses of these aspects will need to complement the technical assessment of routes to a decarbonised society.

15 The European Commission, Special Eurobarometer 409 – Climate Change (2014) http://ec.europa.eu/public_opinion/archives/ebs/ebs_409_en.pdf accessed February 2017

16 Political economy is a term used for studying production and trade, and their relations with law, custom, and government, as well as with the distribution of national income and wealth. Political economy was developed in the 18th century as the study of the economies of states, hence the term political economy

6. Monitoring

As well as setting out targets, policies and measures, 2050 strategies should clearly provide a clear framework for the measurement, reporting, and verification (MRV) of the strategy. This MRV should not be a one way process of sending information to lead agencies, ministries, or international organisations. Instead, the best MRV process should create positive feedback loops, where successful and/or problematic elements are highlighted at an early stage, allowing the 2050 strategy to be honed even as it is implemented – increasing the chance of reaching the ultimate objectives. Through effective MRV, 2050 strategies can be continuously refined and strengthened in a positive iterative process.

The transparency and independence of monitoring should be supported by the creation of a new body, or the use of an existing body, that is given distinct monitoring powers. This independent body should be working with a dedicated set of indicators and should have a clear remit in terms of the frequency, format, and content of reporting, as well as the parties expected to participate in it. The body should report to parliament (legislative branch) as well as government (executive branch). In addition to obligatory reporting by public entities at local, municipal, regional, and national levels as appropriate, a 2050 strategy should promote the voluntary self-reporting of key indicators by other entities, such as businesses.

While a comprehensive MRV framework is crucial to the successful delivery of a 2050 strategy, it is also important to avoid reporting fatigue amongst the organizations providing the information. This is particularly the case in the European Union, where reporting requirements at EU level have frequently been the focus of criticism of an overly burdensome Europe. One key way of achieving detailed and transparent MRV, which reduces unnecessary administrative burdens for those tasked with reporting, is to integrate 2050 strategy indicators within already existing reporting arrangements. Indeed, in a cross-sectoral 2050 strategy, many of the indicators should already be being reported on.

Effective monitoring of 2050 strategies can deliver a number of benefits beyond the maintenance of progress towards achieving the objectives. These benefits can be felt beyond the country in which they were developed, and include the documentation and dissemination of lessons learnt, the identification of best practice, and enhanced awareness raising and understanding of the actions being taken and their intended outcomes. Such shared learning can be particularly beneficial among EU Member States, who already have a wide range of common objectives. Effective 2050 strategy monitoring by EU Member States should also provide the UNFCCC with a better understanding of the EU's contribution, both quantitative and qualitative, to global efforts to tackle climate change.

2050 strategy monitoring should also be used to play an important part in communicating the benefits of a 2050 strategy to stakeholders, including politicians and the general public. This should be done by combining a small number of headline indicators that facilitate easy communication with the more detailed indicator sets that should measure specific outputs and outcomes. The Dutch and French climate change laws require annual reporting to parliament.

WHAT 2050 STRATEGIES MONITORING AND REPORTING SHOULD COVER AS A MINIMUM:

- Emissions being reduced directly (by sector);
- Emissions being reduced indirectly (by sector);
- Mitigation actions;
- Sustainable development co-benefits, and;
- Who is responsible for implementation

Each indicator should clearly define its means of verification, including:

- Who monitors the indicators;
- The timing and frequency of monitoring;
- The procedures for reporting and verification.

As with all planning and reporting, indicators should be SMART (S: Specific, M: Measurable, A: Achievable, R: Relevant, T: Time-Bound) to ensure they effectively support monitoring, reporting and verification efforts.

7. Analytical basis

It is important to note, particularly for European Member States, that there is no need to start from scratch when it comes to developing a robust analytical basis[17] to test the feasibility and sustainability of a national 2050 strategy. All EU Member States already collect and report detailed quantitative data to the EU that can inform their own 2050 strategies. Furthermore, the EU itself has undertaken detailed analysis of decarbonisation pathways that covers all Member States in its 2050 Energy Roadmap which pre-dates Paris and is, therefore, out of date and currently being revised. Member States are able to draw out country level data from such EU led exercises.

Europe also benefits from significant expertise on the analysis and modelling of low-emission development options in academic institutions and think tanks. One of the best-known examples of such work is the "Deep Decarbonisation Pathways" project by the UN and IDDRI (see bibliography). EU Member States, particularly those with fewer resources in this area, would be well advised to draw on the support and expertise of other Member States from an early stage.

The case made for transparency above applies to the analytical basis as well as to the development of a 2050 strategy itself. This transparency can secure buy-in from a wide range of stakeholders, strengthen the analytical basis itself, and head-off criticism before it is made. For example, when critiquing a modelling exercise, opponents most frequently start with criticism of a model's assumptions and underlying data. If these elements have been sourced from, and agreed by as wide a range of stakeholders as possible they are likely to be more robust and have greater acceptance. This acceptance can also be increased by having the analytical basis of a 2050 strategy comprehensively peer reviewed by outside, independent experts.

It is also important for the widespread support of a 2050 strategy that stakeholders understand how data and assumptions become decarbonisation pathways. The UK Carbon Plan, for example, included a clear one page annexe for each of the models used explaining how they work. Therefore, simplicity and transparency should be emphasised in the modelling process. While complex models, such as energy system models, cost optimisation models and general equilibrium models can be valuable tools, less expensive approaches that are more readily understood by a non-expert audience insight might be better options where possible. An approach of clarity and openness should also be applied to a 2050 strategy's baseline, so that all stakeholders can understand what would probably happen in the business as usual situation. While it needs to be recognised that the transparency of modelling and data can be limited by the proprietary holding of such information by entities that compete with each other commercially, public authorities should push for as much transparency as possible given the public interest in the development of effective 2050 strategies.

Selecting the most appropriate modelling approach for a low-emission study is not always straightforward because of the number and variety of different strengths and weaknesses of models. Given that different models can address different questions, and have different strengths and weaknesses, a suite of models is usually required to ensure robust analysis outputs are provided. Furthermore, the scenarios produced by models should be challenged with thorough sensitivity analyses to ensure that critical features of success are highlighted. It is relatively straightforward to set a pathway to decarbonisation assuming that everything will work as and when it should. However, some of the most important strengths and weaknesses of the policies and measures are identified when it is assumed that an important aspect will not be delivered. How will a 2050 strategy's objectives be achieved if, for example, a country suffers a nuclear disaster and abruptly shuts all nuclear plants or if CCS technology is not commercially available as some currently expect in the mid-2030s, or, less dramatically, if the carbon price or fossil fuel prices do not develop as assumed in the model? The European Commission's *Roadmap for moving to a competitive low carbon economy in 2050*, for example, includes some sensitivity analysis on factors such as fossil fuel prices, the rate of electrification, and the introduction of commercially viable carbon capture and storage. Such sensitivity analysis approaches can help to identify the risk factors associated with any given decarbonisation pathway or policy. The key technical, economic, infrastructural, and societal factors that may constrain a rapid energy system transition should be identified, as should options for how such constraints can plausibly be overcome.

A further aspect of looking at the risk factors affecting the achievement of a 2050 strategy's objectives should include analysis of the political economy underpinning decarbonisation scenarios and the potential elements of a strategy to manage the transition to a decarbonised economy to 2030 and 2050. It should be recognised that the robustness of data, assumptions, and modelling underlying a 2050 strategy pathway will not always be sufficient to sway decision makers. In practice, perceptions shaped by dominant narratives tend to win the political arguments. A 2050 strategy's analytical basis will have to acknowledge and seek to mitigate the risk that some politicians remain sceptical that the benefits of climate action, such as reduced oil imports, improved health, and green jobs are bigger than the costs of taking these actions.

Part of achieving this goal will be moving beyond a modelling approach that aims to identify the options that can deliver the biggest carbon reductions at the least cost. While a least cost approach is understandable, it can lead to reductionist debates centred too narrowly on how to deliver cheap mitigation options. Instead of the cheapest abatement, 2050 strategy analysis should highlight the best value options – those which deliver the greatest amount of co-benefits. This value based approach should also address the opportunity costs of resources - the trade-off between acting now or acting later.

As noted above, EU Member States have drawn on the results of European Commission analysis of decarbonisation options. While the Commission has increasingly made use of a range of models for its impact assessment exercises, its main energy modelling tool PRIMES has been criticised by some stakeholders for a lack of transparency and replicability. To ensure the widest possible engagement with, and scrutiny of, modelling of low-emission development, these exercises should be as transparent as possible.

17 This element of 2050 strategy development is the element covered in most detail in the recommended reading that can be found in the Bibliography. Readers are therefore invited to read further into the literature to gain a more detailed understanding of this element.

8. Public transparency

Access to information is the cornerstone of public transparency. This means that all the factors that inform decision making around a 2050 strategy should be fully publicly available at all stages of its development. This includes models, data (baseline and projected), and assumptions that went into the models that are informing the 2050 strategy. However, the availability of this evidence does not guarantee transparency. If the information presented is too complex for the typical lay-person to understand, then it is not transparent. The accessibility of this information should, therefore, be tested in focus groups led by independent moderators. A 2050 strategy should include a section on how the strategy's development, implementation, and review will be communicated to stakeholders.

In general, the accessibility, availability, and independence (both perceived and actual) of the data and models informing a 2050 strategy are likely to be improved if they are managed by an independent agency. The overall aim of public transparency should be to make the policy options being developed and consulted on visible, tangible, and debatable even at the non-expert level. Part of this effort to make the content and supporting evidence of 2050 strategies transparent and accessible should be a clear explanation of the strategy's ambition, considering the country's specific circumstances vis-a-vis globally agreed long-term goals.

9. Stakeholder participation – ensuring all stakeholders have their say

Stakeholder participation is about the engagement of stakeholders in developing a national 2050 strategy. This is different to public transparency (see above) which concerns the availability and accessibility of the content and supporting evidence of a 2050 strategy.

By their cross-sectoral nature and long-term impact, 2050 strategies can offer a space to conduct a wide participative process through which stakeholders contribute to the development of an in-depth and detailed understanding of how to continue a country's development while cutting emissions. Such a process should also help to promote general awareness of, and build a sense of shared ownership around, the final 2050 strategy. Cross-sectoral low-emission development planning also provides an important opportunity to draw together experts from both inside and outside of government to collectively debate, perhaps for the first time, diverse options for a country's future development. Such a gathering of stakeholders can also resolve potential conflicts between sectoral data sets and methodologies.

In order to effectively engage as wide a range of stakeholders as possible in developing 2050 strategies, a range of options should be offered in combination, including on-line fora, public meetings, discussion workshops, and advisory committees. Each method should be aligned to the participants and should not only question consultees on what they think of the options presented, but should also use more open processes from the start, such as the development of parallel strategies that can be combined to inform the final 2050 strategy.

The entity leading the consultation should not assume the engagement of other parts of government. A 2050 strategy consultation process should include a thorough outreach to sub-national bodies, as well as all ministries and relevant agencies. Determined efforts should be made to include the views of as many parts and levels of government as possible. A 2050 strategy should clearly set out how the input gained through such consultation will be taken into account and used to strengthen the strategy.

Because the implementation of 2050 strategies will be felt in all parts of an economy and society, it is important to ensure that typically all sectors are adequately represented in 2050 strategy development, including those who often do not engage with such processes. Organisations such as consumer groups, housing charities, educational charities, trades union, and others that represent those at risk of being left out of a participative approach to 2050 strategy development should be approached for their input.

These consultative exercises should be repeated a number of times during the development of a 2050 strategy, with the outcomes of each, being incorporated into each new iteration of the final 2050 strategy. As a 2050 strategy is developed and concluded, it should describe how the results of the consultative process were incorporated into the final strategy.

The consultation processes that supported the development of the new German 2050 strategy and the recently adopted French 2050 strategy are good examples of best practice.[18] The authorities in both countries successfully engaged a wide range of stakeholders in a deliberative and iterative process that produced widespread buy-in to, and support of, their 2050 strategies.

18 See www.maximiser.eu/news/2017/4/6/climate-scoreboard

10. Review

European Union Member States already provide annual climate and energy data and biennial updates of their climate and energy development strategies to the European Environment Agency. They will also take part in the UNFCCC's dynamic five yearly review of national efforts to reduce greenhouse gas emissions, once it begins. It should therefore be as a matter of course that all EU Member State 2050 strategies include a legal requirement for both the underlying analytical basis and the 2050 strategy itself to be subject to a regular review cycle. This should be additional to reviews triggered by, for example, an increase in the global ambition for limiting the increase in average temperatures as happened at the Paris Climate Change conference in December 2015.

These regular and triggered reviews should lead to the further iteration of a country's 2050 strategy, taking into account the lessons learnt during the implementation, new scientific and technological information and an evolving socioeconomic situation. This should be a dynamic and sustainable process that is institutionalised and enshrined in law. It should lead to the upward adjustments and strengthening of 2050 strategies over time.

ANNEXE 1

Literature review and bibliography

The literature reviewed for these guidelines ranges from legislative texts and governmental agency reports to the outputs of independent research projects. Below is a summary of all the papers that were taken into account. Collectively, they highlight the importance of recognising the scale of the challenge involved in producing an effective climate and energy development strategy. While national circumstances will require some differences between countries' 2050 strategies, the consistency with which the various papers identify the essential building blocks of a strong 2050 strategy should be noted. There is not much, if any, real disagreement on what countries should be doing to build their 2050 strategies and what comes across most clearly in the urgent need for such documents in all countries.

The papers produced by the Deep Decarbonisation Pathways Project and IDDRI are of particular note for the considerable detail they go into while also covering a wide breadth of issues of importance. The joint International Energy Agency and Organisation for Economic Co-operation and Development paper is also a key document for having been one of the first on the subject and still being relevant. The paper from the Green Growth Best Practices Initiative is highly informative since it gives a comprehensive view from a more business oriented perspective than some of the other papers on the list. For a more advocacy based perspective, the paper from the NGOs Friedrich-Ebert-Stiftung, Bread for the World, World Wide Fund for Nature, Climate Action Network International and ACT Alliance of Churches should also be considered essential reading.

Reference	Overview of document
Araya, M & Amorim, A – Nivela Discussion Paper (2016) Climate and development plans to 2050: Lessons and emerging best-practice http://www.nivela.org/updates/climate-plans-to-2050-lessons-and-emerging-practice/en, accessed May 2017	• Highlights the existing work on low-emission development strategies from both governmental and independent organisations – drawing from previous experience and stating, in particular, that there is no need to start from scratch. • Particularly strong on the political aspects of developing and delivering 2050 strategies. • Provides examples of best practice such as the UK Climate Change Act of 2008 and Germany's Energiewende in the EU and work in Chile, Colombia and Peru to create long-term mitigation scenarios informed by rounds of consultations among ministries and stakeholders
Argyriou, M et al. (2016) The impact of the Deep Decarbonization Pathways Project (DDPP) on domestic decision-making processes – Lessons from three countries, IDDRI, Issue Briefs N°11/16. available at: http://www.iddri.org/Publications/he-impact-of-the-Deep-Decarbonization-Pathways-Project-(DDPP)-on-domestic-decision-making-processes-Lessons-from-three-countries, accessed May 2017	• This Issue Brief focuses on the engagement strategy developed by the DDPP teams to have an impact on the domestic processes. • It takes the examples of three countries (Australia, Canada and France), reflecting a diversity of institutional circumstances, for which it presents the context of domestic climate discussions and how the DDPP studies have been useful to affect policy debates.
Averchenkova A – United Nations Development Programme (2010) How-to Guide: Low-emission Development Strategies and Nationally Appropriate Mitigation Actions, https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=956&menu=1515 accessed May 2017	• This guide recognizes that each country has unique national circumstances and priorities, and describes the main steps in the process of developing 2050 strategies and NAMAs that a country would need to follow. • The guide identifies the main questions that need to be addressed at each stage of the process and describes the main relevant policy instruments available, based on the analysis of the practical experience with 2050 strategies and related processes to date. • It provides practical examples to illustrate various elements of a 2050 strategy.
Clapp C, Briner G, and Karousakis K – International Energy Agency & Organisation for Economic Co-operation and Development (2010) Low-Emission Development Strategies (LEDS): Technical, Institutional and Policy Lessons, https://www.oecd.org/env/cc/46553489.pdf, accessed May 2017.	• This paper outlines the evolution of the low-emission development strategies (LEDS) concept in the climate policy discourse. • It looks at how LEDS can ensure that they are effective and efficient in delivering intended goals. • The paper examines seven country case studies from Guyana, Indonesia, Israel, Mexico, Nigeria, Thailand and the UK • It examines technical, institutional, and policy aspects of LEDS development.

Reference	Overview of document
The Deep Decarbonisation Pathways Project (DDPP) Network – Institut du développement durable et des relations internationales (IDDRI) (2016) 2050 low-emission pathways: domestic benefits and methodological insights – Lessons from the DDPP http://www.iddri.org/Publications/Collections/Syntheses/IB1516_DDPP%20network_lessons%20for%202050%20strategies.pdf, accessed May 2017	• This paper provides key messages from the Deep Decarbonisation Pathways Project. It states that designing long-term pathways can help: - Build development pathways that are consistent with both national circumstances and global climate constraints - Support the identification of country-specific actions towards low-emission futures - Select the short-term actions needed to follow truly transformative pathways in the long-term - Inform the regular revisions of domestic transformations in a context of uncertainties - Ensure that low-emission transformations are consistent with the satisfaction of domestic development priorities - Reveal the requirements from international cooperation to enable domestic transformations
Energy Sector Management Assistance Programme (ESMAP) – Knowledge Series 011/12, Low Carbon Growth Studies Program (2012), Planning for a Low Carbon Future – Lessons Learned from Seven Country Studies, http://documents.worldbank.org/curated/en/595361468279331555/Planning-for-a-low-carbon-future-lessons-learned-from-seven-country-studies, accessed May 2017	• This paper is the final synthesis report of the Low Carbon Growth Country Studies Program. • Through this program ESMAP and the World Bank provided support to countries to develop longterm frameworks for reducing GHG emissions in a way that is compatible with economic growth objectives and tied to national and sectoral plans. • The paper collates lessons learnt from studies in Brazil, China, India, Indonesia, Mexico, Poland, and South Africa. • The paper is intended as a practical guide for government officials, practitioners, and development agencies involved in low carbon development planning.
Communication from the Commission to the European Parliament , the Council, The European Economic and Social Committee and the Committee of the Regions, Energy Roadmap 2050 COM/2011/0885 final - http://eur-lex.europa.eu/legal-content/EN/ALL/;ELX_SESSIONID=pXNYJKSFbLwdq5JBWQ9CvYWyJxD9RF4mnS3ctywT2xXmFYhInlW1!-868768807?uri=CELEX:52011DC0885	• In the Energy Roadmap 2050, the Commission explores the challenges posed by delivering the EU's decarbonisation objective while at the same time ensuring security of energy supply and competitiveness.
Communication from the Commission to the European Parliament , the Council, The European Economic and Social Committee and the Committee of the Regions, A Roadmap for moving to a competitive low carbon economy in 2050 COM(2011) 112 final, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0112&from=EN	• This Communication sets out key elements that the European Commission believes should shape the EU's climate action helping the EU become a competitive low carbon economy by 2050. • The Commission's approach is based on the view that innovative solutions are required to mobilise investments in energy, transport, industry and information and communication technologies, and that more focus is needed on energy efficiency policies.

Reference	Overview of document
European Environment Agency, EEA database on climate change mitigation policies and measures in Europe, http://pam.apps.eea.europa.eu/?source={%22query%22:{%22match_all%22:{}},%22display_type%22:%22tabular%22,%22sort%22:[{%22Country%22:{%22order%22:%22asc%22}},{%22ID_of_policy_or_measure%22:{%22order%22:%22asc%22}}]}, Accessed May 2017	• This database contains a number of policies and measures (PAM) implemented or planned by European countries to reduce greenhouse gas emissions. • Most of these PAMs have been reported to the European Commission, the United Framework Convention on Climate Change (UNFCCC) or the EEA. • The search engine gives access to detailed information for each of these PAMs including, in some cases, the expected reductions in greenhouse gas emissions resulting from the implementation of these PAMs, as estimated by countries.
European Environment Agency, Central Data Repository, uploads for obligation 'Low-carbon development strategies': all countries, since 2017-01-01	• This webpage provides access to all of the submissions made by EU Member States to the European Environment Agency in line with their obligations on Low Carbon Development Strategies since the 1st of January 2017.
European Environment Agency, EEA Report No 1/2017 - Climate change, impacts and vulnerability in Europe 2016; An indicator-based report, http://www.eea.europa.eu/publications/climate-change-impacts-and-vulnerability-2016, accessed May 2017	• This report is an indicator-based assessment of past and projected climate change and its impacts on ecosystems and society. • It looks at society's vulnerability to these impacts and at the development of adaptation policies and the underlying knowledge base. • This is the fourth 'Climate change, impacts and vulnerability in Europe' report, which is published every four years.
The Green Growth Best Practice initiative (GGBPI) (2014) Lessons from Country Experiences, https://cdkn.org/resource/green-growth-practice-country-experiences/?loclang=en_gb, accessed May 2017	• The report is an assessment of lessons from experiences of pursuing green growth across all levels of government and all regions in different countries. • The report provides analysis of programs and provides insights on effective planning, analysis implementation and monitoring approaches. • The analysis is drawn from review of more than 60 programs globally.
Hirsch T, Lottje C & Netzer N, (2015) Pioneers of Change: 21 Good practices for Sustainable Low Carbon Development in Developing Countries - Friedrich-Ebert-Stiftung, Bread for the World, World Wide Fund for Nature, Climate Action Network International and ACT Alliance of Churches, http://www.climate-development-advice.de/download/FES_Carbon_Publikation04_ES.pdf, accessed May 2017	• The paper provides 21 good practice examples to demonstrate that low carbon, sustainable development has started, and that it is possible to combine climate and development ambitions. • The publication is part of the »Exploring Low Carbon Sustainable Development Project«, initiated by an international consortium of civil society organizations and networks.

Reference	Overview of document
International Partnership on Mitigation and MRV – Low Emission Capacity Building Programme (2015) Good Practice Analysis 2.0 on INDCs, LEDS, NAMAs and MRV; Summary Report of New Cases, https://mitigationpartnership.net/global-good-practice-summary-report-gpa20, accessed May 2017	• The paper documents examples of mitigation-related good practice worldwide which demonstrate how INDCs, LEDS, NAMAs and MRV systems are being effectively designed and implemented across a range of national contexts. • The resulting good practice case studies provide rich insights from 19 countries on successes and lessons learned that can be disseminated internationally to support increased mitigation ambition.
Pachauri, R.K. and Reisinger, A. (Eds.) – International Panel on Climate Change (IPCC) (2007) Contribution of Working Groups I, II and III to the Forth Assessment Report of the International Panel on Climate Change, https://ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm, accessed May 2017	• The Synthesis Report draws together and integrates, for the benefit of policy makers and those from others professions, up to date policy-relevant scientific, technical and socio-economic information on climate change. • The report is intended to assist governments and other decision-makers in the public and private sector in formulating and implementing appropriate responses to the threat of human-induced climate change.
Project Catalyst (2009), Low Carbon Development Plans – Advancing Good Practice. Working Draft Paper, available at: http://www.zadek.net/wp-content/uploads/2011/04/Project-Catalyst_Low-Carbon-Growth-Plans_Assessing_Current_Practice_2009.pdf, accessed May 2017.	• This paper provides a review of Low Carbon Growth Plans and finds that, although they contain common elements, they are not entirely consistent in their content and development approach. • The paper identifies three key critical elements that explain the difference in the quality and coverage of current plans: - The extent to which they are data-driven - The extent to which they specify concrete goals, targets and timelines - The extent to which they address the need for institutional capacity and funding to implement the proposed policy packages.
Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the Governance of the Energy Union, amending Directive 94/22/EC, Directive 98/70/EC, Directive 2009/31/EC, Regulation (EC) No 663/2009, Regulation (EC) No 715/2009, Directive 2009/73/EC, Council Directive 2009/119/EC, Directive 2010/31/EU, Directive 2012/27/EU, Directive 2013/30/EU and Council Directive (EU) 2015/652 and repealing Regulation (EU) No 525/2013, COM/2016/0759 final - 2016/0375 (COD), http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52016PC0759&from=EN, accessed May 2017	• The main objective of this proposed regulation is to set out the necessary legislative foundation for the process of ensuring the necessary governance to deliver a resilient Energy Union with an ambitious climate policy and a fundamental transformation of EU energy systems. • The proposal seeks to ensure that policies and measures at various levels are coherent, complementary and sufficiently ambitious in view of delivering the Energy Union, which will have to be complemented by non-legislative measures and action for the Governance to succeed.

Reference	Overview of document
REGULATION (EU) No 525/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC, http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32013R0525&from=EN, accessed May 2017	• The regulation sets up a mechanism for monitoring greenhouse gas emissions and for implementing the Kyoto Protocol in the European Union • It provides a framework for monitoring anthropogenic greenhouse gas emissions by sources and greenhouse gas removals by sinks, evaluating progress towards meeting commitments in respect of those emissions and implementing monitoring and reporting requirements under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol in the European Union.
Sartor, O., Donat, L., Duwe, M., Umpfenbach, K. (2017). Developing 2050 decarbonization strategies in the EU: Insights on good practice from national experiences, Study n°03/2017, IDDRI, http://www.iddri.org/Publications/Collections/Analyses/ST0317_EU%202050%20long-term%20strategies_OS%20et%20al..pdf, accessed May 2017	• Sets out key findings of an exercise to highlight good practice from national experiences of developing decarbonisation strategies. These findings include: - Long-term (2050) decarbonisation strategies are vital for raising ambition and for effective climate policy implementation - The EU's draft new energy union governance regulation could do more to promote good practice and effective long-term planning for decarbonisation - Developers of long-term decarbonisation strategies should heed lessons from existing experiences.
Spencer, T., Pierfederici, R. et al. (2015). Beyond the numbers: understanding the transformation induced by INDCs, Study N°05/15, IDDRI - MILES Project Consortium, http://www.iddri.org/Publications/Collections/Analyses/MILES%20report.pdf, accessed May 2017	• The report is the outcome of an international research project involving 14 leading research teams from 10 countries. • The objective of the project has been to produce a detailed analysis of INDCs in terms of three innovative aspects: - Understanding the transformation of the energy sector that would result from implementing the INDCs, in particular at the national level for major economies but also at the global level. - Understanding options to stay on track with 2°C at the global level, in the light of the level of transformation in the global energy system implied by INDCs by 2030. - Understanding the co-benefits and trade-offs of INDCs, in particular related to local air-pollution, energy-security, investment requirements, and risks of lock-in into high emitting infrastructure.

Reference	Overview of document
Stern, N. (2006) Stern Review on The Economics of Climate Change – HM Treasury and the Cabinet Office, http://www.webcitation.org/5nCeyEYJr, accessed May 2017	• The review assessed a wide range of evidence on the impacts of climate change and on the economic costs, and uses a number of different techniques to assess costs and risks. • The report concludes that from all of these perspectives, the evidence gathered by the Review leads to a simple finding: the benefits of strong and early action far outweigh the economic costs of not acting.
United Nations, Resolution adopted by the General Assembly on 25 September 2015, Transforming our world: the 2030 Agenda for Sustainable Development, https://sustainabledevelopment.un.org/post2015/transformingourworld, accessed May 2017.	• The 2030 Agenda is a plan of action for people, planet and prosperity. • It seeks to strengthen universal peace in larger freedom. • The Agenda sets Goals and targets to stimulate action over the next fifteen years in areas of critical importance for humanity and the planet.
United Nations, 2015, Paris Agreement, http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf, accessed May 2017.	• The Paris Agreement aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by: - Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels; - Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; and - Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.

Reference	Overview of document
United Nations Development Programme (2011), Preparing Low-Emission Climate-Resilient Development Strategies – A UNDP Guidebook — Version 1, http://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/Climate%20Strategies/UNDP-LECRDS-Guidebook-v17-web.pdf, accessed May 2017	• This guidebook is intended to enable practitioners to acquaint themselves with a variety of methodologies most appropriate to their development contexts in support of the preparation of Low-Emission Climate-Resilient Development Strategies. • It offers step by step guidance for: - The identification of key stakeholders and establishment of participatory planning and coordination frameworks; - The generation of climate change profiles and vulnerability scenarios; - The identification and prioritization of mitigation and adaptation options; - The assessment of financing requirements; and - The development of low-emission climate-resilient roadmaps for project development, policy instruments, and financial flows.
van Tilburg X, Würtenberger L, de Coninck H, Bakker S – Energy research Centre of the Netherlands (2011) Paving the way for low-carbon development strategies, https://www.ecn.nl/docs/library/report/2011/e11059.pdf, accessed May 2017	• This report provides a historical perspective on the use of an LCDS in a national and international context in order to provide high-level guidance to governments and experts who plan the development of an LCDS. • It states that the ultimate aim of a low-carbon development strategy is to catalyse concrete actions that support development with lower emissions. And that, therefore, the process of LCDS development should not focus narrowly on producing a strategy document. • Rather than specifying a target or producing a document, the report states that an LCDS should provide a process that, depending on the developing country's readiness, meets needs to develop and to fill capacity, knowledge and information gaps. LCDS development should bring stakeholders from government, the private sector and civil society on the same page and eventually lead to greenhouse gas emissions that are lower compared to the situation in which the LCDS process had not been undertaken.
Verolme H & Korduan K (2014), Exploring Sustainable low Carbon Development pathways; An Introduction to International debates, http://library.fes.de/pdf-files/iez/10556-20140221.pdf, Accessed May 2017.	• The report starts with the view that providing sustainable development and fighting climate change are the two major challenges the world faces. • If provides the view that any future development model has to be: Low carbon; Ecologically sustainable; Human rights based; Socially inclusive; Just; Nationally appropriate

Reference	Overview of document
Waisman H, Spencer T, Colombier M – Institut du développement durable et des relations internationales Policy Briefs (IDDRI) (2016) Long-term low emissions development strategies and the Paris Agreement – Why, what and how? http://www.iddri.org/Publications/Collections/Syntheses/PB0616_TS%20et%20al_LT%20LEDS.pdf accessed May 2017	• This paper aims to explain what are "long-term low greenhouse gas emission development strategies" (LT-LEDS for short), why they are a crucial policy tool, and how countries could go about developing them. • Its key messages are: - LT-LEDs are a crucial policy tool that can help to place short-term actions in the context of the long-term structural changes required to transition to a low-carbon, resilient economy by 2050. - LT-LEDS must be transparent, granular, structured and long-term to be useful; they should above all be seen as 'structured strategy exercises' rather than complex modelling exercises. - International cooperation and dialogue can help to define and promote best practice LT-LEDS.
Wienges S, Wenzel K – Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Low Emission Development Strategies, Step-by-step guidance to a long term framework for continuous sustainable development cooperation (Version 5.2), https://mitigationpartnership.net/sites/default/files/leds-tool_5_2_finalpub.pdf, accessed May 2017	• This large slide deck provides step-by-step guidance to a long-term framework for continuous sustainable development cooperation.
Yuan H, Zhoua P, Zhoua D – Nanjing University of Aeronautics and Astronautics (2011) What is Low-Carbon Development? A Conceptual Analysis, Energy Procedia 5 (2011) 1706-1712, https://www.sciencedirect.com/science/article/pii/S1876610211012264, accessed May 2017	• This paper provides a theoretical and conceptual analysis of various low-carbon related concepts. It divides low-carbon development into three different stages through which the key concepts pertaining to each stage are identified. • The paper subsequently provides a systematic comparison of six key concepts including low-carbon development, low-carbon economy, low-carbon society, low-carbon city, low-carbon community and low-carbon life. The similarities and differences among the six concepts are summarized.

ANNEXE 2

MaxiMiseR tool for assessing low-emission development strategies

A 2050 strategy evaluation tool was developed over the first half of 2016 by the Ecologic Institute in close discussion with the climate and energy team in the WWF European Policy Office and the wider WWF European Network of national offices. The draft tool and underlying assumptions were also discussed with the MaxiMiseR project External Reference Group[19] in June 2016. The revised version of the tool[20] has since been used to evaluate the strategies referred to in this report.

The approach taken for the development of the tool is normative - i.e., it has been designed to measure elements that WWF offices throughout the EU, The Ecologic Institute and members of the project's External Reference Group, believe should be included in an ideal 2050 strategy. This view was informed by an Initial desk-based literature review that led to the development of list of crucial variables to be included in the tool, which were then aggregated, clustered and turned into measurable indicators.

The complete tool contains forty-eight indicators which are grouped into the ten criteria presented in Box 1. The ten criteria are grouped into three indices - substance, credibility and process. Substance encompasses the criteria ambition and scope. Credibility includes actionability, integration, political commitment, monitoring and transparency. Process includes process transparency, analytical basis and review.

The ten criteria (and their underlying indicators) are weighted according to their perceived importance. This weighting has been in part determined by a ranking exercise and discussion carried out with the wider WWF Network and the project's External Reference Group.

The tool was used to assess the quality of eleven EU Low-Carbon Development Strategies which qualified for our evaluation and to capture Member State best practices and innovative approaches. We also evaluated the status of the strategies. For a full report on the assessment of EU Member States' 2050 strategies, including detailed results, please see www.maximiser.eu.

19 More: www.maximiser.eu/external-reference-group/

20 More information on the tool concept and the tool development process can be found in the MaxiMiseR project document' submission of a final tool concept for the assessment of low carbon development strategies. July 2016 the Ecologic Institut

BOX 1 – WWF/ECOLOGIC ASSESSMENT CRITERIA FOR EU MEMBER STATE 2050 STRATEGIES

Criteria	Description
Ambition	The level of ambition of the 2050 strategy as shown by the explicit inclusion of temperature goals, emission reduction targets and/or other climate relevant objectives. How strong these targets are with a view to achieving mitigation aims is also assessed. The ambition criteria also measures how forward looking a strategy is and how forward looking a target is. It also takes into consideration whether an assessment of proposed measures was taken.
Scope	The comprehensiveness and coverage of the 2050 strategy in terms of economic sectors, domestic GHG emissions and types of emissions as well as the inclusion of adaptation concerns.
Actionable	The extent to which the 2050 strategy can be put into action. Are there clear actions defined and implemented? Is there a scheduled plan for these actions and/or a carbon budget approach? Does the 2050 strategy explicitly name the responsible agencies? What funding and investment approaches exist?
Integration	The degree to which the 2050 strategy is integrated into other policy fields, governance levels and national planning strategies. Whether the 2050 strategy is aligned with broader economic, social and environmental objectives. . The extent to which the strategy takes into account its possible cross-border implications.
Political Commitment	Whether the 2050 strategy is legally binding and the level of political 'buy-in' from high level policy makers and across the political spectrum.
Monitoring	Whether the 2050 strategy incorporates a robust monitoring mechanism with clear indicators of progress and requires reporting.
Public transparency	Extent to which 2050 strategy documentation and underlying data are available to the public.
Process transparency	Degree to which the 2050 strategy was developed in close and open consultation with government and private sector stakeholders, as well as the general public, in a transparent and participative manner.
Analytical basis	Degree to which the 2050 strategy is based on analysis of domestic mitigation potentials and abatement costs using robust modelling and reproducible data. Additionally, capturing if the final 2050 strategy was reviewed.
Review	Whether a stocktaking/review process is required by the 2050 strategy.

ANNEXE 3

The MaxiMiseR project

The MaxiMiseR project is supported by the European Commission through LIFE funding and by the Mava Foundation to help ensure that EU Member States develop and publish high quality 2050 climate and energy development strategies. The MaxiMiseR project is a response to the risk that EU Member States see the requirement to develop a 2050 strategy as only a paper exercise and that they are able to get away with such an approach because of a lack of civil society and public attention or interest, combined with the absence of any enforcement mechanism available to the European Commission.

By strengthening processes around, and content of EU Member States Low Carbon Development Strategies, as well as looking into funding decarbonisation, MaxiMiseR will enhance the capacity of European Institutes and Governments to iteratively improve their development and implementation of strategies for transitioning to low carbon economies and societies. The overall aim of the project is for EU Member States and institutions to increase their capacity to develop better, more effective processes for, and contents of, low carbon development strategies, and to identify and promote better ways for the EU ETS to fund decarbonisation. This will help the EU to meet the goal of effectively achieving emissions reduction targets.

A key element in the project is the development of these guidelines to inform EU Member States of what their Low Carbon Development Studies should include, and how they should be developed. The guidelines are informed by a comprehensive literature review (See Bibliography for a full list of the publications consulted) and by the project's assessment of those 2050 strategies submitted by EU Member States (WWF, 2017 (need full reference for bibliography)). This assessment was carried out by WWF using a tool developed for the project by the Ecologic Institute that was itself informed by an extensive literature review.

MaxiMiseR

STRATEGIES FOR A LOW CARBON EU BY 2050

The EU and other industrialised countries have pledged to cut greenhouse gas emissions by at least 40% by 2030, and by 80-95% by 2050. EU Member States must produce 'Low-Carbon Development Strategies' (LCDS) to show how they will do so. Ensuring that these LDCS are ambitious and of a high quality, and are developed in a participative, transparent manner is key to meeting the EU's emissions reductions goals. Helping this to happen is the aim of the MaxiMiseR project. MaxiMiseR is funded by the EU LIFE Programme for the Environment and the MAVA Foundation.
www.maximiser.eu

WWF

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.
The WWF European Policy Office The European Policy Office contributes to the achievement of WWF's global mission by leading the WWF network to shape EU policies impacting on the European and global environment.
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