Green Finance and Investment

Developing Robust Project Pipelines for Low-Carbon Infrastructure

OECD

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BETTER POLICIES FOR BETTER LIVES

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Foreword

This report aims to provide policy makers with a comprehensive examination of "project pipelines", a common concept in infrastructure planning and investment discussions. It is structured around some basic but important guiding questions, including: *What is meant by project pipelines? How can we characterise them? What concrete approaches and actions can governments and other public institutions take to develop project pipelines and mobilise private finance into these projects?* Answers to these questions suggest that a pipeline can only be as robust as the investment-ready and bankable projects that constitute it, as effective as institutions that deliver it, and as ambitious as the objectives to which it is linked.

Developed by the Secretariat for the Working Party on Climate Investment and Development of the Environmental Policy Committee, the report has linkages to previous and ongoing OECD work on improving policy frameworks for scaling up investment in low-carbon and climate-resilient infrastructure. At the centre of the OECD's work are governments and other public institutions. This report is no exception; these actors can greatly influence the development of project pipelines through, for instance, the numerous actions, policies and institutions at their disposal to: 1) emphasise specific and upcoming investment opportunities in their countries; 2) fast-track valuable projects; or 3) support certain projects to overcome barriers to their development. This report focuses on actions to develop low-carbon project pipelines but incorporates important, and widely applicable, lessons from other sectors that are fundamental to climate and sustainable development objectives, such as water management.

The report is timely since reference to the term "pipelines" is widespread and has become a focal point in countries' efforts to implement their climate commitments, including the Nationally Determined Contributions and the broader Sustainable Development Goals. Meeting climate mitigation objectives, for instance, requires the successful implementation of many new low-carbon infrastructure projects constituting a pipeline of projects, delivered at the right time, providing the right level of service, and involving the right institutions. All infrastructure will also need to be resilient to future changes in environmental conditions. The scale of this infrastructure investment is far beyond what is done today; the OECD estimates that meeting these objectives needs infrastructure investment of USD 6.9 trillion per year globally until 2030, perhaps double current figures. Encouragingly, however, strong climate action offers a great many co-benefits, in addition to less carbon-intensive economies, and will very likely trigger massive investment opportunities.

Investment currently falls short of what is needed not because of a lack of capital, but because there are not enough identifiable, investment-ready and bankable projects. As noted in recent OECD work, G20 countries' infrastructure project planning is characterised by a lack of detail and inadequate links to climate policy and the broader development goals. Crucially, this comes at a time when we need clarity on what and where project investments are needed, when they should be built, how to finance them,

and if they are sufficient to meet long-term objectives. This information is essential if governments are to put forward robust infrastructure plans that align with their long-term climate objectives.

Through a series of in-depth case studies, this report therefore focuses on the concrete actions needed to develop low-carbon project pipelines, including: what constitutes good practice in infrastructure planning; what it means for governments to build robust project pipelines; and what is being done to strengthen them. The report highlights that while governments and public institutions are already taking actions to develop robust pipelines in a range of country settings, they nevertheless need to be strengthened significantly to meet long-term climate mitigation objectives. Good practices pioneered by the countries and actors in the case studies can provide models for governments to adapt and bolster their own efforts.

Rodolfo Lacy, Director, Environment, OECD

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Abbreviations and acronyms

ADB	Asian Development Bank
CEF	Connecting Europe Facility
CfD	Contract for difference
CICC	Inter-Sectorial Commission on Climate Change (Colombia) *Comisión Intersectorial de Cambio Climático*
CIF	Climate Investment Funds
CO_2	Carbon dioxide
CONPES	National Economic and Social Policy Council (Colombia) *Consejo Nacional de Política Económica y Social*
CTF	Clean Technology Fund (of the Climate Investment Funds)
DNP	National Planning Department (Colombia) *Departamento Nacional de Planeación*
EC	European Commission
EFSI	European Fund for Strategic Investments
EIB	European Investment Bank
EU	European Union
EUR	Euro (currency)
G20	Group of Twenty countries
GBP	British pound (currency)
GDP	Gross Domestic Product
GGGI	Global Green Growth Institute
GHG	Greenhouse Gas

GIB	Green Investment Bank (United Kingdom)
IBRD	International Bank for Reconstruction and Development
IDB	Inter-American Development Bank
IFC	International Finance Corporation
INEA	Innovation and Networks Executive Agency
IPA	Infrastructure and Projects Authority (United Kingdom)
IPE	Investment Plan for Europe
MDB	Multilateral Development Bank
NDC	Nationally Determined Contribution
NIC	National Infrastructure Commission (United Kingdom)
ODI	Overseas Development Institute
OECD	Organisation for Economic Co-operation and Development
PCI	Projects of Common Interest
PPF	Project preparation facility
PPP	Public-private partnership
SISCLIMA	National Climate Change System (Colombia)
SOE	State-owned enterprise
t	Tonnes, metric weight
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States dollar (currency)
W	Watt (power)

Executive Summary

Pipelines of infrastructure projects – or simply "project pipelines" – are a common concept in infrastructure planning and investment discussions. The term "pipelines" is often used to emphasise specific, upcoming investment opportunities, such as low-carbon infrastructure projects to develop renewable energy over the next decade. As such, project pipelines have become a key focal point of countries' efforts to implement their climate and development commitments, including the Nationally Determined Contributions.

Meeting climate mitigation objectives requires the delivery of many new low-carbon infrastructure projects in a range of technologies, which of course need substantial investment. The latest global estimates of infrastructure investment needs may differ, but they all point to a financing gap of trillions of dollars per year until at least the year 2030. Public finance on its own will be insufficient. The private sector, therefore, will need to invest, build and support the development, operation and maintenance of those projects in the pipelines, as well as the retrofit or decommissioning of existing infrastructure to align it with mitigation and other sustainability objectives.

Climate mitigation discussions frequently highlight that the global infrastructure investment gap is not a result of the lack of capital. Rather, there are not enough identifiable, investment-ready and bankable projects to which private sector investors and project developers can commit time, effort and funding. To address this, governments can develop robust infrastructure project pipelines, including the provision of effective policy tools and institutional support to the development of the projects that constitute these pipelines. This report focuses on the concrete actions needed to develop low-carbon project pipelines.

Due to the lack of detailed infrastructure investment plans and poor integration of these plans into national policy contexts, it is not always clear what and where project investments are needed, when they should be built, how to finance them, or if they are sufficient to meet long-term objectives. Poorly defined infrastructure planning and inadequate policy links could open the door to investments that should not be made and could even hinder the flow of infrastructure investment. In contrast, well-defined infrastructure planning can facilitate investment flows; investors and project developers want to identify and source investment opportunities that match their needs from the available options, which are usually driven by government policies and goals.

An important prerequisite is to clarify what is meant by project pipelines, since the term is used and interpreted in many different ways. To date, no formal definition exists for pipelines nor has there been a comprehensive examination of the pipeline concept and its role in planning for or meeting climate objectives. Infrastructure planning efforts vary greatly in scope and scale and very much depend on specific country or regional contexts and infrastructure "starting points". Governments tailor the development of their project pipelines based on these unique national and local contexts. This report suggests that a pipeline can only be as robust as the (investment-ready and bankable) projects that

constitute it, as effective as institutions that deliver it, and as ambitious as the objectives to which it is linked.

Countries' efforts to develop robust pipelines ultimately need to: promote and scale up investment in "suitable" projects across sectors; accommodate the requirements of investors; and allocate preparatory support to certain projects that may help a country achieve its mitigation objectives but which are not yet bankable. Literature review and discussions with experts suggest that, with respect to aligning infrastructure to long-term climate objectives, governments can develop robust pipelines of projects if they:

- link policy making to forward-looking objective setting and the programmes and institutions to deliver them, providing overall co-ordination and leadership to champion project pipelines
- focus on strengthening the interface and mechanisms that governments employ to disseminate information and convene actors, offering transparent processes and communicating relevant information on projects and the pipeline with the financing and investment community
- take a holistic, whole-of-government approach to infrastructure planning and investment, feeding lessons back into policy-making processes to bolster the investment-enabling environment and providing funding or institutional support to projects when appropriate
- fast-track suitable infrastructure project investment in a way that brings the carbon and energy intensities of the country's economy to target levels, prioritising the deployment of "high-value" and strategically important projects and sectors
- foster the development of a diverse set of bankable projects and promote business models suitable for private sector needs, setting strong eligibility criteria to determine which projects should be built and supported and which should not
- increase country resilience to changes in climate and development needs, deploying infrastructure that remains pertinent and relevant over time and tailored to changing external conditions, and avoiding expensive path dependency or lock-in.

The report examines six factors in a series of case studies from a diverse set of countries and regions. These case studies explore the various attributes and important applications of the factors listed below and highlight emerging good practices of its use:

1. **Leadership**, as it relates to governments as a whole, or specific agencies, championing the development of a robust project pipeline.
2. **Transparency**, as it relates to having transparent approaches to developing sectoral investment plans, sourcing projects, and using data effectively.
3. **Prioritising**, as it relates to expediting strategically valuable projects – and shepherding them through development processes.
4. **Project support**, as it refers to various elements of the investment-enabling environment that affect the risk-return profiles of projects such as policy incentives, the supply of public funds and institutional support.

5. **Eligibility criteria** to ensure a pipeline of projects is properly aligned to or in support of long-term climate objectives and necessitate strong systems to assess which projects should be promoted and which should not.
6. **Dynamic adaptability** describes the capacity of governments to keep project pipelines aligned with policy objectives over time, to be pertinent and relevant in the long term, and tailored to changing external conditions.

The findings from this report aim to stimulate thinking on what it means for governments to build robust project pipelines and what can be done to strengthen them. The in-depth review of existing pipeline approaches highlight that:

- governments and public institutions are already taking actions to develop robust pipelines in a range of country settings
- these efforts nevertheless need to be strengthened significantly to meet long-term climate mitigation objectives
- there is a considerable opportunity for governments to share lessons and bolster their own efforts by learning from the good practices of others.

Chapter 1. Recommendations for developing robust project pipelines in support of long-term climate objectives

This chapter provides an integrated overview of the report. In particular, the chapter considers the meaning of project pipelines in the context of investments in support of long-term climate objectives and different aspects of good project pipeline practices. The chapter explores actions governments can take to translate their climate objectives into investment-ready and bankable projects that are attractive to private sector investors. It also examines results from a series of case studies of emerging practices in developing robust project pipelines, highlighting good practices and learning opportunities. To conclude, the chapter identifies areas for future consideration with respect to establishing robust project pipelines.

1.1. Project pipelines and meeting climate objectives: Context

Pipelines of infrastructure projects – or simply "project pipelines" for the purposes here – are a common concept in infrastructure planning and investment discussions. The term "pipelines" is often used to emphasise specific, upcoming investment opportunities, such as low-carbon infrastructure projects to develop renewable energy over the next decade. As such, project pipelines have become a key focal point in countries' efforts to implement their climate and development commitments, including the Nationally Determined Contributions (NDCs).

Meeting global climate mitigation objectives requires pipelines of many thousands if not millions of low-carbon infrastructure projects and substantial investment in these projects. The latest global estimates of infrastructure investment needs may differ, but they all point to a financing gap of trillions of dollars per year until at least the year 2030. Public finance on its own will be insufficient. The private sector, therefore, will need to invest, build and support the development, operation and maintenance of those projects in the pipelines, as well as the retrofit or decommissioning of existing infrastructure to align it with mitigation and other sustainability objectives.

Climate mitigation discussions frequently highlight that the investment gap is not a result of a lack of capital.[1] Rather, there are not enough identifiable, investment-ready and bankable projects to which private sector investors and project developers can commit time, effort and funding. To address this, governments can take concrete actions to develop robust infrastructure project pipelines, including the provision of effective policy tools and institutional support to the projects that constitute these pipelines.

This report focuses on these concrete actions. Chapter 1 provides an integrated overview of the project pipeline report and is structured around the following questions: what is meant by project pipelines in light of climate objectives? (section 1.2); what concrete actions can governments take to build robust pipelines? (section 1.3); what factors can governments consider when building such pipelines? (section 1.4); and finally, what are emerging good project pipeline practices from case studies and next steps in terms of research considerations and applications of the work? (section 1.5). Section 1.6 outlines the structure of the remainder of the report.

1.1.1. Scope of report

The focus of this report is on low- or zero-carbon, mitigation projects such as renewable electricity generation, energy efficiency, public transportation and electric vehicles. Despite this particular focus, the examples of good practice in this report for building low-carbon project pipelines are potentially applicable to other types of infrastructure projects. At the same time, good practices based on an examination of other types of infrastructure projects (or aspects of infrastructure projects, e.g. resilience) are also relevant to low-carbon infrastructure projects. For example, adding resilience measures in the design of these projects, which is essential to their durability, needs to be considered for low-carbon infrastructure upfront and systematically, although such measures may add to the complexity of structuring projects and increase costs (see Box 2.1 in Chapter 2 for work on resilient infrastructure investment).

The development of project pipelines aligned with long-term climate mitigation objectives will also need to be supportive of such important infrastructure sectors as water supply or flood protection (section 3.7 in Chapter 3 examines in more detail water infrastructure and approaches taken by the Netherlands and the United Kingdom).

Lessons from work on water infrastructure can also apply to developing low-carbon infrastructure. In particular, the consideration of long-term strategic pathways, avoiding path dependencies and expensive lock-ins are important to ensure infrastructure investment remains aligned to long-term policy objectives.

More generally, project pipelines for all types of infrastructure need to be supportive of broader sustainability objectives, including those pertaining to biodiversity and other environmental considerations. While low-carbon infrastructure investment predominantly helps countries meet climate mitigation objectives, it also provides many valuable co-benefits beyond reducing emissions like cleaner air or improving energy access. This infrastructure is intimately linked to other sectors; for instance, solar thermal power plants require access to land and water, and will need to be resilient to future changes in environmental conditions. Infrastructure interconnectivities, interlinkages and trade-offs are common and country context dependent, but they merit discussions in countries' approaches to infrastructure planning and investment to meet long-term climate and development objectives.

1.2. What is meant by project pipelines?

No formal definition of a project pipeline has been agreed for infrastructure projects generally, let alone one which is aligned to meeting long-term climate objectives. However, use of the term project pipelines is widespread in literature on infrastructure investment (see Chapter 2). These discussions often recommend that governments develop and manage project pipelines as a means to improve transparency and offer long-term credibility, predictability and vision.

Based on expert interviews, discussions and review of literature, the predominant view amongst governments and the investment community appears to be that a project pipeline is manifested in the form of a list of projects at an advanced stage in the development process, and that it should be published or communicated publicly in some way. Based on this common view, a low-carbon and climate-aligned project pipeline could be described as *"a set of infrastructure projects and assets (accounting for the existing stock of assets), and future assets in early development and construction stages prior to project commissioning, typically presented as a sequence of proposed investment opportunities over time that align with and are supportive of long-term climate and development objectives."*

Despite the absence of a commonly used formal definition, examples of project pipelines from governments, development banks and international initiatives have tended to be fairly consistent with the description of pipelines provided above. These public institutions invariably aim to generate lists of tangible, future assets that will be added to or replace the existing infrastructure stock. Box 1.1 provides some examples of these efforts from the analysis in Chapter 3.

Box 1.1. Selection of government efforts to build project pipelines

Indonesia: To expedite deployment of and clear bureaucratic bottlenecks in infrastructure development, Indonesia established the **Committee for Acceleration of Priority Infrastructure Delivery (KPPIP)** in 2014. An inter-ministerial body, the KPPIP coordinates infrastructure planning by identifying and prioritising the most beneficial projects. More in section 3.2 in Chapter 3.

Mexico: In 2017, the federal government of Mexico launched the **Mexico Projects Hub** to provide investors with: 1) an improved visibility of projects sponsored by government entities; 2) a transparent view of project performance; and 3) the ability to compare investment opportunities. Section 3.3/Chapter 3.

Australia: Infrastructure Australia was established in 2008 to advise the government and *inter alia* create and administer the **Infrastructure Priority List (IPL)**. The IPL comprises projects of national importance and is periodically published on Infrastructure Australia's website. Projects are sourced and identified through a call for proposals as and when required. Section 3.4/Chapter 3.

Programme for Infrastructure Development in Africa (PIDA): The PIDA is a blueprint for continent-wide infrastructure development in energy, transport, trans-boundary water and telecommunications. Adopted by African heads of states in 2012, the initiative devised a **Priority Action Plan** and identified 51 cross-border projects to boost regional connectivity and growth. Section 3.5/Chapter 3.

1.3. What can countries do to attract investors and improve the bankability of projects?

Actions to clearly describe and promote project pipelines can greatly enhance investors' abilities to identify and assess low-carbon infrastructure investment opportunities and encourage actual investment. Investors often look to compare and evaluate investment options across countries and sectors to find suitable opportunities, yet interviews and discussions with experts undertaken for this report suggest that project pipeline approaches, as implemented to date, vary in their use and application. In addition, the lack of clarity in pipeline development practices hampers investors' efforts to identify such opportunities.

A recent review of government infrastructure planning practices in the Group of 20 countries revealed inconsistencies across countries by sector and by level of detail in the project pipeline (according to infrastructure budgets, plans and targets) (OECD, 2017[1]). The report warned that "[project pipelines] that are inaccessible, incomplete or poorly aligned with long-term climate mitigation and adaptation goals are likely to hinder the flow of infrastructure investment in support of climate goals".

Governments as a whole, and specific public agencies and institutions, can develop project pipelines to highlight the scale and scope of investment opportunities and communicate the available tools and policies. These public actors strongly influence the development of domestic project pipelines and have a suite of available tools and levers to involve themselves in infrastructure investments, including: funding projects directly

from public budgets; leading public-private partnerships; employing risk mitigants like public guarantees; or setting policy incentives on specific sectors or technologies.

Investors (and project developers) want to identify and source investment opportunities that match their needs from the available options which are usually driven by government policies and goals. They have at their disposal numerous channels through which to invest and assess projects, take positions and secure attractive returns. Long-term investors, like pension funds or insurance companies for instance, are typically less interested in one-off investments than in the possibility of an attractive, enduring portfolio of bankable projects with the right risk-return profile and track record of various actors involved.

A recommendation often made to governments is to overcome the dearth in bankable projects by having "better pipelines". Such advice fails to consider that there is a lack of easily identifiable, bankable projects at the volumes, scales and risk-return profiles that interest investors. The notion of having better pipelines should account for these demands and other country needs, which make the task of developing and delivering better pipelines, and the associated projects, much more complex than the simple phrase ("better pipelines") would suggest.

Project preparation facilities (PPFs) are one such tool to overcome the lack of government capacity to support the development of economically attractive investment opportunities. PPFs are increasingly offered by public institutions to assist the development of projects to reach investment-ready states (see Annex 2.F in Chapter 2 for more information on PPFs and project bankability). Increasing emphasis is being placed on these facilities, particularly in developing and emerging economies; the costs for global project preparation activities have been estimated at 2.5–10% of total infrastructure investment (GCEC, 2016[2]; Kortekaas, 2015[3]) or up to USD 690 billion per year to meet climate objectives.[2]

1.4. What effective actions can governments take to develop robust project pipelines?

A key motivation for examining project pipelines more comprehensively is the general lack of knowledge on what constitutes effective approaches and efforts to build project pipelines. Due to the lack of detailed infrastructure investment plans and poor integration of these plans into national policy contexts, it is not always clear what and where project investments are needed, when they should be built, or how to finance them, or if they are sufficient to meet long-term objectives.[3] In this context, poorly defined infrastructure planning and lack of policy links could open the door to investments that should not be made and could hinder the flow of infrastructure investment.

There is no one-size-fits-all method to promote and build infrastructure project pipelines. Infrastructure planning efforts vary greatly in scope and scale and very much depend on specific country or regional contexts and their infrastructure "starting points" as discussed in Chapter 2. There is, however, significant potential for governments to share and learn from good practices and approaches taken to build project pipelines, as shown next.

Based on the findings in this report, including a review of existing pipeline practices, a project pipeline aligned to climate objectives can be developed. However, such a pipeline can only be as robust as the (investment-ready and bankable) projects that constitute it and as effective as the institutions that deliver it. In addition, such a pipeline will only be as ambitious as the government objective to which it is linked. In the context of low-

carbon project pipelines, ambition can refer to the stringency of mitigation action implied in the NDCs and the way in which the target is expressed (e.g. absolute emissions reduction, renewable energy target and others).

1.4.1. Characterising robust project pipelines

Efforts to develop robust pipelines ultimately need to: promote investment in "good projects",[4] across a variety of sectors, of different scales, at the same time as; accommodate the requirements of investors; and allocate preparatory support to certain projects that may help a country achieve objectives like those in the NDCs, but which are not yet bankable. Literature review and discussions with experts suggest that, with respect to aligning infrastructure to long-term climate objectives, governments can develop robust pipelines of projects if they:

- link policy making to forward-looking objective setting and the programmes and institutions to deliver them, providing overall co-ordination and leadership to champion project pipelines
- focus on strengthening the interface and mechanisms that governments employ to disseminate information and convene actors, offering transparent processes and communicating relevant information on projects and the pipeline with the financing and investment community
- take a holistic, whole-of-government approach to infrastructure planning and investment, feeding lessons back into policy-making processes to bolster the investment-enabling environment and providing funding or institutional support to projects when appropriate
- fast-track suitable infrastructure project investment in a way that brings the carbon and energy intensities of the country's economy to target levels, prioritising the deployment of "high-value" and strategically important projects and sectors
- foster the development of a diverse set of bankable projects and promote business models suitable for private sector needs, setting strong eligibility criteria to determine which projects should be built and supported and which should not
- increase country resilience to changes in climate and development needs, deploying infrastructure that remains pertinent and relevant over time and tailored to changing external conditions, and avoiding expensive path dependency or lock-in.

1.4.2. Effective efforts to develop robust project pipelines

Building from the preceding analysis, and based on a thorough review of project pipeline efforts across many countries, a number of policy and institutional factors have been identified which are common to effective government efforts to develop robust pipelines. Through a series of case studies, Chapter 3 examines each of the following six factors in the context of a country's or region's efforts to build robust project pipelines. Each case study explores the various attributes and important applications of the factor and highlights emerging good practices of its use:

1. **Leadership**, as it relates to governments as a whole, or specific agencies, championing the development of a robust project pipeline.

2. **Transparency**, as it relates to having transparent approaches to developing sectoral investment plans, sourcing projects, and using data effectively.
3. **Prioritising**, as it relates to expediting strategically valuable projects – and shepherding them through development processes.
4. **Project support**, as it refers to various elements of the investment-enabling environment that affect the risk-return profiles of projects such as policy incentives, the supply of public funds and institutional support.
5. **Eligibility criteria** to ensure a pipeline of projects is properly aligned to or in support of long-term climate objectives and necessitate strong systems to assess which projects should be promoted and which should not.
6. **Dynamic adaptability** describes the capacity of governments to keep project pipelines aligned with policy objectives over time, to be pertinent and relevant in the long term, and tailored to changing external conditions.

Each case study focuses on one of the above factors, considers particularly noteworthy pipeline developments in the country or region, and explores the various attributes and important applications of the factor. The case studies also examine the institutions involved in pipeline development, their roles and initial results or successes (if applicable). The following questions are used to frame each case study: what is the project pipeline factor? What is the context in which the factor is employed? Why is the factor important for developing robust project pipelines (in the specific case)? Who is involved and what role did they play to ensure the successful application of the project pipeline factor? What should governments consider before replicating this approach elsewhere?

The case studies are relatively diverse, covering OECD countries in Europe (the Netherlands, the United Kingdom and the European Union as a whole) and emerging countries in Latin America and South East Asia (Colombia and cities in Viet Nam). Likewise, the sectoral coverage includes clean urban transport systems (in cities), large-scale clean energy technologies (countries), network infrastructure (regional) and financing water infrastructure (countries) – as shown in Table 1.1. Each case study also includes additional examples to illustrate how specific pipeline factors (e.g. leadership practices) are applied in other country settings (e.g. in Argentina or Indonesia). These additional examples can be found in boxes towards the end of each case study, and total 16 countries, regions, institutions and initiatives.

Table 1.1. Overview of project pipeline case studies in Chapter 3

Project pipeline factor	Factor description	Geography	Key institution	Sector
Leadership (section 3.2, Chapter 3)	Governments and other agencies championing the development of a robust project pipeline	Colombia	Inter-Sectorial Commission on Climate Change (CICC) and its co-chair, the National Planning Department (DNP)	Economy-wide
Transparency (section 3.3, Chapter 3)	Transparent decision making processes that inform investment	Viet Nam	Climate Investment Funds; sub-national government entities; Asian Development Bank	Clean, sustainable urban transportation
Prioritisation (section 3.4, Chapter 3)	Expediting, optimising strategically valuable projects and shepherding them through development processes	European Union cross-border Projects of Common Interest	European Commission, European Investment Bank; Innovation and Networks Executive Agency	Network infrastructure and low-carbon projects as part of the Investment Plan for Europe
Project Support (section 3.5, Chapter 3)	Provision of public funds and institutional support to overcome investment barriers	United Kingdom	United Kingdom government, agencies and national bodies	Offshore wind
Eligibility criteria throughout* Chapter 3	Setting criteria and conditions to systematically identify, assess and promote eligible projects	x	x	x
Dynamic adaptability (section 3.7, Chapter 3)	Flexibility to adjust infrastructure to changing conditions so that investments remain pertinent over time	Netherlands; United Kingdom	Government and government agencies of the Netherlands; United Kingdom National Infrastructure Commission	Water infrastructure planning and financing**

Notes: * Eligibility criteria does not have its own dedicated case study since it plays an important role in each of the other case studies and smaller examples. See the "Note on project eligibility criteria and their importance for building robust project pipelines" in Chapter 3. ** Lessons from this case study are also extremely relevant to infrastructure beyond the water sector, including energy and transport networks.

1.4.3. Case study summaries and key messages for governments to consider

The case study on **leadership** looks at Colombia's Inter-Sectorial Commission on Climate Change, which oversees the delivery of the national climate strategy, with eight ministries, nine regional co-ordination groups and four thematic technical committees. Based on the findings presented in the case study, governments could consider how they might apply the following aspects of Colombia's leadership factor:

- employ cross-ministerial commissions to lead with authority and delegate where helpful
- provide a single, co-ordinated voice for government action on pipeline development, including the alignment of policies and institutions
- mobilise private sector investors with investment "one-stop shops" to provide information, direction and co-ordination
- avoid cumbersome or complex public institutional arrangements that hinder engagement with project developers and investors.

The case study on **transparency** looks at how the Climate Investment Funds (CIF) channel donor funds through Multilateral Development Banks (MDBs) to recipient governments and local private sector actors to build clean transport projects in the Vietnamese cities of Hanoi and Ho Chi Minh City. Governments could consider how they might apply the following aspects of the CIF's transparent approaches:

- provide clarity on investment opportunities where appropriate[5] and secure buy-in from and communicate with key actors involved in financing, building or approving infrastructure
- gather and use data and indicators to track and measure progress against policy objectives, assess risks and highlight or identify opportunities
- share experience on how to replicate and scale-up investment successes by engaging public and private actors in the country and elsewhere if appropriate
- standardise infrastructure planning processes, including contract arrangements and legal agreements, to streamline efficient project development.

The case study on **prioritisation** looks at how the European Union fast-tracks the development of strategically important projects within the bloc of 28 countries. Facing diverse country infrastructure "starting points" across its member countries, the European Union provides institutional access as well as public guarantees and funds to expedite and prioritise investment in low-carbon technologies and network infrastructure. Governments could consider how they might apply the following aspects of the European Union's prioritisation processes:

- incorporate infrastructure priorities into national (and wider regional) strategic planning, ensuring that such plans are aligned to long-term climate objectives and promote suitable investments
- overcome non-financial barriers by placing prioritisation mechanisms within, rather than separate from or in conflict with, existing regulatory and institutional arrangements
- employ experienced institutions with high capacity and expertise to assess project eligibility, determine strategic value, and bridge investment gaps by allocating funding and other policy tools
- use prioritisation as a means to feed into policy processes and align project pipeline development to changing investment requirements.

The case study on **project support** looks at how the United Kingdom government kick-started the offshore wind energy market. The United Kingdom supported this market by establishing dedicated public institutions, policy incentives to target investment barriers, and capacity auctions to signal and indicate future opportunities. Based on this case study, governments could consider the following:

- target high-potential and suitable, but as yet under-developed, low-carbon technologies
- mainstream key project support within national long-term climate strategies
- address specific barriers to lower investment hurdle rates
- align existing institutions to help fill knowledge and funding gaps, and disseminate lessons.

Eligibility criteria ensure that a pipeline of projects is properly aligned to or in support of long-term climate objectives. While this factor does not have its own dedicated case study, it plays an important role in every case study. To be effective, such eligibility criteria need to be complemented by strong systems to assess which projects should be promoted and provide clear guidance on how mitigation objectives, like those in the NDCs, should be "translated" into project pipelines. They can provide guidance on, for instance, which projects should be built and supported and which should not (such as to avoid expensive economic stranding of assets).

The case study on **dynamic adaptability** looks at two countries' efforts (the Netherlands and the United Kingdom) to align water infrastructure project pipelines with policy objectives and keep them relevant in the long term. This report has placed emphasis on mitigation infrastructure planning and investment. However, the challenges associated with meeting water infrastructure investment needs – the focus of this case study – are extremely valuable beyond the water sector. A number of lessons and emerging good practices from this case study are important for governments to bear in mind while developing national plans and strategies for all infrastructure, including energy, transport, buildings, water and other types. Based on analysis of approaches to finance and plan water infrastructure in the Netherlands and the United Kingdom, governments could consider the following:

- situate project pipelines within, rather than in parallel to, long-term strategic pathways, and medium-term goals like the NDCs, to ensure infrastructure investment remains aligned to long-term policy objectives
- combine long-term strategic infrastructure perspectives with iterative decision making that can be adjusted over time as more information becomes available
- take steps to avoid premature obsolescence of infrastructure, inefficient path dependencies or costly infrastructure retrofits, and consider how short-term actions potentially enable or foreclose future options
- identify actions that promote additional flexibility, and provide opportunities to shift among options depending on evolving trends (economic, climatic, demographic, technological, etc.).

1.5. Next steps: Future considerations on robust project pipelines

The findings from this report aim to stimulate thinking on what it means for governments to build robust project pipelines and what can be done to strengthen them. The findings are based on in-depth reviews of current approaches to build pipelines. The case studies highlight that while governments and public institutions are already taking actions to develop robust pipelines in a range of country settings, these efforts need to be strengthened significantly to meet long-term climate mitigation objectives. The factors given above were specifically chosen to be widely applicable beyond the country or region in question, giving an opportunity for governments to share lessons and bolster their own efforts by learning from the good practices of others.

The case studies (and other examples summarised throughout Chapter 3) offer lessons on what worked and what did not in terms of developing robust project pipelines, as well as pointing to good project pipeline practices. Beyond these examples of good practice, the case studies offer a possible approach for assessing the alignment of pipelines to long-term climate objectives; the pipeline factors in this report may be used as indicators to

evaluate and compare government actions to develop robust project pipelines. The following important elements can also be considered:

- **Establishing pipeline performance metrics**. MDBs have extensive experience measuring and tracking project investment metrics and indicators and comparing results with institutional objectives (see, for instance, Boyd et al. (2017[4])). MDBs typically track indicators on a project-by-project basis, which is administratively burdensome over thousands of projects. A shift to programmatic approaches, as indicated by the Climate Investment Funds, could allow for wider assessments of investment portfolios as a whole.
- **Translating long-term objectives into short-term sectoral emissions pathways**. The United Kingdom has a comprehensive institutional arrangement whereby carbon budgets are set in five-year periods – aligned to the national 2050 emissions reduction target. The United Kingdom's independent Committee on Climate Change sets these five-yearly carbon budgets at the sectoral level.
- **Accounting for infrastructure interconnectivities, interlinkages and trade-offs**. The focus of this report is on low-carbon infrastructure investment that will predominantly help countries meet climate mitigation objectives. However, as noted in the report, these infrastructure projects also provide many valuable co-benefits beyond reducing emissions like cleaner air or improving energy access. This infrastructure is also intimately linked to other sectors; for instance, solar thermal power plants require access to land and water, and will need to be resilient to future changes in environmental conditions. These issues will be country context dependent but merit discussions in countries' approaches to infrastructure planning and investment to meet long-term climate and development objectives.
- **Quantifying power infrastructure misalignments**. One approach to quantify the global project pipeline in the power sector is explored in a forthcoming OECD paper (see also Box 2.2 in Chapter 2). This study compares global electricity generation capacity (under construction and planned over the next five years) against low-carbon scenarios to test for misalignment.
- **Benchmarking good infrastructure practices**. The World Bank, with others, has assessed and benchmarked regulatory frameworks in 135 countries against internationally recognised good practice in procuring infrastructure under public-private partnerships (World Bank Group, 2018[5]).

In addition to the outstanding research questions discussed in each case study, there is scope for further work in evaluating project pipelines. These areas include: undertaking more in-depth case studies of country infrastructure investment and planning practices and assessing them in the context of the wider investment enabling environment; understanding the significance of government project pipeline practices for specific classes of investors, specifically, but not limited to, project developers and equity investors; and benchmarking project pipeline approaches with a metric-based evaluation framework.

1.6. Structure of the report

The remaining chapters of the report will address the following topics:

- Chapter 2 explores the project pipeline concept in the context of climate objectives to scale-up investment in low-carbon infrastructure. It examines what is meant by project pipelines and related government processes to mobilise finance for low-carbon investment. Finally, it describes a set of effective factors that governments can consider when building robust project pipelines.
- Chapter 3 consists of five case studies, focusing on the role of specific pipeline factors in several approaches taken by governments and public institutions to build robust project pipelines. By looking at elements, attributes and important applications of the specific factor, the case studies provide models that other countries can consider for or adapt to their own pipeline development programmes.

Notes

[1] See section 2.2 in Chapter 2 for more information on the infrastructure investment gap. Institutional investors, like pension funds and insurance companies, manage infrastructure assets far in excess of what is needed. In OECD countries alone they hold up to USD 84 trillion in assets under management, but only directly invest around 1% of this in infrastructure (OECD, 2017[6]).

[2] When applied to the OECD estimates of annual global infrastructure needs at USD 6.9 trillion for the 15-year period to 2030 (OECD, 2017[1]).

[3] Analysis of the current set of Nationally Determined Contributions suggests that they do not put global emissions on a pathway to meet the temperature goals laid out in the Paris Agreement (UN Environment, 2017[7]). In addition, analysis of the power sector suggests that current building and planned construction of coal capacity over the next five years is incompatible with long-term climate ambitions. Renewable energy deployment, on the contrary, appears to be going in the right direction but needs to accelerate (see Box 2.2 in Chapter 2).

[4] Governments will also need to have the foresight to look to the development of "better projects" in the future: those that are more suitable to the longer term climate objectives, resilient to future changes in environmental conditions, without risk of stranding assets, and also bankable by nature.

[5] For instance, in line with confidentiality concerns; private sector investors and project developers do not typically "publish" full data due to the confidential nature of project-level information and financial details – see the case study for more information (section 3.3 in Chapter 3).

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Chapter 2. An overview of project pipelines

This chapter explores "project pipelines", a common concept used in infrastructure planning and investment discussions and government strategies to engage private sector stakeholders and mobilise finance. To begin, the chapter examines what is meant by project pipelines in the context of climate objectives to scale-up investment in low-carbon infrastructure. Important to these objectives is how project pipelines relate to government's wider investment policy framework and the tools, activities and processes with which governments: disseminate information; highlight investment opportunities; and encourage market actors to engage, commit funding and devote time to executing infrastructure investments. To close, the chapter explores what concrete actions governments can take to build robust pipelines and what factors governments can consider when building such pipelines – the focus of Chapter 3 which includes case studies of emerging good project pipeline practices.

2.1. Introduction to project pipelines

Pipelines of infrastructure projects – or simply "project pipelines" for the purposes here – are a common concept in infrastructure planning and investment literature (see, for instance, OECD (2015[1]; 2017[2]; 2017[3]) and others including Mercer and Inter-American Development Bank (2016[4]), Nassiry, Nakhooda and Barnard (2016[5]) and Kortekaas (2015[6]). Pipelines are often used in these discussions to emphasise specific, upcoming investment opportunities in infrastructure assets, such as prospects to develop large-scale renewable energy projects in a country over the next decade. As such, project pipelines have become a key focal point in countries' efforts to implement their climate and development commitments, including the Nationally Determined Contributions (NDCs).

Meeting climate mitigation objectives requires pipelines of many thousands if not millions of low-carbon infrastructure projects throughout the world. Public finance on its own will be insufficient. The private sector, therefore, will need to invest, build and support the development, operation and maintenance of those projects in the pipelines, as well as the retrofit or decommissioning of existing infrastructure to align it with mitigation and other sustainability objectives. Clear policy objectives and commitments are important to investors since they often look to government strategies as important signals of intent, which can be a critical factor in decision-making and trigger actual low-carbon investment. The following section gives more information on how much infrastructure investment is required and which sectors are covered in this report.

Governments (of all levels, national or otherwise) are best-placed to promote and develop project pipelines to foster private sector investment in projects and achieve their policy objectives and commitments, like the NDCs or the longer term 2050 low-emissions development strategies. The NDCs, for instance, provide and serve as a framework for national low-carbon investment priorities in countries that ratified the Paris Agreement. To meet their NDCs, countries will need to have a pipeline of suitable investment-ready infrastructure projects.

There is no one-size-fits-all method to promote and build infrastructure project pipelines. To date, no formal definition exists for pipelines nor has there been a comprehensive examination of the pipeline concept and its role in planning for or meeting climate objectives. Infrastructure planning efforts vary greatly in scope and scale and very much depend on specific country or regional contexts and their infrastructure "starting points". There is, however, significant potential for governments to share and learn from good practices and approaches taken to build project pipelines, as discussed in this chapter.

The remainder of this chapter examines the following questions: What infrastructure investment is needed to meet climate objectives? (section 2.2); What is meant by project pipelines in the context of climate objectives? (section 2.3); What concrete actions can governments take to build robust pipelines and what factors can governments consider when building such pipelines? (section 2.4). Chapter 3 examines these approaches in more detail through case studies of governments and other public actors developing project pipelines to meet climate objectives.

2.2. Infrastructure investment needs to meet climate objectives and scope of report

The challenge to meet climate objectives is to both scale up finance for long-term investment in infrastructure and shift investments towards low-carbon alternatives

(OECD, 2015[7]). Low-carbon infrastructure has been deployed in rapidly increasing volumes with decreasing costs, particularly in the energy sector. The ramifications of these low-carbon technologies and improved operational experience have been felt globally, and many countries now have access to new and increasingly affordable low-carbon sources of energy and clean transportation.

Despite these significant advances, estimates of what is planned continue to significantly lag behind estimates of what is needed, despite new commitments such as the NDCs. Investment in low-carbon infrastructure, for instance, needs to occur at volumes well above current levels. While estimates of investment needs differ, they all point to a significant infrastructure investment gap of trillions of dollars per year to meet climate and sustainable development objectives.[1] For instance, latest figures suggest that total current infrastructure investment is around USD 3.4–4.4 trillion globally per year (OECD, 2017[3]), but the gap to meeting climate and development objectives may be an additional USD 2.5 trillion per year to 2030 (when compared to the estimated investment needs of USD 6.3–6.9 trillion per year[2]).

The current set of NDCs do not put global emissions on a pathway to meet the temperature goals implicit in the Paris Agreement (UN Environment, 2017[8]). All sectors will be affected by the investments required to meet long-term climate objectives, including the reorientation of existing infrastructure or deployment of new low-carbon and climate-resilient assets:

- energy, e.g. renewable energy technologies
- transport, e.g. public transport options like bus rapid transit and electric vehicles (ITF, 2017[9])
- industry, e.g. improved process efficiencies
- housing, e.g. efficiency measures such as insulation and deep retrofitting
- water, e.g. water supply and sanitation, flood protection, water storage and conveyance
- food and sustainable agriculture, e.g. irrigation, resilience to extreme changes in climate
- forestry, e.g. reforestation
- resilience infrastructure, e.g. to protect assets from potential storm damage.

2.1.1. Scope and focus of report

The focus in this report is on low- or zero-carbon, mitigation projects such as renewable electricity generation, energy efficiency, public transportation and electric vehicles. Despite this particular focus, the examples of good practice in this report for building low-carbon project pipelines are potentially applicable to other types of infrastructure projects. At the same time, good practices based on an examination of other types of infrastructure projects (or aspects of infrastructure projects, e.g. resilience) are also relevant to low-carbon infrastructure projects. For example, adding resilience measures in the design of these projects, which is essential to their durability, needs to be considered for low-carbon infrastructure upfront and systematically, although such measures may add to the complexity of structuring projects and increase costs (see Box 2.1 for work on resilience infrastructure investment).

The development of project pipelines aligned with long-term climate mitigation objectives will need to be supportive of such important infrastructure sectors as water supply or flood protection (Section 3.7 in Chapter 3 examines in more detail water infrastructure and approaches taken by the Netherlands and the United Kingdom). Lessons from work on water infrastructure also can apply to developing low-carbon infrastructure. In particular, the consideration of long-term strategic pathways, avoiding path dependencies and expensive lock-ins are important to ensure infrastructure investment remains aligned with long-term policy objectives.

Box 2.1. Investment in climate-resilient infrastructure

The physical impacts of climate change, such as changes in temperatures, changes in rainfall patterns and sea-level rise, will affect all types of infrastructure investments. Potential threats include reduced asset lifetimes, increases in operational expenditure, the need for additional capital expenditure, and increased risks of environmental damage and litigation. Decisions taken now about the location, construction and operation of infrastructure will determine future resilience. Adopting a resilient approach to respond to climate change also means accepting that some disruptions are occasionally unavoidable.

Improving the climate resilience of new or existing infrastructure can be achieved by reducing exposure or sensitivity to climate-related hazards through a wide range of context-specific adaptation responses. Adaptation measures may require implementing "hard" civil engineering measures to protect assets, or "soft" measures, which include modifying maintenance routines or information-sharing practices. Innovative solutions can also be used, such as working with nature. These measures can have very different costs, both in absolute and relative terms with respect to an overall construction or retrofitting project.

National governments have the opportunity to ensure that future investment supports resilience and avoids locking-in vulnerability. Vallejo and Mullan (2017) identified four areas in which governments can focus their efforts to facilitate climate-resilient infrastructure:

1. **Improving risk assessment and information to support decision making.** Ensuring data on projected natural hazards is available and accessible, raising awareness, and building the capacity of relevant decision makers all contribute to better decision-making. High–level risk assessments should also be undertaken to identify the exposure of existing infrastructure.
2. **Screening and factoring climate risks into public investments.** When investing in or commissioning infrastructure, governments can require contractors and suppliers to demonstrate they have considered climate risks.
3. **Enabling infrastructure resilience through policy and regulation.** Governments can support climate-resilient infrastructure by removing regulatory distortions, or adding regulatory requirements to consider physical climate risks.
4. **Encouraging climate risk disclosure.** The disclosure of physical risks can encourage action to manage those risks, as well as revealing interdependencies and supporting the design of public policy.

Source and further reading: Vallejo, L. & M. Mullan (2017), "Climate-resilient infrastructure: Getting the policies right", OECD Environment Working Papers, No. 121, OECD Publishing, Paris. *http://dx.doi.org/10.1787/02f74d61*

2.3. An overview of project pipelines: Meaning and context

The importance of project pipelines is evident from a body of literature (summarised in Annex 2.A) which recommends that governments develop and manage them as a means

to improve transparency and offer long-term credibility, predictability and vision. Pipelines are recommended largely because investors' abilities to identify and assess low-carbon infrastructure investment opportunities are greatly helped if pipelines are clearly described and promoted by governments (Kortekaas, 2015[6]).

Yet, in the context of scaling up infrastructure investment for climate objectives, few reports go beyond this generic recommendation to explore how to characterise or identify good project pipeline practices, or what concrete steps governments can take to develop more robust project pipelines and thereby scale-up investment in low-carbon infrastructure. To shed more light on these issues, this section explores project pipelines in the context of meeting climate objectives and examines the following questions:

- What is meant by project pipelines in the context of climate objectives? (Section 2.3.1)
- How do project pipelines relate to the government's wider investment policy framework to mobilise private finance? (Section 2.3.2)
- How does this report help shift the current discussions of project pipelines from concept to actions? (Section 2.3.3)

2.3.1. What is meant by project pipelines in the context of climate objectives?

No formal definition of a project pipeline has been agreed for infrastructure projects generally, let alone one which is aligned to meeting long-term climate objectives. Based on expert interviews, discussions and review of literature, the predominant view amongst governments and the investment community appears to be that a project pipeline is manifested in the form of a list of projects at an advanced stage in the development process and that it should be published or communicated publicly in some way.

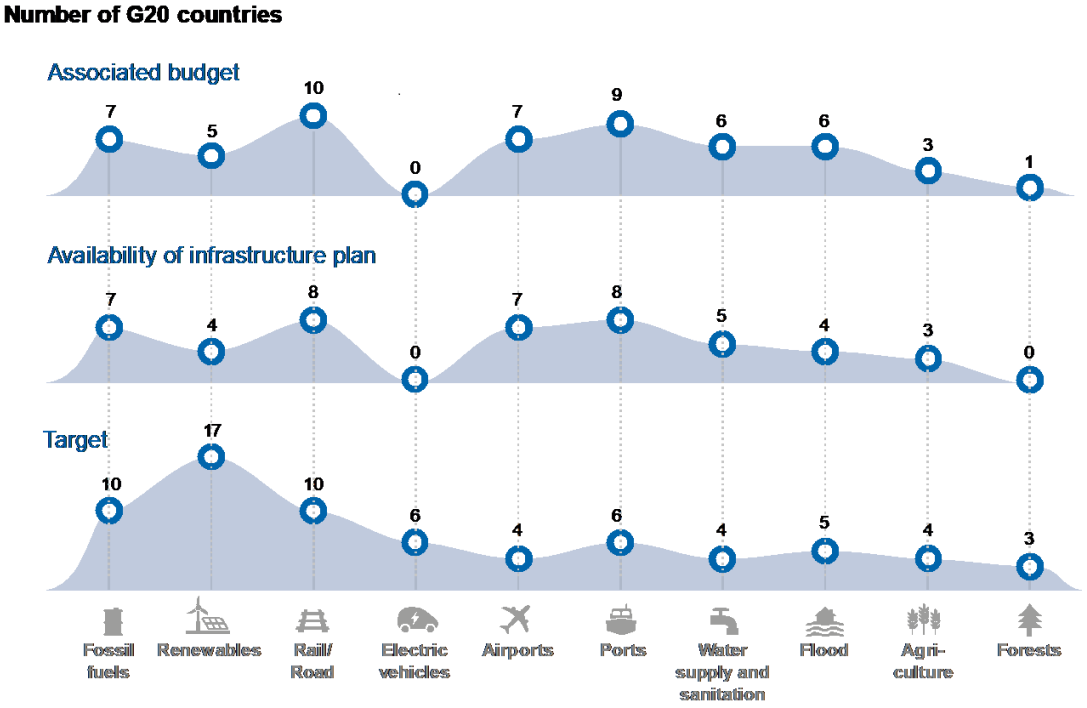
Based on this common view, a low-carbon and climate-aligned project pipeline could be described as *"a set of infrastructure projects and assets (accounting for the existing stock of assets), and future assets in early development and construction stages prior to project commissioning, typically presented as a sequence of proposed investment opportunities over time that align with and are supportive of long-term climate and development objectives."*

Despite the absence of a commonly used formal definition, examples of project pipelines from governments, development banks and international initiatives have tended to be fairly consistent with the description of pipelines provided above. These public institutions invariably aim to generate lists of tangible, future assets that will be added to or replace the existing infrastructure stock. One such example explored in Chapter 3 is the Clean Technology Fund of the Climate Investment Funds (CIF). The CIF works in 72 developing and emerging economies to assist governments with country assessments of their low-carbon and climate-resilient infrastructure needs and develops a number of near-term and tangible investment opportunities.[3] See Chapter 3 for several other examples of efforts to build project pipelines.

The OECD recently examined national-level, infrastructure investment plans for the Group of 20 (G20) countries (OECD, 2017[3]).[4] Figure 2.1 shows an overview of these G20 infrastructure plans, taken from OECD (2017[3]). The plans cover ten infrastructure sectors from fossil fuel to flood prevention, and were filtered according to a number of criteria: whether a target or objective was in place (e.g. to increase the number of electric vehicles to 1 million by 2025); if a public budget was available to support investment

(e.g. there is a public fund of EUR 300 million available to de-risk investments); or if information was publicly available on individual projects (e.g. typically a list of all or, more often, a subset of the projects included in the plan, presented online or otherwise).

Figure 2.1. Overview of degree of infrastructure planning by G20 countries



Note: This figure shows the number of G20 countries that, as of early 2017, had sector targets (bottom graph), plans of projects (middle), and associated budgets to support their development (top).
Source: OECD (2017[3])

The analysis revealed inconsistencies across the G20 countries by sector and by level of detail in the project pipeline (according to analysis of infrastructure budgets, plans and targets in early 2017). The study found that while 17 countries had set a renewable energy target, for instance, only four (Argentina, Brazil, Mexico and the United Kingdom) had an associated infrastructure plan that outlined the projects involved. Indeed, few countries had a budget or plan for the development of important infrastructure sectors like agriculture, sanitation, flood prevention or forestry. Likewise, while six countries had a target for deploying electric vehicles, no country had a plan or budget to reach it.[5]

The OECD (2017[3]) report found that there are gaps in the consideration of climate change mitigation and adaptation objectives, and challenges to determine the extent and nature of project pipelines. Only five of the 20 countries studied, for instance, mention climate mitigation or adaptation measures within their infrastructure planning processes. The report also recognised that very few countries have so far developed 2050 low-emission development strategies,[6] and strongly urged others to rapidly scale up investment in low emissions infrastructure by developing a prioritised and "[publicly available] pipeline of infrastructure projects."

Similar messages are also found in a forthcoming OECD paper (Mirabile and Calder, 2018 forthcoming[10]) which attempts to 'quantify' the project pipeline in the global power sector. This study, summarised in Box 2.2, compares global electricity generation

capacity (under construction and planned over the next five years) against low-carbon scenarios to test for misalignment. It finds that the current building and planned construction of coal capacity over the next five years are incompatible with long-term climate ambitions. Renewable energy deployment, on the contrary, appears to be going in the right direction, but needs to be accelerated.

Many countries will soon begin or have already begun to include their NDCs or other forms of climate targets in their long-term infrastructure planning and policy-making processes. These processes are country and context specific. Nevertheless, the ability to identify and compare common or good practices for project pipeline planning and development may prove beneficial to other countries. What constitutes good project pipeline practice is the focus of the next section and Chapter 3.

Box 2.2. Quantifying the project pipeline in the power sector

With 40% of energy emissions accounted for by the electricity sector – themselves representing 68% of global greenhouse gas emissions – decarbonising electricity infrastructure is essential if climate goals such as the Paris Agreement are to be achieved. This study establishes whether electricity generation infrastructure under construction and planned in the next five years – the "pipeline" – is in line with a low-carbon scenario.

Results indicate that globally, there are approximately 6 300 GW of power capacity in operation, 1 200 GW currently under construction (to become operational in the next five years). An analysis of this pipeline indicates that renewable energy technology is expanding rapidly: it represented only 34% of the installed capacity in 2017 yet accounts for 62% of the plants under construction (mostly from wind and solar power). In contrast, the development of new coal power plants is slowing: currently representing 31% of total installed generation capacity, coal power represents 23% of electricity capacity under construction.

While these results provide encouraging signs that the decarbonisation of the energy sector is in motion, data suggest that coal will still be the main source of electricity output by 2022. Solar power – while being deployed widely – still only accounts for 1% of electricity generation (IEA, 2017[11]). To be in line with 2020–30 energy scenarios that provide pathways to reach the Paris Agreement temperature goal of limiting global temperature rise to well below 2°C, not only should the installed capacity of coal stall, global coal capacity should decrease by 2% per year in the next ten years (compared to a 3% increase in the last ten years). The current building of coal capacity and planned construction in the next five years are not compatible with staying on an emissions scenario of below 2°C. Renewable energy deployment, on the contrary, appears to be going in the right direction, but needs to be accelerated.

This study indicates that a number of changes need to take place in the electricity sector to meet the Paris Agreement's mitigation goals. In addition, the implied transition brings with it a number of challenges and opportunities that governments need to consider, such as: addressing air quality and climate issues simultaneously; ensuring a just and inclusive transition; managing stranded assets; arranging alternative government revenues (including from carbon pricing).

Source and further reading: Mirabile and Calder (2018 forthcoming[10]).

2.3.2. How do project pipelines relate to the government's wider investment policy framework to mobilise private finance?

Governments as a whole, and specific public agencies and institutions, strongly influence the development of domestic project pipelines by signalling intent, setting policies and regulations, establishing promotional institutions and planning infrastructure. Public actors have a suite of available tools and levers to involve themselves in infrastructure investments. They can, for instance: fund projects directly from public budgets; lead public-private partnerships; employ risk mitigants like public guarantees; or set policy incentives for specific sectors or technologies (see Annex 2.B for more information).

High-level objectives and policy frameworks

The NDCs are an important example of government efforts to set high-level national mitigation objectives. They could influence policy frameworks, infrastructure investments and the associated project pipelines in almost all countries to the period to 2025–30. Yet, even where the NDCs have clear goals, their implementation, as manifested in changes in the domestic policy framework, is still at an early or basic stage in many countries. The lack of detailed infrastructure investment plans and integration of these plans into national policy contexts means it is not always clear what and where project investments are needed, or how to finance them. Importantly, poorly defined infrastructure planning and lack of policy links could open the door to investments that should not be made, such as those which result in expensive lock-in or path dependencies and those which are incompatible with climate objectives.

By using the various policy tools available to them (see, for instance, Annex 2.B), a range of public institutions can shape how project pipelines and efforts to develop pipelines relate to the wider policy framework and the investment-enabling environment.[7] For instance, subnational and local governments set policies specific to their local needs (see Annex 2.C). Regulators set expectations for financial returns from infrastructure assets in sectors that may inherently lack competition but where investments are often undertaken by the private sector, such as electricity grids and transport networks. Development banks employ technical capacity and local knowledge to promote and support infrastructure investment in emerging and developing economies (see Annex 2.D and section 3.3 in Chapter 3). Lessons from these activities and institutions, such as what works and what does not, can feed back into policy-making processes and improve understanding of investment obstacles or gaps (and how to overcome those).

Mobilising private sector investors

Private sector investors and project developers, who are expected to provide up to three-quarters of green infrastructure investment (WEF, 2013[12]), have at their disposal numerous channels through which to invest and to assess projects, take positions and secure attractive returns on their investments.[8] Governments can foster such channels and maintain relevant funding activities (see, for example. OECD (2016[13]; 2015[1])) including ensuring that, to the best of their abilities, projects are investment-ready and attractive (see the next section).

Investors (and project developers) want to identify and source investment opportunities that match their needs from the available options, which are usually driven by government policy and goals. Long-term investors, like pension funds or insurance companies, are typically less interested in one-off investments than in the possibility of an attractive, enduring portfolio of bankable projects with the right risk-return profile and track record of various actors involved. Meanwhile, private equity and early-stage investors are typically interested in higher risk-return profiles (particularly important in low carbon investments in developing countries). In both cases, investors often compare and evaluate investment options across countries and sectors to find suitable opportunities. Annex 2.E discusses the role of better infrastructure data and more transparency in project pipeline development processes.

A key motivation for examining project pipelines more comprehensively is the general lack of knowledge on what effective approaches and efforts to build project pipelines look like. This situation presents challenges to investors and, from an investor or project developer perspective, may ultimately constrain investment. OECD (2017[3]) warned that

"[project pipelines] that are inaccessible, incomplete or poorly aligned with long-term climate mitigation and adaptation goals are likely to hinder the flow of infrastructure investment in support of climate goals". Expert interviews and discussions undertaken for this report reached similar conclusions: project pipeline approaches, as implemented to date, vary in their use and application; the range of pipeline practices are too varied and dissimilar to allow conclusions to be made on what works best; and the lack of clarity in pipeline development practices hampers investors' efforts to identify such opportunities.

2.3.3. How does this report help shift the current discussions of project pipelines from concept to concrete actions?

By providing an in-depth exploration of what is involved in building project pipelines in the context of meeting climate objectives, this report aims to move discussions on pipelines beyond high-level assessments of project pipelines. The next section examines what concrete actions governments can take to build robust project pipelines and Chapter 3 explores a set of case studies to identify good practices in this area.

This report aims to complement and expand on other examinations of pipelines completed to date, which have focused on such topics as:

- reviewing available data and studying government reports and publications (e.g. the approach taken by OECD (2017[3])
- analysing planned investments in one sector (e.g. power sector analysis presented in Box 2.2)
- building an online tool for hosting projects that are in later stages of development but do not account for climate or sustainability factors (e.g. see the Global Infrastructure Hub presented in Annex Box 2.E.1)
- targeting the preparation of individual projects to be added to a national project pipeline (e.g. within Multilateral Development Banks)
- summarising infrastructure initiatives in general (e.g. a survey by Mercer and the Inter-American Development Bank (2016[4])).

2.4. Robust project pipelines and effective efforts to develop them

Governments can take action in a number of areas to make their project pipelines robust in the context of meeting climate objectives. The process to "translate" such objectives into a tangible set of projects involves collective action from a range of actors. Governments (of all levels, national or otherwise) are best-placed to support the development of robust project pipelines through various activities, processes and practices.

Based on expert interviews and a review of literature and existing pipeline practices, a national project pipeline aligned to climate objectives can be developed. However, such a pipeline can only be as robust as the (investment-ready and bankable) projects that constitute it and as effective as the institutions that deliver it. In addition, such a pipeline will only be as ambitious as the government objective to which it is linked. In the context of low-carbon project pipelines, ambition can refer to the stringency of mitigation action implied in the NDCs and the way in which the target is expressed (e.g. absolute emissions reduction, renewable energy target and others).

The following subsections look at key areas of government efforts to build project pipelines and ultimately ensure that they are robust and fit-for-purpose.

- Influencing the bankability of projects in the pipeline (Section 2.4.1)
- Characterising robust project pipelines (Section 2.4.2).
- Highlighting effective efforts to develop robust project pipeline (Section 2.4.3).

2.4.1. Influencing the bankability of projects in the pipeline

A commonly proposed but vague solution to the lack of bankable and investment-ready projects is for governments to have "better pipelines". This prescription fails to consider that there is a lack of easily identifiable, bankable projects at the volumes, scales and risk-return profiles that interest investors. The notion of having better pipelines should, therefore, account for these demands and other country needs, which make the task of developing and delivering better pipelines, and the associated projects, much more complex than the simple phrase ("better pipelines") would suggest. This concern points to two items of importance, 1) how to ensure projects within the pipeline are bankable, and 2) what actions governments can take to support them.

Governments sometimes lack the capacity and knowledge to convert project proposals into economically attractive investment opportunities. To that end, project preparation facilities (PPFs) are increasingly offered by public institutions to assist the development of projects to reach investment-ready states (see Annex 2.F for more information on PPFs and project bankability). An increasing amount of emphasis is being placed on these facilities, particularly in developing and emerging economies; the costs for global project preparation activities have been estimated between 2.5% and 10% of total infrastructure investment (GCEC, 2016[14]; Kortekaas, 2015[6]) or up to USD 690 billion per year.[9]

The amount of preparation needed depends on the sector and type of infrastructure. In designing PPFs, governments play a key role in ensuring projects are in line with the country's strengths. For instance, the rapid cost reductions witnessed in some areas such as renewable energy sources like wind and solar energy mean that identifying bankable electricity generation projects is becoming less of a challenge than in other sectors, noting that even solar energy projects face significant barriers in many sun-rich countries. The reducing sizes of "average" infrastructure projects (e.g. small-scale energy efficiency, demand-side technologies, and distributed renewable energy) mean many millions of new, and often discrete, projects will be required globally. Of course, since infrastructure normally lasts for decades, bankable projects will need to be adequately resilient to future changes in environmental conditions (see Box 2.1 for information on resilience).

2.4.2. Characterising robust project pipelines

The preceding discussion suggests that governments can develop robust project pipelines to highlight the scale and scope of investment opportunities and communicate the available tools and policies. Efforts to develop robust pipelines ultimately need to: promote investment in "good projects",[10] across a variety of sectors, of different scales; accommodate the requirements of investors; and allocate preparatory support to certain projects that may help a country achieve objectives like the NDCs, but which are not yet bankable.

Literature review and discussions with experts suggest that, with respect to aligning infrastructure to long-term climate objectives, governments can develop robust pipelines of projects if they:

- link policy making to forward-looking objective setting and the programmes and institutions to deliver them, providing overall co-ordination and leadership to champion project pipelines
- focus on strengthening the interface and mechanisms that governments employ to disseminate information and convene actors, offering transparent processes and communicating relevant information on projects and the pipeline with the financing and investment community
- take a holistic, whole-of-government approach to infrastructure planning and investment, feeding lessons back into policy-making processes to bolster the investment-enabling environment and providing funding or institutional support to projects when appropriate
- fast-track suitable infrastructure project investment in a way that brings the carbon and energy intensities of the country's economy to target levels, prioritising the deployment of "high-value" and strategically important projects and sectors
- foster the development of a diverse set of bankable projects and promote business models suitable for private sector needs, setting strong eligibility criteria to determine which projects should be built and supported and which should not
- increase country resilience to changes in climate and development needs, deploying infrastructure that remains pertinent and relevant over time and tailored to changing external conditions, and avoiding expensive path dependency or lock-in.

2.4.3. Highlighting effective efforts to develop robust project pipelines

Building from the above analysis, and based on a thorough review of project pipeline efforts across many countries, a number of policy and institutional factors have been identified which are common to effective government efforts to develop robust pipelines. Through a series of case studies, Chapter 3 examines each of the following six factors in the context of a country's or region's efforts to build robust project pipelines. Each case study, therefore, explores the various attributes and important applications of the factor and highlights emerging good practices of its use.

1. **Leadership** relates to governments as a whole, or specific agencies, championing the development of a robust project pipeline. It is manifested when these government actors possess and use authority to oversee policy actions, co-ordinate and mobilise public and private actors, signal investment needs, devote time and cater to national and international priorities, and disseminate information. Governments can also help direct actors to scale up activities in certain areas such as technology manufacturing or research by providing a vision of future investment needs and direction. See section 3.2 in Chapter 3.
2. **Transparency** relates to having transparent approaches to developing sectoral infrastructure investment plans, sourcing projects, providing targeted funds and using data management processes that foster investment. Lack of transparency is a

major barrier to mobilising project developers and investment decision makers. Improved transparency, on the other hand, equips investors with information they can use to justify subsequent commitments and positions in one or more pipelines or develop exit strategies. See section 3.3 in Chapter 3.

3. **Prioritising**, expediting or optimising strategically valuable projects – and shepherding them through development processes – constitutes a critical step in building robust pipelines aligned to long-term climate objectives. Developing and implementing low-carbon projects at scales and rates far beyond current volumes, including projects involving more than one country, is often hindered by complex institutional arrangements and misaligned regulatory processes. See section 3.4 in Chapter 3.
4. **Project support** refers to various elements of the investment-enabling environment that affect the risk-return profiles of projects such as efforts by governments to: bridge investment gaps, overcome investment barriers, unlock important but challenging sectors or technologies, and mobilise actors. These include policy incentives, the supply of public funds and institutional support, and the provision of effective and efficient project preparation facilities where needed. See section 3.5 in Chapter 3.
5. **Eligibility criteria** ensure a pipeline of projects is properly aligned to or in support of long-term climate objectives. Such criteria necessitate strong systems to assess which projects should be promoted and set conditions of how strategies like the NDCs are "translated" into project pipelines. They can provide guidance on, for instance, which projects should be built and supported and which should not (such as to avoid expensive economic stranding of assets). Each of the case studies presented in Chapter 3 includes, to some extent, systematic processes for identifying eligible projects and supporting them.
6. **Dynamic adaptability** describes the capacity of governments to keep project pipelines aligned with policy objectives over time, to be pertinent and relevant in the long-term, and tailored to changing external conditions, avoiding expensive path dependency or lock-in. To develop project pipelines that are dynamic and adaptable, governments should make efforts to ensure pipelines are informed by long-term strategic planning of investment pathways. See section 3.7 in Chapter 3.

Many of these factors and the associated approaches are already applied, to some extent, by governments and public institutions aiming to mobilise private sector investment. The case studies and factors were specifically chosen to be widely applicable beyond the country or region in question. The factors are well understood solutions to common infrastructure investment barriers (see, for instance Annex Table 2.B.1 in Annex 2.B): including: the existence of clear leadership structures, methods to prioritise important projects or ensuring infrastructure plans are kept pertinent to changing environmental conditions over time.

The case studies show that important actions to develop project pipelines are already being taken by policy makers in a range of settings. These examples (and others summarised throughout Chapter 3) offer lessons to other countries on what worked, what did not, and other good project pipeline practices.

Notes

[1] See Section 3 and Box 3.1 in OECD (2017[3]) for a discussion on and the challenges related to estimating infrastructure investment, including estimates from the Global Commission on the Economy and Climate (GCEC, 2014[34]), Bhattacharya et al. (2016[26]) and UNCTAD (2014[35]).

[2] OECD (2017[3]) suggests that, to meet development needs, investment in new infrastructure could reach USD 6.3 trillion per year over the period 2016–30, even before governments consider climate change concerns. A further 10%, around USD 0.63 trillion, may be necessary to put emissions on a pathway in line with a well-below 2°C scenario, notably including increased demand-side investments in energy. The difference between these estimates and current investment volumes (USD 3.4-4.4 trillion per year) is approximately USD 2–3 trillion per year.

[3] The CIF is examined in more detail in section 3.3 in Chapter 3 in the context of supporting clean transport investment in cities in Viet Nam.

[4] Argentina, Australia, Brazil, Canada, the People's Republic of China (China), France, Germany, India, Indonesia, Italy, Japan, Korea, Mexico, the Russian Federation (Russia), Saudi Arabia, South Africa, Turkey, the United Kingdom and the United States, plus the European Union.

[5] Since publication of the report (OECD, 2017[3]), the United Kingdom released its July 2018 "Road to Zero" strategy which sets out in detail the ambition for at least 50% of cars to be ultra low-emission by 2030. For more details, see: www.gov.uk/government/news/government-launches-road-to-zero-strategy-to-lead-the-world-in-zero-emission-vehicle-technology.

[6] Nine at the time of writing and most from developed economies. See unfccc.int/focus/long-term_strategies/items/9971.php for more information.

[7] The investment-enabling environment is where, as discussed by the OECD (2015[36]), governments establish strong policy and institutional frameworks (including core climate policies like carbon pricing, fossil fuel subsidy reform), and provide support to low-carbon alternative sources of energy like renewable energy.

[8] Private sector actors are multifaceted and have fundamentally important roles in delivering project pipelines: project developers to build and operate these infrastructure projects, and prepare projects for implementation and thus foster involvement of other actors through various channels; investors to provide capital and take ownership of projects and can also bring technical and management capabilities; and supply chain actors to provide skills and manufacturing capabilities. Investors can structure project financing by taking equity or mezzanine positions, commercial loans for capital-intensive construction phases or refinancing those projects that are already operational.

[9] When applied to the OECD estimates of annual global infrastructure needs at USD 6.9 trillion for the 15-year period to 2030 (OECD, 2017[3]).

[10] Governments will also need to have the foresight to look to the development of "better projects" in the future; those that are more suitable to the longer term climate objectives, resilient to future changes in environmental conditions, without risk of stranding assets, and also bankable by nature.

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Annex 2.A. In which infrastructure contexts are project pipelines commonly discussed?

Governments have widely recognised the importance of green,[1] low-carbon infrastructure to help establish strong economic growth and deliver low-carbon pathways (OECD, 2017[3]). In addition, the associated infrastructure projects that constitute the pipeline can themselves be an enabler for development and social progress (Nassiry, Nakhooda and Barnard, 2016[5]), so governments would do well to ensure such project pipelines are robust and effective in delivering the desired objectives. Project pipelines are mentioned often in contexts related to infrastructure investment in general, and to governments meeting their climate and development objectives specifically – and can be summarised across three themes below.

The apparent gap between available capital and investment-ready, bankable projects. The apparent investment gap is driven not by the availability of private capital (there is an oversupply of capital seeking bankable projects), but the lack of available and suitable bankable or investment-ready projects (Mercer and Inter-American Development Bank (IDB), 2016[4]; Nassiry, Nakhooda and Barnard, 2016[5]; Kortekaas, 2015[6]). A bankable or investable project is one that offers a level of returns commensurate with the risk appetite of private investors, thus making it attractive for them to invest or commit financial positions.[2]

The lack of available projects is not a problem restricted to climate and development investment alone, on which there is a great deal of literature (World Bank Group and International Monetary Fund, 2014[15]; UNFCCC, 2015[16]; OECD, 2017[3]). It applies equally to infrastructure investment in general and remains one of the primary impediments to bridging the evident gap between infrastructure investment demand and the supply of infrastructure finance (BIS, 2014[17]). See Annex 2.F for information on facilities to prepare projects to a bankable or investment-ready state.

Long-term vision and clarity to mobilise private finance. A number of OECD reports recommend that governments follow better practice related to infrastructure planning and investment, taking a long-term perspective, and consider developing robust project pipelines as an important means to mobilise finance and send signals of intent to investors. For instance, the OECD (2015[1]) recommends that governments establish "a national infrastructure strategy and roadmap with project pipeline" including detailing the timing, capacity needs, locations of investment, and available policy support. The OECD (2017[2]) also proposes that governments to set infrastructure objectives relevant to project pipelines such as "a national long-term strategic vision", "clear criteria to guide the choice of delivery", "review existing infrastructure resilience in the face of evolving natural and manmade risks and develop guidelines to future proof new infrastructures."

International fora such as the Group of 20 countries (G20) have also recognised the importance of project pipelines in aligning investment and private sector action (OECD, 2016[13]) and, during the 2014 G20 Summit, leaders agreed that "to help match investors with projects, [they would] address data gaps and improve information on [infrastructure]

project pipelines" (G20 Leaders, 2014[18]). The Global Infrastructure Hub, for instance, was established by the G20 in the same year to deliver its multi-year Global Infrastructure Initiative. Launched with a mandate to provide support for a global pipeline of bankable projects, the Global Infrastructure Hub offers a suite of tools to help investors navigate investment decision making and identify the most appropriate opportunities.

Mainstream climate considerations into investment decisions. Rydge, Jacobs and Granoff (2015[19]) pointed to the need to ensure climate concerns are properly accounted for within infrastructure investments. They suggest infrastructure and climate policies "[too often] exist in separate silos." A joint report by UN Environment and the Italian Ministry of the Environment (2016[20]) highlights that public and private support for infrastructure is "de-linked from sustainability priorities."

Furthermore, the OECD found that only nine of the G20 countries integrated both mitigation and adaptation considerations into infrastructure planning (OECD, 2017[3]). Not only does this de-linking impact negatively on the quality of service provided by infrastructure. it may overlook valuable co-benefits (such as cleaner air and reduced traffic congestion) and could potentially lock-in vulnerability to or future damage from the impacts of climate change. The inclusion of future damages in projects could help make projects that avoid these damages more attractive investment opportunities.

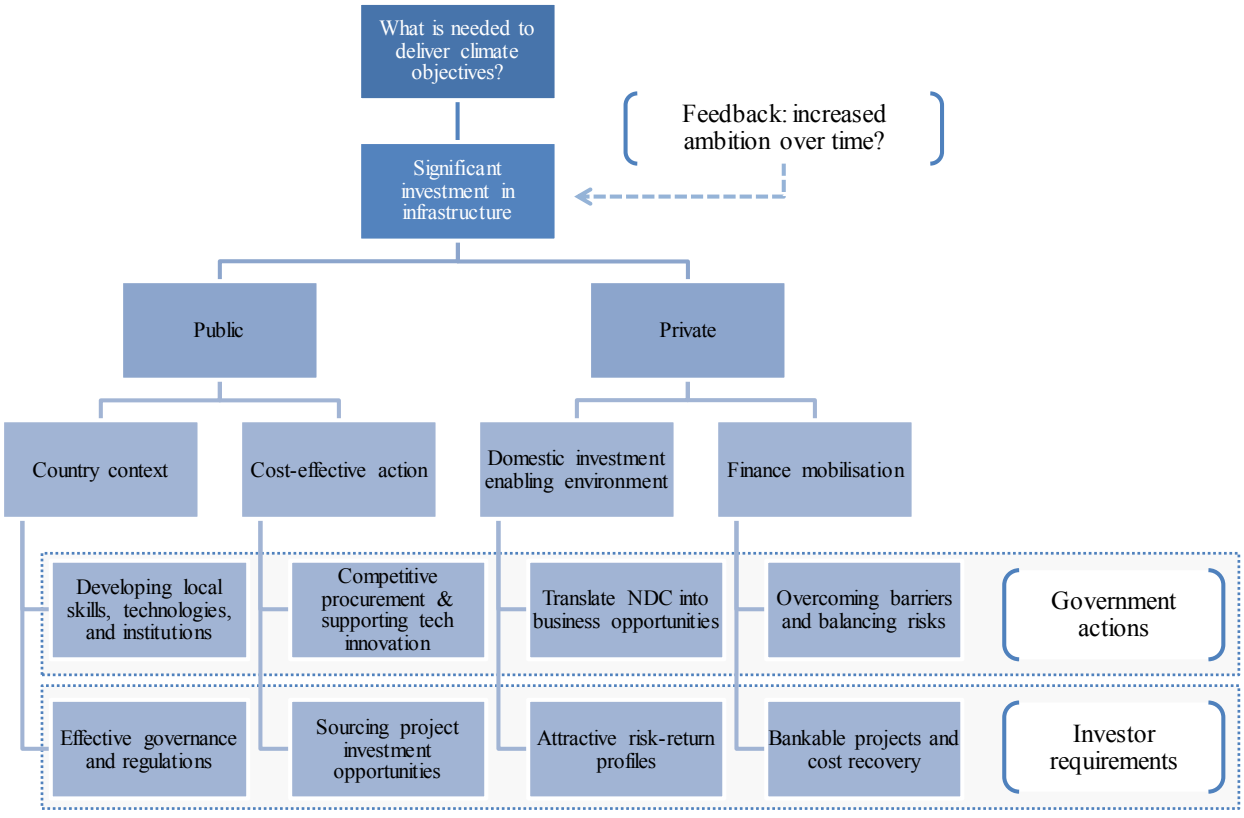
Annex 2.B. Government actions and tools to drive domestic infrastructure investment

Governments have a suite of tools and institutional arrangements available to mobilise investment and overcome common barriers to infrastructure investment (as highlighted in Annex Table 2.B.1). They can, for instance:

- procure goods and services and fund large capital projects such as transport and energy infrastructure directly from public budgets
- direct or influence investment decisions of state-owned enterprises, which are important actors in many developing and emerging economies, particularly in the energy sector[3]
- lead public-private partnerships and other initiatives often used to anchor large bulky infrastructure projects and encourage effective co-investment by public and private actors[4]
- employ public instruments (risk mitigants and transaction enablers) such as guarantees that reduce or mitigate investment risks or allocate them to those actors able and willing to manage them (OECD, 2017[21])
- support research into innovative technologies or solutions; or design policies and plans to support climate objectives and ensure domestic policies are cost-effective and well-aligned across the economy and at different levels of government (OECD, 2015[7])
- support the development of innovative financial instruments and project finance structures to help avoid costly and burdensome administrative approaches and lower transaction costs. These include, for instance: standardising contracts, methods and processes, like those applied by the Climate Investment Funds in over 70 emerging and developing countries (see section 3.3 in Chapter 3); and encouraging the securitisation or warehousing of aggregate smaller assets into larger investment tickets (often attractive to long-term investors like pension funds).

The high-level linkages between government actions and private investment needs and expectations are shown in Annex Figure 2.B.1. It highlights the various but specific roles governments have to foster, scale-up and accelerate infrastructure investment to meet long term climate objectives, like the Nationally Determined Contributions (with relevant feedback to increase ambition over time).

Annex Figure 2.B.1. Relationship of government actions to private investor requirements to scale up low-carbon infrastructure investment in light of long-term climate objectives



Note: The figure provides a simplified and illustrative overview of the various government actions and investor requirements. Relationships may not always be a one-way process between one level (e.g. private finance mobilisation) and the next (e.g. governments acting to overcome barriers). There, of course, may be feedback within levels (e.g. the domestic investment-enabling environment may also influence the extent of private finance mobilisation). NDC: Nationally Determined Contribution.

Annex Table 2.B.1. Overview of barriers to scale-up infrastructure investments

Barriers to scaling up low-carbon investment	Discussion of key issues in the context of robust project pipelines
Lack of focus towards meeting climate targets Strong incumbents that obstruct or slow transition to low- or zero-carbon alternatives	Actors align with long-term direction and objectives, improving financial and technical support for investments through policy and regulation. Delay in aligning the infrastructure stock and flow could increase the economic damage of stranded assets, particularly for energy assets. [Indeed, the IEA and IRENA (2017[22]) and IRENA (2017[23]) estimated the value of stranded (energy infrastructure) assets to be around USD 850 billion between 2014 and 2050, assuming an orderly transition to meet long-term climate objectives.] A central organising agency like a cross-government "infrastructure hub" for investment could offer valuable co-ordination if efforts are taken to: avoid "gatekeeping" in which projects go through cumbersome review procedures; and account for subnational leadership and existing governance structures.
Poor infrastructure investment planning Delays due to poor supply chain connectivity	Infrastructure often requires "sequencing", particularly in network infrastructure. Electric vehicles, for instance, need adequate charging stations before the market can scale. Better project pipelines can help improve information on strategic investments like electricity grid infrastructure in anticipation of future renewable energy deployment. Likewise, manufacturing capacities and the project delivery system (e.g. local skills, engineers, craftsmen) will stay informed of future needs to scale-up efforts.
Lack of clear accountability in delivery of long-term climate objectives	Specific roles and tasks are given to the actors involved in developing the project pipeline. This can result in reduced coordination inefficiencies and improved clarity in responsibilities in the event of, for instance, lack of progress to deliver robust projects or slow progress to meeting the targets.
Investors facing expensive and opaque processes to source investment opportunities	Investors are less interested in one-off investments (a project-by-project approach) than in the possibility of an attractive, enduring portfolio of bankable projects with the right risk-return profile and track record, that there will be exit-entry opportunities in the time-horizon they operate within, or levels of liquidity they require. Entry costs in potentially new markets can be expensive. Governments can develop pipelines to provide better identification of investment opportunities and entry-exit strategies. In addition, good practices like replication and standardisation of documents and contracting processes could lessen investment transaction costs over time.
New business models or unclear cost recovery opportunities in low-carbon and climate-resilient infrastructure investments	The diversity and scale of assets to deliver long-term climate objectives presents significant investment challenges, including: new technologies and markets; new, perceived investment risks; capital-intensive infrastructure with higher up-front costs; variable project cash flow dependent on environmental factors (e.g. lack of wind); and new ways of doing business with unclear cost recovery. Governments need to foster access to the most suitable technologies (e.g. rapidly improving renewable energy project economics) and adjust for changing private sector needs (e.g. new business models and innovative tools and approaches to financing).
Non-competitive processes to allocate investments or projects	Governments already use a range of efficient competitive processes to allocate sector-specific policy support to projects, or to allocate technology contracts or participation in government infrastructure projects that match the risk-return expectations of private sector participants. Governments could also use these processes to allocate positions on the project pipeline to bankable or investment-ready projects. Reverse auctions, for instance, are increasingly used to allocate project developers with agreements to build (e.g. government-backed guarantees) and have been shown to bring down costs of innovative technologies like in thermal solar power plants (Stadelmann, Frisari and Rosenberg, 2014[24]).
Lack of effective processes to fast-track important or high-value projects	Governments can include fast-track regulatory processes for deploying projects in certain technology classes or locations that are deemed strategically important in the national or regional context – see for instance section 3.4 in Chapter 3.
Lack of social awareness and acceptability of investment programme	Large-scale infrastructure investments often face challenges due to social acceptability and land-use issues, particularly when investments are in greenfield sites. Open and transparent pipeline processes can offer insight into the motives or the need behind infrastructure investments, and help ensure acceptability or social awareness of investments.

Annex 2.C. Accounting for infrastructure "starting points" in project pipelines

Countries' approaches to investment planning and designing project pipelines take inputs from various areas of government, from sub-national, local regions and cities to federal ministries, agencies and regulators. Private actors carry out the majority of the investments in many countries and thus have a role in also developing project pipelines themselves.

National governments often take the lead to develop and cultivate pipelines of projects at the national level, but pipelines can of course extend to other levels of government. Local governments and cities in particular have, to various extents, their own competencies and capacities to design, develop and fund infrastructure projects.

These subnational actors are important for meeting long-term climate objectives and pledges. Cities, for instance, host more than half of the world's population, use more than 70% of the world's energy and emit around the same share of global greenhouse gases, and contribute the vast majority of global economic flows (e.g. 85% of global gross domestic product (GDP) was generated in cities in 2015) (Gouldson et al., 2015[25]). In December 2017, over 2 500 cities from around the world have submitted non-state actor climate pledges to the United Nations Framework Convention on Climate Change (see http://climateaction.unfccc.int for information). Indeed, a recent review of the activities of subnational governments in 100 countries, found that they were responsible for 25% of public expenditure worldwide (equivalent to 9% of global GDP) and 40% of public investment (60% in OECD countries) (OECD/United Cities and Local Government, 2017[26]).

Project pipelines will depend on many interconnected political, institutional and economic factors that affect the short- to long-term infrastructure investment and planning priorities. The resulting route to delivering mitigation objectives under the long-term climate objectives will be different for each country given the various drivers and infrastructure "starting points" including, but not limited to:

- level of economic development and growth expectations
- urbanisation and population growth
- previous infrastructure investment and expected future needs
- maturity and composition of financial capital markets
- ambition of plans in terms of quality and scale of green infrastructure deployed
- level of coherence and co-operation within the government and across public agencies, and between the government and private sector
- capacities of sub-national governance (e.g. degree of autonomy of cities, states from central government)

- government support available to foster a favourable regulatory and investment environment, creating markets to engage the private sector domestically and internationally
- availability of local skills and technologies.

Annex 2.D. Emerging economies and institutional support to mainstream climate considerations into investment decisions

The demand for new infrastructure and corresponding investment gap as noted in section 2.2 will be higher in emerging and developing economies (Bhattacharya et al., 2016[27]; Bielenberg et al., 2016[28]; Woetzel et al., 2016[29]; GCEC, 2016[14]). In many of these countries, climate considerations may need active institutional and technical support if they are to be mainstreamed into public and private sector activities.

Public financial institutions such as national and Multilateral Development Banks (MDBs) bring important experience in supporting the design and development of national infrastructure investment plans and project pipelines. Mainstreaming climate investment considerations in national infrastructure planning and the operations of development banks remains a key research and operational priority for MDBs (Trabacchi et al., 2016[30]; World Bank Group, 2015[31]; OECD, 2017[3]) and also national development banks (Abramskiehn et al., 2017[32]).

To address investment barriers, the Asian Development Bank (ADB) recently proposed that governments consider setting up a national facility to scale-up investment in green infrastructure projects bridging gaps that hinder the sourcing of investment-grade projects (ADB, 2017[33]). The ADB *Green Finance Catalyzing Facility* is based on the principle that risk should be, but is often not, allocated to the parties best-suited to manage them, and proposes using concessional finance to mitigate key project risks and costs in certain situations. The provision of such finance will be ultimately conditional upon governments developing project "roadmaps" and indicators to check progress on achieving objectives.

MDBs have also supported the SOURCE platform (https://public.sif-source.org),[5] which provides, *inter alia*, a comprehensive and harmonised compendium of climate considerations and principles to be used in investment decision making. It is available for free for government agencies in emerging countries and offers templates for the preparation of projects, including governance, technical, legal, financial, economic, environment and social aspects. Templates are further adapted to adjust to sector requirements and different project stages. SOURCE also generates data (from the project portfolio, national and/or global levels) which can be assessed to develop analytics, benchmarks and indicators on the performance and sustainability of infrastructure projects. In addition, SOURCE provides guidance to governments in the project preparation process and allows them to identify barriers to project bankability and provides an entry-point for investors to procure projects or find answers to queries (see Annex 2.F for the role of project preparation facilities).

Annex 2.E. Better infrastructure data to inform private sector investments

Investors are often hampered by the lack of data and information on projects. According to discussions with experts undertaken for this report, however, government efforts to build project pipelines need to be (but currently are not often) communicated using parameters that investors work with or with the appropriate "presentation" medium that balances transparency and confidentiality.[6]

Better data and availability of information offer the opportunity to develop robust cross-country assessments of infrastructure gaps. As suggested by OECD (2017[3]), project pipelines not only improve information on future needs (e.g. what projects are needed later?), but also provide better information and data dissemination tools (e.g. what projects or processes are working now or have worked in the past, and what could be improved?).

In turn, better data and knowledge helps inform policy-making, providing valuable policy feedback and better investment planning as governments take steps to turn low-carbon objectives into investible business plans and establish markets for infrastructure investment. See also efforts to increase transparency in section 3.3 in Chapter 3. Examples of efforts to improve infrastructure data include, but are not limited to:

- The OECD, European Investment Bank, Global Infrastructure Hub and the Club of Long Term Investors together launched the "Infrastructure Data Initiative" in 2017 to address the issue of establishing infrastructure as an asset class through data collection and improving the availability of infrastructure investment data (see Annex Box 2.E.1 for information on the Global Infrastructure Hub).
- The SOURCE platform (introduced in Annex 2.D) is an online infrastructure project preparation and data management platform, led by Multilateral Development Banks (MDBs) and managed by the not-for-profit, Sustainable Infrastructure Foundation. To date, SOURCE hosts more than 1 700 users across 44 countries, and is supporting the development of 198 infrastructure projects globally.

Annex Box 2.E.1. The Global Infrastructure Hub: Leveraging digital capabilities for infrastructure development

The **Global Infrastructure Hub (Hub)** was established by the G20 in 2014 to support its multi-year Global Infrastructure Initiative. Launched with a mandate to provide a global pipeline of bankable projects, the Hub offers a suite of tools to help investors navigate investment decision making and identify the most appropriate opportunities. It fosters a network among governments, the private sector and multilateral organisations to identify best practices, develop knowledge tools to bridge data gaps, address information asymmetry, improve the policy environment, and allow visibility for projects to an international audience of investors.

At the heart of the Hub is the **Global Infrastructure Project Pipeline**, designed to afford governments an opportunity to tap into a wide pool of international capital. The pipeline provides prospective investors with all relevant information, in a lucid format. Investors can access project profiles in a personalised dashboard and contact the relevant authority to invest with the click of a button. Projects are categorised under eight progressive stages of development based on first-hand data from governments. The global pipeline is linked to the databases of governments and MDBs, to match investors with projects of interest, and is regularly updated. Presently, the Hub lists 298 projects across 34 countries.

Analytical tools supplement the pipeline to support investors and policymakers. For instance the **InfraCompass**, based on an in-house capability framework developed by the Hub, assesses the capacity of 49 countries to deliver "quality" infrastructure* and evaluates the strength of their policy, legal and financial environment. An annotated matrix of risks associated with public-private partnership (PPP) projects is provided by the **PPP risk allocation tool**. To further its objectives, the Hub has also partnered with the OECD, World Bank Group and other multi-lateral organisations.

Together, these digital tools allow the investment community to interface with the governments and relevant authorities, allow information symmetry and channel the cross-border flow of capital to infrastructure projects.

* Noting that InfraCompass does not account for climate or sustainability factors within its definition of "quality" infrastructure.

Sources: https://www.gihub.org/; http://www.g20.utoronto.ca/2014/2014-1116-communique.html; http://www.mofa.go.jp/files/000059859.pdf [PDF]

Annex 2.F. The need for project preparation facilities alongside project pipelines

Governments can procure or direct project development and project pipelines to help facilitate private investment. In some cases additional public support may be required to get projects "over the line" to reach an investment-ready or bankable state.[7] Improving the bankability of projects in the pipeline is an important and often cited step to increase the flow of capital towards low-carbon infrastructure projects. A project preparation facility (PPF) is an entity that supports infrastructure investment by channelling a small amount of finance to overcome technical and financial barriers that prevent the project from being bankable or investable to the investment community.[8, 9]

Project preparation is not a pre-set activity, but rather a dynamic concept that adapts and evolves according to the needs of a country, sectors and individual projects, with the ultimate aim of reaching bankability; from supporting engineering design plans, enhancing feasibility studies, or fast-tracking government investment and procurement processes in the preparation of technical and financial documents. Pipelines are often associated with PPFs because sourcing finance and building a bankable project pipeline is made simpler when the projects are well-structured and have detailed demand, engineering, and cost analyses that highlight potential gaps (Kortekaas, 2015[6]).

Governments have an interest in ensuring projects aligned to the climate objectives are attractive to investors, added to the pipeline, and not held up before deployment. The need for PPFs varies depending on sector and country context but is a rapidly growing area of concern since the costs for global project preparation activities have been estimated at 2.5–10% of total infrastructure investment (GCEC, 2016[14]; Kortekaas, 2015[6]) or up to USD 690 billion per year.[10]

Discussions with experts for this report suggest that these preparation facilities will be supported with public funds. In other words, investors may rely on government support before committing their own funds to project investments. As a result, governments should properly consider and account for these costs when translating national objectives like the Nationally Determined Contributions into granular investment plans. Given their magnitude, the costs would significantly affect the overall returns on investment from designing and developing a pipeline of successful projects. They could also be a significant challenge for smaller governments or those in emerging and developing economies, and risk adding a layer of complexity when implementing low-carbon ambitions.

On their own, PPFs are not expected to overcome the wide range of non-financial constraints common to infrastructure investment, and will struggle to do so. The World Bank with others (World Bank Group et al., 2013, p. 3[34]) warns that "the same lack of skills and experience in the public sectors of developing countries *vis-à-vis* developing PPPs constrains the ability of PPFs to deliver results on the ground." These possible constraints include (World Bank Group et al., 2013[34]):

- an absence of credible partnerships between public and private actors (e.g. public-private partnerships, to the extent that this model is used)
- insufficient capacity for project design and implementation
- poor accountability, performance- and contract-management, or lack of co-ordination across actors
- other considerable market and non-market barriers are also prevalent – such as high interest rates, external debt accumulation, geo-political situations (especially for cross-border or transboundary infrastructure projects), trade-offs with other policy agendas (e.g. food and water security or biodiversity protection) and so on.

PPFs provide investors with an entry point into pipeline and project procurement, a means to find answers to queries, and ways to identify investment opportunities suited to their individual requirements and appetites. Approaches to support and finance projects on a project-by-project basis may be administratively burdensome and costly for the institutions involved. Standardisation of contracts and processes, for instance, is one such method to lower these transactions costs. Given infrastructure needs and the diminishing size of projects (e.g. towards decentralised as opposed to centralised energy sources), however, many thousands, if not millions, of new and discrete projects will be required globally, with the majority located in developing and emerging economies.

A more holistic approach to project and pipeline development, including the securitisation and aggregation of smaller assets, would bring advantages if it creates a two-way exchange between investors and policy-makers to identify investment barriers and ensure possible gaps are understood earlier on in the project development cycle. This would include the government's interface through which it engages and encourages investment from private sector actors.

Notes

[1] The OECD (Kennedy and Corfee-Morlot, 2012[37]; Corfee-Morlot et al., 2012[38]) defines green infrastructure as "low-carbon, climate-resilient infrastructure projects [that] either mitigate greenhouse gas emissions and/or support adaptation to climate change in the area of transport, energy or buildings."

[2] Nassiry, Nakhooda and Barnard (2016[5]) explain that bankability itself is dependent on a number of important factors such as: domestic capacities to structure and negotiate projects; processes for proponent/beneficiary engagement; policy and regulatory environment; revenue generation; technology and project feasibilities; and cost or risk-return tolerance.

[3] In China, for example, of the eight largest Chinese power companies, accounting for more than 50% of China's generation capacity, seven are state-owned (Prag, Röttgers and Scherrer, 2018[39]). In South Africa, state-owned energy utility Eskom generates over 95% of electricity in the country (see McNicoll et al. (2017[40])).

[4] PPPs are defined as collaboration between public and private entities in which risks, returns and financing are negotiated between the partners where the private entity provides public services for a financial return – see OECD (2008[41]) for definitions.

[5] SOURCE is funded primarily by International Financial Institutions and led by Multilateral Development Banks, which approve the platform's strategic direction and annual budget. The Sustainable Infrastructure Foundation (SIF), a not-for-profit organisation established in 2014 in Switzerland, manages the implementation of SOURCE platform development and delivery.

[6] Private sector companies will likely not "publish" full project pipeline data due to the confidential nature of the project-level information and financial details, but they can provide governments with metadata that is relevant to meeting long-term climate objectives (e.g. capacity installed, emissions avoided per year).

[7] Bankable means, from an investor perspective, that the project investment offers an appropriate return profile for the risk they take. Project preparation requires a wide array of actors to work together to bridge knowledge or capacity gaps, from legal experts to technical advisors.

[8] Common reasons for projects to leave or drop from the project pipeline include but are not limited to: policy or regulatory risks; technology risks; supply chain constraints; lack of developer track record; or lack of affordable financing options. However, the barriers are likely linked to the underlying domestic policy framework such as presented in (OECD, 2015[42]). The aim of project preparation is to develop projects to a point where they attract sufficient interest from investors (Rohde, 2015[43]), and are intended to "translate demand for infrastructure into bankable projects" (Kortekaas, 2015[6]).

[9] Of course, projects can theoretically fail at any stage of their development cycle, sometimes abruptly, voluntarily "leaving" or exiting the pipeline if, for instance, they face prohibitively high costs or risks and other development problems. Depending on eligibility and investment processes, projects can also be "dropped" at various stages of the project cycle. For instance, the US Overseas Private Investment Corporation can drop projects from their investment plans if they do not meet certain energy efficiency criteria (Boyd et al., 2017[44]). Some projects, of course, may never enter the pipeline because of barriers or risks that prevent them from developing in the first place such as very early-stage technologies or because they do not meet certain pre-determined entry criteria.

[10] When applied to the OECD estimates of annual global infrastructure needs at USD 6.9 trillion for the 15-year period to 2030 (OECD, 2017[3]).

Chapter 3. Emerging good practice in project pipeline development

This chapter explores approaches taken by governments and public institutions to build robust project pipelines and align infrastructure investment to long-term climate objectives. Chapter 2 identified concrete government actions and effective factors that can facilitate the development of robust project pipelines, namely: leadership, transparent approaches, prioritisation mechanisms, project support, eligibility criteria and dynamic adaptability. These factors will be reviewed in country- or regional-specific examples of emerging project pipeline practices in Colombia, the European Union, the Netherlands, the United Kingdom and Viet Nam. By looking at elements, attributes and important applications of these specific factors, the case studies provide models that other countries can consider using or adapting their own pipeline development programmes. In addition, each case study is accompanied by short examples to illustrate how specific pipeline factors are applied in other country settings and contexts. The first section (3.1) provides an overview of the case studies and highlights key messages from the case studies that follow.

3.1. Overview of project pipeline case studies and key messages

This chapter explores approaches taken by governments and public institutions to build robust project pipelines that align infrastructure investment to long-term climate objectives. Each case study examines project pipeline development and practices in a particular country or region: notably Colombia, the European Union, the Netherlands, the United Kingdom and Viet Nam. In addition, each case study focuses on one of the six factors identified in Chapter 2 as important to developing project pipelines: leadership, transparent approaches, prioritisation mechanisms, project support, eligibility criteria[1] and dynamic adaptability. In each country- or regional-specific example, the chosen factor for each country or region plays a central role in the development of project pipelines.

3.1.1. Scope of case studies

The case studies each follow a similar structure, exploring the various attributes and important applications of a specific factor in the context of efforts to build robust project pipelines. By looking at specific elements of and particularly noteworthy pipeline developments in the country or region in question, the case studies could provide models for other countries to consider or adapt for their pipeline development programmes.

Each case study examines the institutions involved, their roles and initial results or successes (if applicable), using the following questions to frame each case study: what is the project pipeline factor chosen in this case study and why? What is the context in which the factor is employed? Why is the factor important for developing robust project pipelines (in the specific case)? Who is involved, what role did they have to ensure the successful application of the project pipeline factor? What should governments consider before replicating this approach elsewhere?

Key messages are provided in the introduction of each case study and each case concludes with outstanding research questions that could help determine the effectiveness or performance of such factors. The chapter is structured as follows:

- **Leadership** to champion infrastructure investments and mobilise finance in Colombia (section 3.2)
- **Transparent approaches** to plan infrastructure investment and disseminate lessons in clean urban transport in Viet Nam (section 3.3)
- **Prioritisation** mechanisms to identify and fast-track valuable or important projects in European Union countries (section 3.4)
- **Project and institutional support** to overcome key investment barriers for large-scale clean energy technology in the United Kingdom (section 3.5)
- **Dynamic and adaptable** infrastructure planning and investment to ensure water infrastructure is adequate and sufficient to meet changing conditions and requirements in the Netherlands and the United Kingdom (section 3.7).

3.1.2. Case study diversity

The case studies cover a range of geographies, sectors and institutions in sub-national, national and regional contexts. For instance, OECD countries in Europe (the Netherlands, the United Kingdom and the European Union as a whole) and emerging countries in Latin America and South East Asia (Colombia and cities in Viet Nam). Likewise, the sectoral

coverage includes clean urban transport systems (in cities), large-scale clean energy technologies (countries), network infrastructure (regional) and financing water infrastructure (countries) – as shown in Table 3.1. In addition, each case study section also includes additional examples to illustrate how specific pipeline factors (e.g. leadership) are applied in other country settings (e.g. in Argentina). These additional examples can be found in boxes towards the end of each case study, and total 16 countries, regions and institutions.

Table 3.1. Overview of project pipeline case studies

Project pipeline factor	Factor description	Geography	Key institution	Sector
Leadership (section 3.2, Chapter 3)	Governments and other agencies championing the development of a robust project pipeline	Colombia	Inter-Sectorial Commission on Climate Change (CICC) and its co-chair, the National Planning Department (DNP)	Economy-wide
Transparency (section 3.3, Chapter 3)	Transparent decision making processes that inform investment	Viet Nam	Climate Investment Funds; sub-national government entities; Asian Development Bank	Clean, sustainable urban transportation
Prioritisation (section 3.4, Chapter 3)	Expediting, optimising strategically valuable projects and shepherding them through development processes	European Union cross-border Projects of Common Interest	European Commission, European Investment Bank; Innovation and Networks Executive Agency	Network infrastructure and low-carbon projects as part of the Investment Plan for Europe
Project Support (section 3.5, Chapter 3)	Provision of public funds and institutional support to overcome investment barriers	United Kingdom	United Kingdom government, agencies and national bodies	Offshore wind
Eligibility criteria throughout Chapter 3* (noted in section 3.6)	Setting criteria and conditions to systematically identify, assess and promote eligible projects	x	x	x
Dynamic adaptability (section 3.7, Chapter 3)	Flexibility to adjust infrastructure to changing conditions so that investments remain pertinent over time	Netherlands; United Kingdom	Government and government agencies of the Netherlands; United Kingdom National Infrastructure Commission	Water infrastructure planning and financing**

Notes: * Eligibility criteria does not have its own dedicated case study since it plays an important role in each of the other case studies and smaller examples. See the "Note on project eligibility criteria and their importance for building robust project pipelines" in Chapter 3. ** Lessons from this case study are also extremely relevant to infrastructure beyond the water sector, including energy and transport networks.

3.1.3. Key messages by case study

Leadership

Leadership as considered here relates to governments, whether as a whole, or a particular government entity, championing the development of a robust project pipeline. Leadership in the context of pipelines is demonstrated when these government actors possess and use authority to oversee policy actions, co-ordinate and mobilise public and private actors, signal investment needs, devote time and cater to national and international priorities, and

disseminate information. Of all actors relevant to pipelines, national governments are best-placed to lead the development of robust project pipelines; they can allocate resources, promote effective action, highlight opportunities, mediate and negotiate challenges, direct public investment, and be a trusted partner with the private sector.

To meet its climate objectives, the Colombian government established an Inter-Sectorial Commission on Climate Change to oversee the delivery of the national climate strategy, with eight ministries, nine regional co-ordination groups and four thematic technical committees. Central to Colombia's national climate effort is the effective engagement, mobilisation and co-ordination of all relevant actors. Given its role as co-chair of the committee and key executive agency, the National Planning Department is well-placed to direct Colombia's climate action and associated infrastructure investments. Based on the findings presented in the case study, policy makers in other countries could consider how they might apply the following elements of Colombia's leadership factor (i.e. elements of its leadership, communication and co-ordination) to help develop project pipelines aligned to and supportive of long-term climate objectives:

- employ cross-ministerial commissions to lead with authority and delegate where helpful
- provide a single, co-ordinated voice for government action on pipeline development, including the alignment of policies and institutions
- mobilise private sector investors with investment "one-stop shops" to provide information, direction and co-ordination
- avoid cumbersome or complex public institutional arrangements that hinder engagement with project developers and investors.

Transparency

Transparency as considered here relates to having transparent approaches to developing sectoral infrastructure investment plans, sourcing projects, providing targeted funds, and using data management processes that foster investment. The lack of transparency from public actors in these areas is a major barrier to mobilising project developers and investment decision-makers.

The case study looks at how the Climate Investment Funds (CIF) channel donor funds through Multilateral Development Banks to recipient governments and local private sector actors to build clean transport projects in the Vietnamese cities of Hanoi and Ho Chi Minh City. The CIF formed a platform to convene actors, mobilise investment and bolster planning across and among institutions in Viet Nam. Transparent decision-making processes that influence investment were a key ingredient to this platform. Based on the findings from the case study, governments could consider how they might apply the following aspects of the CIF's transparent approaches to develop better project pipelines:

- provide clarity on investment opportunities where appropriate[2] and secure buy-in from and communicate with key actors involved in financing, building or approving infrastructure
- gather and use data and indicators to track and measure progress against policy objectives, assess risks and highlight or identify opportunities
- share experience on how to replicate and scale-up investment successes by engaging public and private actors in the country and elsewhere if appropriate

- standardise infrastructure planning processes, including contract arrangements and legal agreements, to streamline efficient project development.

Prioritisation

Prioritising, expediting or optimising strategically valuable projects[3] – and shepherding them through development processes – constitutes a critical step in building robust pipelines aligned to long-term climate objectives. Developing and implementing low-carbon projects at scales and rates far beyond current levels, including projects involving more than one country, is often hindered by complex institutional arrangements and misaligned regulatory processes.

The European Union manages infrastructure investment gaps by channelling public funds through existing institutions like the European Investment Bank which carry out due diligence, optimise investments, promote strategically important projects and mobilise public and private actors. Facing diverse national infrastructure "starting points" across its 28 member countries, the European Union provides institutional access as well as public guarantees and funds to expedite and prioritise investment in low-carbon technologies and network infrastructure in line with long-term international objectives. Based on the lessons from this case study, governments could consider how they might apply the following aspects of the European Union's prioritisation processes to fast-track the development of strategically-important projects:

- incorporate infrastructure priorities into national (and wider regional) strategic planning, ensuring that such plans are aligned to long-term climate objectives and promote suitable investments
- overcome non-financial barriers by placing prioritisation mechanisms within, rather than separate from or in conflict with, existing regulatory and institutional arrangements
- employ experienced institutions with high capacity and expertise to assess project eligibility, determine strategic value, and bridge investment gaps by allocating funding and other policy tools
- use prioritisation as a means to feed into policy processes and align project pipeline development to changing investment requirements.

Project support

Project support as considered here refers to various elements of the investment enabling environment that affect the risk-return profiles of projects. These include: policy incentives; the supply of public funds and institutional support; the provision of effective and efficient project preparation facilities where needed; and other instruments that foster and sustain markets for high-potential low-carbon technologies.

For projects that are not bankable or investment-ready, securing debt financing and equity investment is typically very challenging, because investors and/or project developers are presented with unacceptable risk-return profiles. Project support is often necessary to ensure project pipelines consist of bankable projects that successfully align to climate objectives and appeal to investors. The United Kingdom government kick-started the offshore wind energy market by establishing dedicated public institutions, policy incentives to target investment barriers, and capacity auctions to signal and indicate future opportunities. Based on this case study, governments could consider the following:

- target high-potential and suitable, but as yet under-developed, low-carbon technologies
- mainstream key project support within national long-term climate strategies
- address specific barriers to lower investment hurdle rates
- align existing institutions to help fill knowledge and funding gaps, and disseminate lessons.

Dynamic adaptability

Dynamic adaptability describes the capacity of governments to keep project pipelines aligned with policy objectives over time, pertinent and relevant in the long-term, and tailored to changing external conditions, and to avoid expensive path dependency or lock-in. Keeping project pipelines pertinent and tailored to objectives over time, as infrastructure stocks and flows evolve, is a fundamental challenge to their robustness.

In the Netherlands, water infrastructure investment is guided by the national government, regional water authorities, and provincial and local municipal planners. Its Delta Programme combines a long-term perspective, an iterative decision-making cycle, and a dedicated fund to guide and implement investments for flood protection. In the United Kingdom, the National Infrastructure Commission was recently established to provide independent, expert advice to the government on infrastructure planning, including for water and flood protection infrastructure. Based on these case studies, governments should consider the following:

- situate project pipelines within, rather than in parallel to, long-term strategic pathways, and medium-term goals like the NDCs, to ensure infrastructure investment remains aligned to long-term policy objectives
- combine long-term strategic infrastructure perspectives with iterative decision making that can be adjusted over time as more information becomes available
- take steps to avoid premature obsolescence of infrastructure, inefficient path dependencies or costly infrastructure retrofits, and consider how short-term actions potentially enable or foreclose future options
- identify actions that promote additional flexibility, and provide opportunities to shift among options depending on evolving trends (economic, climatic, demographic, technological, etc.).

3.2. The importance of leadership for building robust project pipelines: The case of Colombia's Inter-Sectorial Commission on Climate Change

Current long-term, international climate objectives place great emphasis on bottom-up action and country ownership to design, develop and implement national plans to scale up investment in suitable infrastructure. The country pledges, as embodied in the Nationally Determined Contributions (NDCs), ideally necessitate economy-wide transformations but in aggregate, to date, do not place countries on a pathway to meet long-term climate objectives nor do they in all cases provide adequate signals for investors to source investment opportunities.

Serving as the champion of infrastructure development and planning, "leadership" – for the purposes here – is a crucial component of efforts to direct and support project pipeline development. Governments (of all levels, national or otherwise) are best-placed to lead the development of project pipelines that are aligned to long-term climate objectives: they manage resources, convene actors, signal investment needs and direct investment (see Chapter 2). Their leadership, foresight and ability to bring key actors together greatly improves infrastructure planning strategies and can help stimulate investment at the right time and place. By championing overall investment processes,[4] national governments, or individual ministries and other public agencies with the authority to act, provide a central voice on project pipeline development. They also serve as the central point of contact on pipeline development, and ensure a strong interface between policy actions and institutions on the one side, and the private sector on the other (such as project developers, investors and supply chain actors).

To meet the demands posed by its NDC and longer-term climate strategies, the government of Colombia has taken efforts to establish a body for planning and governance processes. One element of this effort, and the focus of this case study, is the establishment of the Inter-Sectorial Commission on Climate Change (Comisión Intersectorial de Cambio Climático, CICC) to sit within and lead the national climate policy system. The CICC has oversight and responsibility to deliver the *National Policy on Climate Change* of Colombia. It organises and coordinates efforts from eight (of the sixteen) ministries with NDC responsibilities, nine regional groups and four thematic committees. Crucially, the CICC acts with collective authority to assess needs, set national policy and oversee institutional actions.

Leadership case study summary box

What is it? Leadership is about championing the development of a robust project pipeline and using authority to oversee policy actions, co-ordinate and mobilise public and private actors, signal investment needs, devote time and cater to national and international priorities, disseminate information.

Why is it essential to building robust project pipelines? Governments are best-placed to lead the development of robust project pipelines: they can allocate resources, promote effective action, promote opportunities, mediate and negotiate challenges, direct public investment and be a trusted partner with the private sector.

Who is involved? To meet its climate objectives, the Colombian government established a committee to sit within and oversee the delivery of the national climate system, with authority from eight ministries, nine regional co-ordination groups and four thematic committees.

Key messages and actions for governments to consider on leadership

- employ cross-ministerial commissions to lead with authority and delegate where helpful
- provide a single, co-ordinated voice for government action on pipeline development, including the alignment of policies and institutions
- mobilise private sector investors with investment "one-stop shops" to provide information, direction and co-ordination
- avoid cumbersome or complex public institutional arrangements that hinder engagement with project developers and investors.

3.2.1. Case study context

Colombia is a low-emitting country, responsible for only 0.36% of global emissions and one of the lowest per capita emissions in the world (Carbon Trust, 2018[1]).[5] Around 70% of Colombia's electricity is generated by hydro-electric power stations. However, the country's diverse geography and dependence on natural resources renders it vulnerable to climate change. For instance, the La Niña phenomenon in 2010 resulted in asset loses of USD 6 billion in the country (IDB and ECLAC, 2012, p. 59[2]; OECD, 2014[3]). The OECD *Environmental Performance Review of Colombia* estimates significant potential economic, environmental and social costs resulting from climate change (OECD/ECLAC, 2014[4]).

Since 2010, Colombia has enacted laws and developed policies to respond to climate change. For instance, it has put in place the Colombian Low Carbon Development Strategy, the National Climate Change Policy and the National Development Plan (2014–18), which includes a Green Growth Strategy. It also created the Inter-Sectorial Commission on Climate Change to implement and coordinate climate change efforts at the national and regional level (Lütkehermöller et al., 2018 forthcoming[5]). Its NDC sets an unconditional goal to reduce emissions by 20%, compared to the "business-as-usual" scenario, by 2030, and an associated conditional goal of a 30% emissions reduction, contingent on commensurate international support. The adaptation component of the NDC reflects the 2011 National Action Plan for Climate Change and formulates 10

priority actions, including integrating climate change resilience in infrastructure projects of national and strategic interest.

Financing sustainable growth in Colombia

Colombia's National Development Plan provides the overarching framework to identify sectorial and investment priorities. Since 2006, these plans have included strategies and institutional arrangements to further climate goals (Jaramillo, 2014[6]). For instance the 2014–18 National Development Plan outlines three broad policy objectives and six transversal strategies, including developing strategic and competitive infrastructure and focusing on green growth, to achieve them. The National Development Plan further formulates the National Investment Plan (NIP) 2015–18 to articulate priority themes under each strategic focus and their intended sources of funding (Government of Colombia, 2015[7]; Progreso, 2015[8]).

The climate finance landscape in Colombia involves an array of actors, both domestic and international. The NIP 2015–18 allocates USD 9.5 billion to green growth across three priority areas and envisages financing from both the public and the private sector. The national budget follows the agenda of the plan and channels funds to the ministries, which in turn direct investment in mitigation and adaptation activities for certain pre-identified key sectors (Jaramillo, 2014[6]).

Driven by strong economic growth, public expenditure increased six-fold in the period 2000–15 and is expected to increase almost 20% until 2019 (DNP, 2018[9]). Despite this growth, Colombia is looking for ways to increase private sector investment to meet its infrastructure needs including a Public-Private Partnership (PPP) Regulatory Framework (DNP, 2018[9]) to help foster private investment across its economy including a system to promote both publicly- and privately-sourced projects and those projects of national and strategic interest (see Box 3.2).

The infrastructure plan and other related policy measures provide a robust foundation for Colombia's climate change efforts. Aligned with its policy framework, Colombia, in association with the Inter-American Development Bank, launched *Colombia Sostenible*, a multi-year umbrella initiative to consolidate the many internationally funded climate change and sustainability programmes operating in the country. The initiative focuses on rural development, environmental sustainability, and climate change in post-conflict areas. It comprises a fund, with a 15-year horizon, to leverage private capital and finance projects (APC-Colombia and IDB, 2015[10]).

3.2.2. Focus on leadership factor

Leadership of Colombia's long-term climate objectives and championing the development of a robust project pipeline

As introduced in Chapter 2, governments can employ and act through a project pipeline interface where they, *inter alia*, communicate intent, convene actors and allocate responsibilities. A lack of leadership is a key challenge in developing good investment frameworks (OECD, 2017, p. 11[11]) that, in turn, have a significant impact on the development of robust project pipelines. Conversely, strong leadership is an essential ingredient to ensure the interface between policy setting and investors is efficient and effective.

Inadequate infrastructure investment is a significant barrier to Colombia's growth and development.[6] A prominent area of investigation has thus been to bolster infrastructure investment in Colombia (OECD, 2012[12]) and the national climate finance architecture (Jaramillo, 2014[6]). Improving the leadership of and co-ordination between national and regional actors has been essential to this effort. A recent OECD review of public investment in Colombia, for instance, recommended that Colombia enhance its investment effectiveness by improving co-ordination across levels of government and strengthening subnational capacities (OECD, 2016[13]). This is particularly evident with new efforts to determine investment needs and mobilise private sources of finance towards infrastructure.[7]

The Inter-American Development Bank (and Climate Investment Funds) identified several leading causes that are driving investment needs in Colombia (CIF, 2017[14]), namely: rapid growth in energy demand, high dependence on hydroelectric power and associated vulnerabilities, and increases in future fossil fuel investments. These factors result from Colombia's solid economic growth since 2000 at around 4.2% per year which, following a short period of slow growth in recent years, is expected to pick up again by 2020 (CIF, 2017[14]). As a result, energy demand is expected to grow by almost 3% per year in the period 2015–29.[8]

To sustain this level of economic growth and meet energy demand, the Colombian government will need to foster infrastructure investments from the private sector.[9] Until now, infrastructure has been almost entirely funded from public budgets, particularly state-owned enterprises in the energy sector. In the period 2011–16, for instance, annual investment related to climate (both mitigation and adaptation) in Colombia amounted to approximately USD 600 million, with 80% from public sources. Going forward, the executive administrative agency in charge of national policy strategies and planning, the National Planning Department (Departamento Nacional de Planeación, DNP), suggests that, to meet mitigation objectives contained in Colombia's NDC, USD 1 billion is needed per year until 2030,[10] of which just over 60% will need to come from private sources.

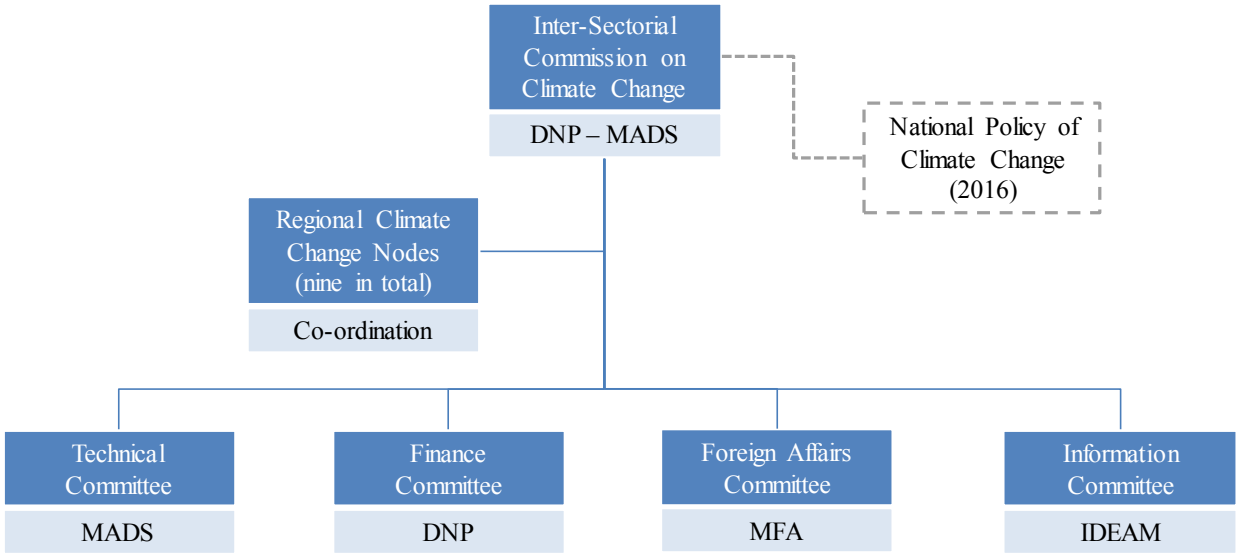
Colombia's rapidly changing macro-economic situation, its emission reduction ambitions as well as the expected shift in investment sourcing from (almost entirely) public to largely private, are challenges for which the government sees a strong need to co-ordinate and align actors. The last ten years have seen Colombia build a comprehensive institutional and policy framework to deliver its economic and social policy developments and investment objectives (see Box 3.1 for a brief overview of this process).

This whole-of-government approach mobilises key actors and places climate and sustainable development at the centre of its efforts, mitigating emissions through renewable energy and deforestation measures, as well as building climate-resilient infrastructure. The National Climate Change System (SISCLIMA) was established in 2016 to house the delivery of the *National Policy on Climate Change*. (The SISCLIMA structure, with its links to ministries, regional nodes and technical committees, is shown in Figure 3.1.) While the institutions involved in SISCLIMA also play a key role in co-ordinating the country's NDC efforts and promoting national and regional climate action, the CICC is of central importance, and is the focus of the rest of this case study.

To help improve the alignment of top-down leadership and planning to bottom-up action, Colombia's institutional efforts build on "an extensive preparatory phase and analysis of [climate] mitigation potentials" as explained in a forthcoming study commissioned by the German Environment Agency (Lütkehermöller et al., 2018 forthcoming[5]). The study

also suggests that the improved alignment of national actors could be a crucial ingredient to help Colombia overachieve its NDC.[11]

Figure 3.1. Illustrative overview of Colombia's National Climate Change System (SISCLIMA) and the Inter-Sectorial Commission on Climate Change



Note: See text for details. DNP: National Planning Department; MADS: Ministry of the Environment and Sustainable Development; MFA: Ministry of Foreign Affairs; IDEAM: National Institute of Hydrology, Meteorology and Environmental Studies.

Source: Adapted from (Rodríguez Vargas and Lopez Arbelaez, 2017[15]).

Box 3.1. Colombia's national climate strategy: Key institutions and milestones

A forthcoming study commissioned by the German Environment Agency (Lütkehermöller et al., 2018 forthcoming[5]) suggests the route taken by Colombia to develop its national climate strategy (and subsequent development of the Nationally Determined Contribution) has been the result of significant efforts to promote policy integration and coherence from the top levels of government that have been "consistently strengthened" over the years.

The President of Colombia is empowered to provide direction to the development of climate policy* via the National Economic and Social Policy Council (CONPES), the key institution charged with ensuring coherence among policies (OECD, 2012[12]), and its executive secretariat, the National Planning Department (DNP).

In 2011, the DNP, with the Ministry for Environment and Sustainable Development (MADS), were put in charge of managing national climate action. In 2013, CONPES issued guidelines for the development and implementation of projects of "national strategic interest" (see Box 3.2 for more information on these projects).

In doing so, CONPES identified a cumbersome authorisation process, lack of procedural clarity, and the absence of institutional coordination and management as key hindrances to executing projects. It acknowledged the benefit of a single body for overseeing the planning and design process, fostering a dialogue with the private sector, and communicating investment opportunities.

Later, in 2016, the National Climate Change System (SISCLIMA) was established to house the delivery of Colombia's national climate policies and actions among other objectives as covered by Jaramillo (2014[6]): to interlink the fragmented initiatives on climate across the country, to mainstream climate beyond environmental institutions and reach all sectors, and to increase and improve information on and understanding of climate change impacts in Colombia.

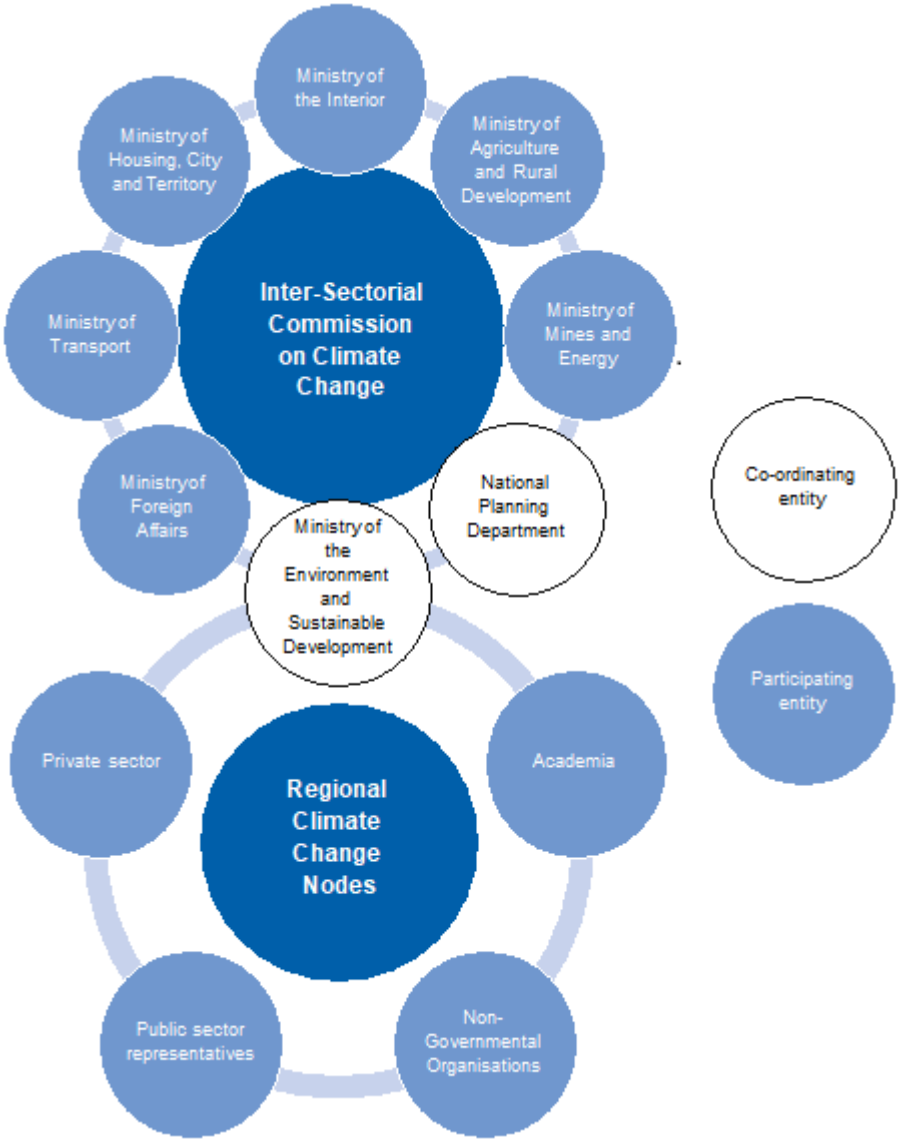
The SISCLIMA commission approved the *National Policy on Climate Change* in 2017 to integrate the mitigation and adaptation strategies and mainstream climate change into territorial and sectoral planning processes (Lütkehermöller et al., 2018 forthcoming[5]).

* President Juan Manuel Santos (in office until August 2018) is reportedly "committed to reducing GHG emissions and preserving biodiversity" (Lütkehermöller et al., 2018 forthcoming, p. 22[5]).

What are the elements of Colombia's leadership to champion and develop a robust project pipeline?

Central to Colombia's national climate effort is the effective engagement, mobilisation and co-ordination of all relevant actors. Based on the existing co-operation between the National Planning Department (DNP) and the Ministry for Environment and Sustainable Development (MADS), the Inter-Sectorial Commission on Climate Change (CICC) is a crucial link between the government's national climate policy to national and sub-national action. The CICC is comprised of ministries and ultimately acts as the SISCLIMA governing body to push for better co-ordination across these ministries. Figure 3.2 illustrates the CICC structure.

Figure 3.2. Illustrative overview of the Inter-Sectorial Commission on Climate Change



Note: See text for details.
Source: Adapted from (Lütkehermöller et al., 2018 forthcoming[5]).

The inclusion in SISCLIMA of various regional nodes, technical committees and local actors enables the CICC to engage not only relevant national institutions, but also regional and local actors. Indeed, the CICC's wide-ranging influence on Colombia's national climate strategy and action across government is a useful structure on which to review leadership and its links to better project pipelines. The following will be discussed in turn:

- co-ordinating and championing climate action
- unifying and delegating investment activities
- mobilising investments and providing access to institutions.

Co-ordinating and championing climate action. According to Gornitzka and Pipa (2018[16]), government leadership depends on the "ability to strengthen [the government's] own internal integration and policy coherence among different levels of government … guiding but not dominating, embracing new ideas, and challenging and complementing existing structures". As described above, leadership of Colombia's climate objectives has evolved over many years and across all levels of government.

At the centre of SISCLIMA, the CICC aligns various ministries and draws on their respective responsibilities and authorities to direct resources as needed. By doing so, the CICC is in a position to address some major institutional misalignments that had been identified in the country; for instance, the 2012 OECD *Investment Policy Review of Colombia* pointed out in 2012 that minimal inter-ministerial co-operation was a potential barrier to scaling up green investment and attracting investors (OECD, 2012, p. 124[12]). A study of the Colombian climate finance landscape also explained that a key benefit of the SISCLIMA strategy is to bring together actors working on climate in the country when, before, they were "spread widely with few inter-linkages" (Jaramillo, 2014[6]). The study continues to suggest that "strong leadership and collaborative work by the DNP, MADS and MFA [Ministry of Foreign Affairs] have helped [to build] ownership inside the government."

Importantly in this case, the CICC was crafted to take account of the various actors involved in implementing climate policy and act as the focal point for their collective strengths and abilities. The CICC has since developed an extensive knowledge base on what investment is needed and where (Lütkehermöller et al., 2018 forthcoming[5]). It benefited from, for instance, existing work of the National Planning Department and its regularly updated four-year country investment plans, and the significant experience of the Ministry of Foreign Affairs to manage international climate finance and technical support (Jaramillo, 2014[6]).

Unifying and delegating investment activities. The CICC has formalised interactions with subnational stakeholders that are important to the SISCLIMA architecture. By pulling together regional efforts from three groups, the CICC can take advantage of local knowledge and bring together valuable skills that ultimately improve the effectiveness of its implementation and planning.

- **First, the CICC engages in regional activities through the Regional Climate Change Nodes** (*Nodos Regionales de Cambio Climático*, NRCC), and ensures integration of mitigation and adaptation into investment decisions throughout the country. The Ministry for Environment and Sustainable Development (MADS) also participates with NRCC processes to develop better coherence in national, sectoral and regional NDC implementation.
- **Second, the CICC-NRCC fosters relationships with a range of non-state actors that can play a key role in delivering global and national climate action**.[12] Here, the CICC (with MADS and the NRCC acting as intermediaries) engages and consults with private sector actors (like business and investors), academics and researchers, as well as non-governmental organisations and civil society.
- **Third, the CICC links to four technical committees**, which act as sources of knowledge and advisory hubs. These technical committees sit alongside the CICC in order to help shape and implement the SISCLIMA and provide additional intelligence and technical capacities.

Of particular interest here are the technical committees – as shown in Figure 3.1. Each of the committees are chaired by a different ministry with specific expertise: the MADS chairs the Technical Committee; the DNP chairs the Finance Committee; the Ministry of Foreign Affairs chairs the Foreign Affairs Committee; the National Institute of Hydrology, Meteorology and Environmental Studies chairs the Information Committee. The committees have the ability to provide detailed and specialised knowledge on sectoral and regional processes, convene and direct technical working groups, and co-ordinate international activities (Jaramillo, 2014[6]).

The DNP-led Finance Committee, for instance, played an active role in the initial development of SISCLIMA and continues to co-ordinate financing and investment activities.[13] By linking to other areas of government such as the Treasury and working with the private sector, the Finance Committee identifies national and international sources of finance (Jaramillo, 2014[6]). The Finance Committee also links to the DNP's investment planning process to understand what is available domestically and what needs to be sourced elsewhere, and will ultimately feed into the development of a project pipeline. The Public-Private Partnership Regulatory Framework is expected to help bolster private sector investment in infrastructure and develop a pipeline of projects of national interest (see Box 3.2 for a discussion of the Colombian projects of national strategic interest). In 2017, the committee enacted the National Climate Finance Strategy as a tool to comply with the NDC target including the alignment of existing investment pipelines with the NDC (DNP, 2018[17]).

Box 3.2. Colombian projects of national and strategic interest

The Colombian Projects of National Strategic Interest (*Proyectos Estratégicos de Interés Nacional*, PINES) are developed in accordance with the wider objectives of the National Development Plans and the Public-Private Partnerships Regulatory Framework (see DNP (2018[9]) for more information). They focus on key sectors of national importance: transport, energy, mining and hydrocarbon sectors. Projects are proposed either by the public or private sector and assessed by relevant ministries against sectoral priorities.

Ministries forward the most appropriate proposals to the *Inter-Sectorial Commission on Infrastructure and Strategic Projects*, which evaluates and delivers a pipeline of national strategic projects. The commission is chaired by the Minister of Transport and composed of the Ministers of Interior, Finance and Public Credit, Mines and Energy, and Environment and Sustainable Development. The National Planning Department forms the technical secretariat. The commission acts as a national manager and is assisted by technical committees to analyse environmental and other aspects of the projects proposed.*

See also section 3.4 on the European Projects of Common Interest.

* Documento Conpes 3762 de 2013. *Lineamientos de política para el desarrollo de proyectos de interés nacional y estratégicos* – PINES (link).

Mobilising investments and providing access to institutions. Colombia needs to sustain public investment efforts to respond to huge infrastructure gaps and continue to attract private sector investment (OECD, 2016[13]). In addition, the DNP estimates that, to deliver the NDC objectives, the government needs to mobilise USD 1 billion per year in

total until 2030 with the private sector funding 60% (USD 600 million), up from 20% (USD 125 million) in the period 2011–16. This suggests a need for government to foster and sustain more low-carbon infrastructure investment from private sources to 2030.

Acting through SISCLIMA, the CICC can engage directly with and encourage the private sector to invest. Through its technical committees, regional bodies and –importantly – direct links to ministries, the CICC can highlight investment opportunities and gaps and work across the country to deliver policy tools and incentives. In addition to the CICC's key role in the government's interface to engage the private sector, it can improve the dissemination of good practices from one region that may benefit another by incorporating regional and local planning processes and public consultations. Furthermore, the CICC has a strong link to the *National Policy on Climate Change*, meaning it can help to identify what areas of the institutional framework are working and which ones need support.

Colombia also benefits from public institutions like the Inter-American Development Bank (IDB) which have a long history of working in the country and mobilising private finance.[14] In 2009, for instance, the IDB provided a policy loan of USD 250 million to the government in support of the development of its climate change policy and to bolster national capacities (Jaramillo, 2014[6]). Two of Colombia's four national development banks, Bancoldex and Findeter, have also integrated mitigation and adaptation measures into support initiatives to help foster investment in these areas (Jaramillo, 2014[6]).[15]

3.2.3. Summary: What can governments do to lead and champion the development of robust project pipelines?

The preceding discussion described the evolution of Colombia's National Climate Change System (SISCLIMA), with key leadership provided by the CICC. Over several years, Colombia worked to mobilise actors across the country, align capabilities in key ministries and institutions, and mainstream climate within national and regional policy objectives. The ability of the CICC to champion processes and link to all levels of government is central to Colombia's national climate strategy and ultimately improves investment in projects to support the delivery of its climate objectives.

The CICC provides links to technical committees and regional "nodes" which, in turn, engage local actors including the private sector. Of particular importance to this case study is the DNP, which is well-placed to direct Colombia's climate action and associated infrastructure investments. In addition to its roles as a key executive government agency and CICC joint co-ordinator, the DNP aligns institutions and policy in two ways: first, it acts as executive secretariat of the National Economic and Social Policy Council, the key institution charged with ensuring coherence among policies and institutions; and second, it has the technical capability to assess country investment and infrastructure needs (such as through the National Development Plan processes, which is an essential step for implementing the country's National Determined Contribution).

Championing the development of a project pipeline in support of long-term climate objectives requires interaction and co-operation among a wide variety of institutions, each with different priorities and interests. Colombia has built its national climate strategy around key institutions with the authority and knowledge to plan investment and mobilise finance. Key elements are summarised in Table 3.2.

Table 3.2. Overview of leadership elements and application in Colombia

Element of leadership	Application in this case study
Delegating responsibilities	Mobilising key institutions to lead with authority and accountability
Improving coherence	Establishing national strategies, commissions and technical committees to bring together various public bodies such as national development banks and others including local non-state actors
Linking national to regional action	Engaging subnational and local stakeholders and fostering public and private partnerships
Mainstreaming climate into government planning processes	Aligning policies to climate objectives and identifying mitigation and adaptation needs across the country
Transparency and improving access to information	Building on existing national infrastructure planning efforts to consolidate and host information

Table 3.2 shows the potential benefits of better leadership in driving national infrastructure strategy to support climate objectives and build robust project pipelines. Colombia's national infrastructure architecture is the result of several years of strengthening institutions and their respective responsibilities, focusing on climate as a key barrier to economic development, and taking a systematic approach to align thinking and co-ordinate actors. It offers better coherence and, importantly, provides a key link from policy making at the top of government to subnational and local action, the project pipeline interface as introduced in Chapter 2. As such, better leadership is a critical element in directing and developing robust project pipelines beyond the Colombian case study presented here (see Box 3.3 for other examples on leadership in developing project pipelines). Indeed, using the Colombian case study as an example of potential leadership good practice, the following considerations could be explored in more detail:

- *How can the effectiveness of leadership approaches be determined?* As described above, Colombia orients its climate leadership into a central commission that brings together eight ministries and executive agencies, with technical committees and regional nodes to provide expert advice and connections to subnational activities. More research is needed to determine the effectiveness of various leadership "options" available to governments (e.g. top-down, comprehensive and unified approaches; bottom-up or local approaches; more flexible or less cumbersome alternatives). In addition, there is a need to weigh the relative importance of tools that can champion better project pipelines. For example, so-called "one-stop shops" can provide a useful and simple approach to link the government's project pipeline interface (e.g. policy levers, investment needs) and local activities (e.g. investors or project developers) (see also Box 3.3 and section 3.5).
- *How can the government achieve buy-in from and manage potential conflicts in a diverse set of actors?* Jaramillo (2014[6]) noted that, in Colombia, potential institutional conflict was a major barrier to effective climate action. The government was aware of these challenges and so targeted "inter-ministerial co-operation and dialogue" to build a "national vision" and mainstream the climate issue across a wider government agenda. More work will be needed to better understand the assessment and management of conflicts in building robust project pipelines, specifically when such processes involve many diverse public (and private) institutions.
- *How to ensure that leadership is accountable?* The National Planning Department is well-placed to support Colombia's national climate policy with its links to the

executive levels of government and experience assessing investment needs. National climate strategies bring together ministries with various priorities and authorities, and so accountability on these topics is often not clear. As discussed in section 3.5, the United Kingdom's Committee on Climate Change is independent from government and can, for instance, hold the government and its agencies accountable to meeting the carbon budgets implied in the national Climate Change Act. Such an approach may be important to ensure the accountability of project pipelines champions.

Box 3.3. Examples of leadership in infrastructure project pipelines

Indonesia

To expedite deployment and clear bureaucratic bottlenecks in infrastructure development, Indonesia established the Committee for Acceleration of Priority Infrastructure Delivery (KPPIP) in 2014. The KPPIP is an inter-ministerial body mandated to co-ordinate infrastructure planning by identifying and prioritising the most beneficial projects. As the focal point in the infrastructure development and decision making process, the KPPIP delivers and monitors a pipeline of **national strategic projects** and a pipeline of **priority projects**, both geared to further the objectives of the Long-term National Development Plan, 2005–25 and the Masterplan for Acceleration and Expansion of Indonesia's Economic Development, 2011–25. The KPPIP evaluates the feasibility study, assesses the prospective projects according to its criteria and guidelines and determines the source of funding. Projects that are relatively urgent and need to be realised in the short term are designated nationally strategic and fast-tracked.

Source: *https://kppip.go.id/en/about-kppip/*

Philippines

To facilitate the implementation of public-private partnership projects, the Philippines established the **Public Private Partnership Centre** (PPP Centre) as the central coordinating and monitoring agency for all PPP projects in the country. The PPP Centre is tasked with *inter alia* administering the project pipeline, providing technical assistance, advisory services, policy development and managing the Project Development and Monitoring Facility (PDMF) – a revolving facility to finance pre-feasibility and feasibility studies and preparation of tender documents. Projects are identified and prioritised by the various government departments before submission to the PDMF. Once the project structure is vetted and finalised by the PDMF, it undergoes an approval process by the PPP Centre and other relevant authorities including the National Economic and Development Authority, before being included in the pipeline.

Source: *https://ppp.gov.ph/?page_id=8*

Argentina

In 2016, Argentina established the **National Climate Change Cabinet** (NCCC) to articulate climate change policies across all functions of the government. The NCCC brings together 17 ministries, in a parallel cabinet, to engage across 8 thematic tables including finance, energy, transport and adaptation. As a focal point for inter-ministerial dialogue, the NCCC provides an integrated platform to co-ordinate Argentina's strategy and response to climate change and identify synergies. Its core functions include designing sectoral plans for mitigation and adaptation, enhancing public awareness of relevant issues, and facilitating engagement of stakeholders at both the national and sub-national level to align incentives and achieve a wider buy-in.

Sources: http://unfccc.int/files/focus/application/pdf/argentina_webinar2.pdf [PDF]; https://www.greenclimate.fund/documents/20182/466992/Readiness_proposals_-_Argentina___Fundaci_n_Avina___Strategic_Framework.pdf/221b84a2-ebe9-4962-b910-ca6b0b6cf51a, https://unfccc.int/files/adaptation/application/pdf/argentina_nap_experience.pdf [PDF].

3.3. The importance of transparency for building robust project pipelines: The case of the Climate Investment Funds in Hanoi and Ho Chi Minh City in Viet Nam

Transparency – specifically transparent decision-making processes that influence investment – offers many benefits to developing robust infrastructure project pipelines. Within government, for instance, it can help limit inefficient coordination of investment and improve coherence across and between investment actors. Governments can also make better use of communication channels with investment actors to highlight available investment needs (and opportunities), foster competitive and fair approaches for project sourcing and procurement, or help identify where to focus technical assistance and capacity building. Transparent processes also allow for better data – its availability, management and, ultimately, analysis – including the measurement of progress made against climate and other objectives including economic growth and development. Finally, transparent processes can enhance government's efforts to engage with and gain public acceptance for actions in support of low-carbon infrastructure.

Transparent processes are of course helpful at all levels of government (supranational, national and subnational). For instance, the effective operation of cities – facilitated by transparent processes – is fundamental to almost all countries. Cities host more than half of the world's population, use more than 70% of the world's energy and emit around the same share of global greenhouse gases,[16] and contribute the vast majority of global economic flows, e.g. 85% of global gross domestic product (GDP) was generated in cities in 2015 (Gouldson et al., 2015[18]).[17]

The value of more transparent investment processes in cities and urban infrastructure is clear; they represent an essential meeting point between public actors, private institutions and millions of individuals. The way cities and urban areas are designed – and how investment is planned within them – can therefore have significant consequences on those who live, work and move within them. Improving transparency here can greatly benefit the effectiveness of meeting national and subnational climate objectives and of mobilising investment to where it is needed.

Transparency case study summary box

What is it? Transparent approaches to developing sectoral infrastructure investment plans, sourcing projects, providing targeted funds, convening and mobilising actors.

Why is it essential to building robust project pipelines? Lack of transparency by public actors and investment decision makers is a major barrier to mobilising private investment.

Who is involved? The Climate Investment Funds channel donor funds through Multilateral Development Banks to recipient governments and private sector actors, mobilising local actors to build low-carbon projects, providing technology and managing assets.

Key messages and actions for governments to consider on transparency

- provide clarity on investment opportunities where appropriate[18] and secure buy-in from and communicate with key actors involved in financing, building or approving infrastructure
- gather and use data and indicators to track and measure progress against policy objectives, assess risks and highlight or identify opportunities
- share experience on how to replicate and scale-up investment successes by engaging public and private actors in the country and elsewhere if appropriate
- standardise infrastructure planning processes, including contract arrangements and legal agreements, to streamline efficient project development.

3.3.1. Case study context

Since 1990 Viet Nam has experienced an almost four-fold increase in its total greenhouse gas (GHG) emissions excluding land-use change.[19] Its cities account for 70% of the CO_2 emissions and suffer from high levels of pollution (OECD, 2018[19]).[20] While Viet Nam has seen rapid development in the past two decades, it remains one of the countries most vulnerable to climate change (Vieweg et al., 2017[20]). Viet Nam's emissions intensity of GDP is much higher than that of OECD countries, and continue to rise (OECD, 2018[19]).

The government of Viet Nam devised its National Climate Change Strategy in 2011 to set long-term goals and direction of sustainable growth. Its NDC provides comprehensive mitigation and adaptation targets: on mitigation, for instance, Viet Nam unconditionally aims to increase its forest cover to 45% and reduce national emissions by 8% across energy, agriculture, land use, land-use change, and forestry, and waste sectors by 2030 compared to 2010 levels. This emissions reduction target can be scaled up to as high as 25% if commensurate international support, such as finance and technical assistance, is received. To address adaptation needs, the NDC outlines three broad objectives: 1) respond pro-actively to disasters and improve climate monitoring; 2) ensure social security; and 3) respond to sea-level rise and urban inundation.

The need to improve transparency in infrastructure planning

Infrastructure development and investment is an integral component of Viet Nam's climate strategy. However, the United Nations Economic and Social Commission for Asia Pacific (ESCAP) estimates that there is a USD 12 billion annual financing gap in

Viet Nam's infrastructure spending. UN ESCAP suggests that one possible option is to leverage domestic and international capital markets in order to alleviate limited government budget and Official Development Assistance (UN ESCAP, 2017[21]). To attract international capital, UN ESCAP recommends, *inter alia*, streamlining project delivery and creating a pipeline of bankable projects. However, it also recognises that important institutional reforms addressing governance and transparency, in particular, remain a vital prerequisite to this objective (UN ESCAP, 2017[21]).

Viet Nam's Socio-Economic Development Plan for 2016–20 acknowledges the need for greater transparency, stability and fairness to encourage businesses to invest in infrastructure projects (Socialist Republic of Vietnam, 2016[22]). Studies attribute the insufficient pace of infrastructure development, particularly renewable energy projects, to *inter-alia* unclear and poorly communicated procedures and opportunities for investors, complex and cumbersome processes for developers to start and operate projects,[21] and lack of transparency regarding project approvals (ADB, 2012[23]). While the OECD *Investment Policy Review of Viet Nam* (OECD, 2018 forthcoming[24]) illustrates a range of measures undertaken by the Vietnamese government to address the lack of transparency, these include efforts to develop clearer investment planning and project pipelines.

Enhancing transparency to unlock investment: Interventions by the Climate Investment Funds

The Clean Technology Fund (CTF) country investment plan of the CIF, in Viet Nam, is a good example of how a transparent planning and prioritisation process can engage stakeholders and mobilise finance. Working with the government of Viet Nam, the CIF channels USD 184 million into six different CTF programmes totalling investment of approximately USD 1.3 billion. The revised investment plan from 2013 identifies three strategic areas in which they intervene and corresponding goals (CIF, 2013[25]): 1) to improve energy efficiency in the electricity grid and heavy industries (through public sector investments); 2) to accelerate clean energy financing initiatives (through private sector investments using intermediaries); and 3) to expand access to low-carbon urban transport infrastructure and mobility (through public sector investments).

Alongside the CTF, the projects receive around USD 1.1 billion from the Asian Development Bank (ADB) and the World Bank Group (International Bank for Reconstruction and Development – IBRD; International Finance Corporation – IFC), the government of Viet Nam and other sources including the private sector (CIF, 2018[26]). The CIF, including the financing plan for the Viet Nam CTF programme, is further explored in Box 3.4.

Box 3.4. The Climate Investment Funds and the Viet Nam Clean Technology Fund

Multilateral climate funds, like the Climate Investment Funds (CIF), manage and disburse donor funds, predominantly from developed countries, and channel these funds to recipient governments, public sector entities like development banks and private sector actors. In most cases, the terms and tenors of these disbursements are dependent on recipient country contexts, such as level of development or risks facing specific projects, national income on a per capita basis, or public debt levels. The CIF makes exclusive use of existing institutions like Multilateral Development Banks (MDBs) to act as implementing entities and disburse the funds. On the one hand, donors expect the funds to be used cost-effectively and that decision making by the fund administrator is clear, justified and openly accessible. On the other hand, the CIF has a responsibility to maximise impact and ensure its interventions benefit clients and other recipients.

There are four programmes under the CIF, each with specific lending criteria and focus, for instance by technology or by country income-level:

1. Clean Technology Fund (CTF) which targets large-scale renewable energy/energy efficiency/clean transport in middle-income countries
2. Pilot Program for Climate Resilience (PPCR), climate resilience
3. Forest Investment Program (FIP), sustainable forestry
4. Scaling up Renewable Energy Program (SREP), energy access in low-income countries.

The focus here is the CTF. The latest financing plan for the Viet Nam CTF is shown in Table 3.3 (CIF, 2018[26]), suggesting the CTF will disburse around USD 184 million with co-financing of USD 1.13 billion. This table includes financing sources for each programme and project under the CTF. Important to note is that, as these projects move closer to implementation, indicative investment figures and project costs first approved in previous Investment Plans (e.g. in 2009, 2011 and 2013) will be subject to change.†

Table 3.3. Overview of Clean Technology Fund Financing Plan in Viet Nam (latest as per CTF website)

	Programmes and Projects (latest as per CTF programme website) (USD millions)						
Financing Source	Distribution Energy Efficiency (IBRD)	Ha Noi Sustainable Urban Transport (project 1) (ADB)	Ha Noi Sustainable Urban Transport (project 2) (ADB)	Mainstreaming Climate Change Mitigation into National Infrastructure (ADB)	Sustainable Energy Finance Programme (IFC)	Sustainable Urban Transport for Ho Chi Minh City (ADB)	TOTAL
CTF	30.00	50.00	48.95*	0.95	3.00	48.95*	183.95
Other co-financing	770.40	335.20**	10.00**	0.03	0.98	16.05	1132.66
TOTAL	800.40	385.20	60.00	0.98	3.98	65.00	1316.61

Notes: See text and source for details. The lead Multilateral Development Bank is provided in brackets. ADB: Asian Development Bank; IBRD: International Bank for Reconstruction and Development; IFC: International Finance Corporation. * Clean Technology Fund figures do not include preparatory grants and Multilateral Development Bank fees of USD 1.05 million each. ** Co-financing figures are different from those provided by the ADB in 2016 as shown in Figure 3.3.
Sources: CIF (2018[26]; 2014[27]).

† Estimates from the 2013 revised Investment Plan (CIF, 2013[25]), for instance, were USD 250 million from the CTF, USD 1 645 million from the Asian Development Bank and the World Bank Group (IBRD/IDA and IFC), USD 975 million from the government of Viet Nam and almost USD 1 500 million from other sources including private sector sourced funding

3.3.2. Focus on transparency factor

Transparent approaches to support low-carbon urban mobility in Viet Nam

Transparency of actions at all levels of government and public agencies, including policy making and the use of public funds, is important to encourage the mobilisation of private finance. Efforts to develop investment plans, identify needs, procure and source projects, channel funds and provide project support all benefit in some way from more transparent and open approaches. Indeed, the lack of transparency in project pipelines is mentioned as a key barrier to investment in 21 of the 30 existing infrastructure investment initiatives globally (as reviewed by Mercer and the Inter-American Development Bank (2016[28])).

Since its inception in 2008, the CIF has played a central role in the international climate finance architecture. The CIF was, for instance, the largest source of external finance to the six MDBs that act as its implementing agencies, providing about 45% of the MDB external concessional climate finance in 2013–14.[22] In addition, it has approved and mobilised more funds more quickly than any other multilateral climate fund, amounting to around 60% of the total finance committed by eight multilateral climate funds in the ten years to 2016 (Trabacchi et al., 2016[29]).

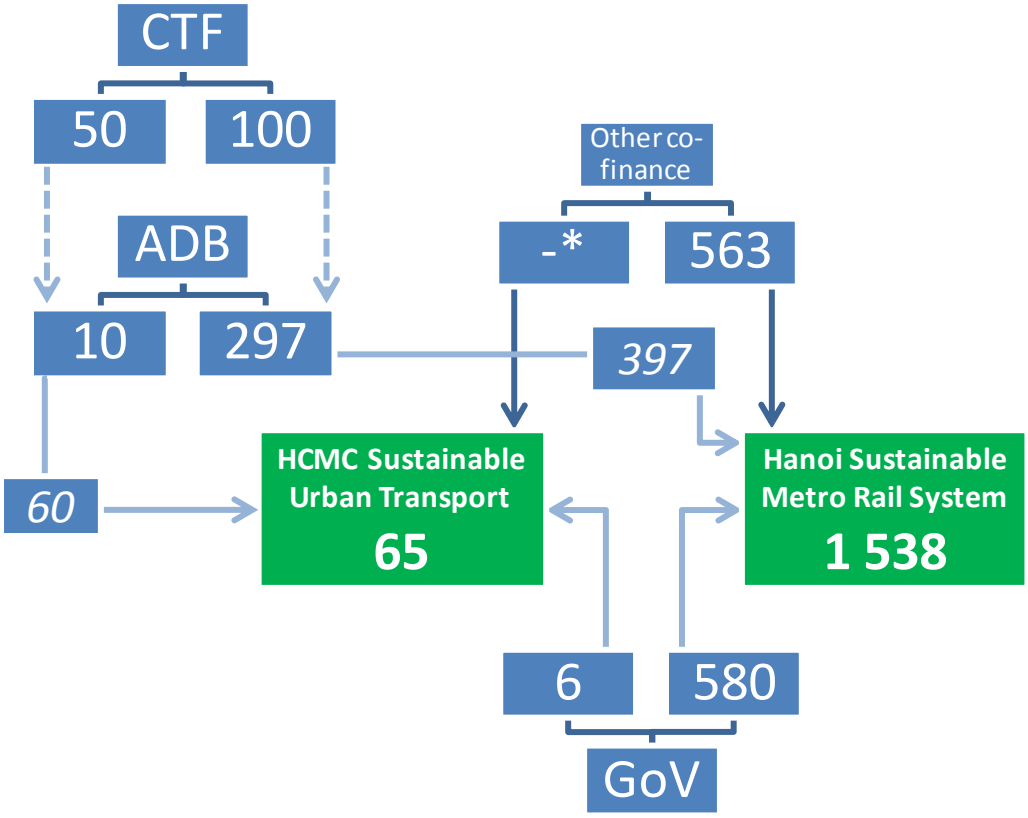
The CIF employs standardised and established documentation processes to work with governments, MDBs and other domestic actors to create and develop country investment plans. The development of these plans allows the CIF to build a detailed understanding of low-carbon infrastructure needs in the recipient country;[23] for instance, they detail the volume of support required and, depending on which CIF fund instrument is used,[24] interventions are targeted to country-, sectoral- or technology-specific needs. The CTF, for instance, supports low-carbon (energy) technologies (such as renewable energy, energy efficiency and sustainable transport) that may be new to the recipient country, are innovative in some way, or have high potential in the recipient country but to date lack scale or face significant investment barriers. Through the CIF consultation process, the CTF offers funding dependent on the client need, with the flexibility to provide grants for a public actor to undertake feasibility studies or private sector lending at concessional[25] rates and tenors.

The country investment plans provide clarity on why funding is needed, where it is needed, current investment barriers and risks, and who will be involved, including if the recipient is a public or private actor. In addition, the CIF Administrative Unit identifies and subsequently tracks co-financing from the involved actors (see below), and also receives project and programme level information from MDBs who channel CIF funds. Recipient governments, MDBs (and other development financial institutions), as well as mobilised private sector finance can all provide project or programme co-financing alongside the CTF.

Of particular interest to this case study are the transparency arrangements related to the Viet Nam CTF country investment plan (in 2009 and revised in 2011 and 2013 (CIF, 2009[30]; CIF, 2011[31]; CIF, 2013[25])) and specifically two of its largest programmes to

support low-carbon transport and mobility in Hanoi and Ho Chi Minh City. Figure 3.3 shows the illustrative financing flows (from a 2016 Asian Development Bank report, (ADB, 2016[32])) where USD 150 million in lending from the CTF (including two project preparation grants at USD 1 million each) contributes to total investment in projects of approximately USD 1.6 billion.

Figure 3.3. Illustrative Viet Nam Clean Technology Fund sustainable urban transport financing structure (as of 2016) (USD millions)



Note: Illustrative as of detailed estimates made in 2016 – see text and sources for details. Figures may not add up to rounding. Dashed lines imply Clean Technology Fund funding is channelled through the Asian Development Bank (ADB). * Co-financing figures not provided for the HCMC (Ho Chi Minh City) project. GoV: Government of Viet Nam.

Source: Modified from CIF (2013[25]; CIF, 2018[26]) and ADB (2016[32]).

What are the elements of Viet Nam's CTF transparency framework?

According to the CIF, the Viet Nam country investment plan "intends to identify, assess, select and promote opportunities for investments in low-carbon technology in Viet Nam that support the government's development priorities, objectives and ambitions for the relevant sectors and that meet the criteria of the CTF" (CIF, 2009, p. 4[30]). Of course, the CTF programme in Viet Nam alone cannot replace a strong domestic policy framework. The CTF programme is complementary to efforts to develop robust project pipelines in support of long-term climate objectives and to the government interface to convene actors and mobilise investment.

The OECD's *Investment Policy Review of Viet Nam* (OECD, 2018 forthcoming[24]) found that lack of transparency was an important barrier to scaling up infrastructure investment in the country,[26] particularly from foreign private investors. To alleviate the burden on investors, for instance, the review recommends that Viet Nam translates its investment promotion vision into a clear national action plan (OECD, 2018 forthcoming[24]), and improve the ease of investing (for a foreign business) by making available online investment content and data and are kept up to date (OECD, 2018 forthcoming[24]).[27]

The investments of almost USD 1.3 billion, mobilised in part by the CIF's CTF as shown in Box 3.4, represents only a share of total infrastructure investment in the country. In the five years from 2011 to 2015, for instance, the Global Infrastructure Hub estimated total public and private infrastructure investment in Viet Nam of approximately USD 57 billion, with USD 7 billion from private finance sources.[28] Yet, the CIF-MDB programme framework also provides a reliable platform to convene and inform actors on meeting certain national development objectives, and promote dialogue between national government, cities and local actors. For these reasons, the CIF interventions make important contributions to Viet Nam's project pipeline interface.

The investment plan highlights investment opportunities and is developed through an open and collaborative process that typically involves site visits, interactions across ministries, MDBs, the private sector and civil society. Depending on the funding programme and countries, it can take several months to complete. Once a plan is developed, it provides a basis to disseminate lessons for future plans. It also enables useful comparisons of investment needs and opportunities between countries. The CIF's efforts to standardise these investment plan approaches[29] across the large number of countries where it is active helps create a streamlined planning process with operational efficiencies in these countries and, to some extent, facilitates regional approaches to developing and investing in clean energy infrastructure. This broad, standardised approach and the associated plans and implementation framework are a useful basis on which to provide transparency and its links to investment planning (discussed in turn below):

- providing rationale and justification for CIF country intervention
- tracking expected results and performance indicators
- publishing project documents, decision-making and amendments
- disseminating lessons through and with existing institutions.

Providing rationale and justification for CIF country intervention. An important constraint self-imposed by the CIF is to justify interventions prior to financing and to track performance thereafter. The country plan reflects a combination of various planning and priority elements from national government objectives: the capacity, experience and operational focus of the participating MDBs; and other priorities established by the CTF. For each country plan (including but not limited to Viet Nam's plan), the CIF provides an overview of the national policy landscape, before identifying possible interventions according to various indicators and baselines such as direct impact (e.g. emissions reductions, increased passenger-trips), scale-up and replication potential (and associated impacts), and feasibility and costs (see also results and performance indicators below).

In the sustainable transport programme, for instance, the ADB provided further details and justifications, including how the programme links to the cities' Transport Master Plans which were approved in both Hanoi and Ho Chi Minh City in 2008 and updated in

2012. The CTF funding was envisaged as catalysing a modal shift from private to public transport (a key target of the master plan given the large costs of congestion in the cities, estimated around 6.25% of Ho Chi Minh City's annual GDP (in: CIF (2013, p. 15[25])). The CIF country plans are often revised to remain relevant and accommodate national policy changes as best as possible; see Box 3.5.

Box 3.5. Revising Viet Nam's Clean Technology Fund programme to maintain relevance and accommodate changes to national policy

The Climate Investment Funds (CIF) allows for revisions to the country plan as part of a dynamic process that adjusts and accommodates changes in country needs. For instance, the initial 2009 country plan was revised in 2011 and 2013 to accommodate a number of additions to the country's policy and institutional landscape: Viet Nam's National Climate Change Strategy was introduced in 2011 and its Green Growth Strategy in 2012; Multilateral Development Banks' national activities adjusted since first publication of the country plan; and, in the case of the sustainable transport programme, the update included more realistic implementation timelines of the projects. In addition, estimates of Clean Technology Fund (CTF) funding and project/programme co-financing have changed as projects get closer to implementation and actual investment costs become clearer.

The revisions and its impacts on performance of the CTF interventions were assessed against a series of CTF criteria included in (CIF, 2013[25]), such as: potential emissions savings, cost-effectiveness (in USD per tonne of CO_2 equivalents), demonstration potential, development impact, implementation potential, and additional costs and risk premium. Their impact assessment is summarised in the revised investment plan (CIF, 2013, pp. 8-11[25]). (See also section 3.7 for a case study, focusing on efforts to ensure water infrastructure investment planning is kept up-to-date in light of changing environmental conditions.)

Tracking expected results and performance indicators. The CIF and the ADB as participating MDB expect the transport programme to provide three main results that will be tracked over time: 1) reduce annual emissions; 2) scale-up and mobilise private finance; and 3) the delivery of development objectives. The CIF and the ADB expect to reduce emissions in Hanoi and Ho Chi Minh City by over 1.2 million tonnes of CO_2-equivalent ($MtCO_2e$) per year (approximately equivalent to about 2% of Viet Nam's current NDC) (CIF, 2013, p. 13[25]; Vieweg et al., 2017[20]).[30] These emissions reduction figures relate to phase one of the mass rapid transport in Hanoi (42 kilometres of lines in total), with a further three phases planned (with potential of 230 km), meaning the potential emissions reductions from the post-CTF programme could be well above 5 $MtCO_2e$ (CIF, 2013, p. 18[25]).

The ADB further aims to attract co-financing alongside the CTF by at least USD 1.15 in private finance for every USD 1 in public CTF funds. While other investments made by the ADB may achieve higher private co-financing ratios,[31] the Viet Nam CTF sustainable transport programmes are public sector projects, which typically involve lower proportions of private finance than private sector-led projects. The demonstration of these projects is expected to lead to further attractive investment opportunities in the public transport system across the country. In addition, the projects aim to support the national Transport Master Plan by increasing public transport usage 15% by 2022 and to 30% (Ho Chi Minh City) and 35% (Hanoi) by 2038. Current national policy sets targets at 30–40%

by 2030, up from approximately 7–10% in 2013. The 2030 target is, according to the ADB, ambitious relative to international benchmarks (CIF, 2013, p. 15[25]).

The CIF and MDBs both monitor and report regularly (e.g. results annually and general project updates biannually) on the programme performance for due diligence purposes, and aim to track a number of indicators as explained in the country plan. For instance, the ADB will track or monitor many of the above indicators through impacts, outcomes and outputs of the Ho Chi Minh City programme. These include (ADB, 2014, p. 11[33]): public transport usage figures (sourced from government statistics and operator data), quality and satisfaction (independent survey of users), emissions reductions (monitoring and post-evaluation reports), and other information (like improved station access, transport information systems or relevant transport policies).

In addition, the country plan also includes details of the various risks and assumptions that are assessed prior to commencing the project and will be tracked by both the CIF and ADB over time. These include, for instance (CIF, 2009, p. 31[30]): policy and regulatory framework risks (maturity and effectiveness of support policies); institutional capacities (private sector existing skills and experience); technology (commercial or innovative); finance (perceived risks); scale-up and replication (use of proven technologies and phased implementation to avoid "overloading the market"); environmental and social safeguards (pollution controls). For the Ho Chi Minh City programme, the ADB scored overall risk at "medium" across 16 potential risks in implementation, public finance management, procurement and corruption.[32]

Publishing project documents, decision-making and amendments. The CIF stores online all documents related to its projects,[33] including the six CTF programmes in Viet Nam.[34] The documents can be filtered and arranged by programme, each with various documents within including project appraisal documents (PADs), project initiation documents (PIDs), outputs, decisions, revisions, amendments, notes and other information. The CIF project website also contains information on all versions of the country plans, and donor/Trust Fund Committee comments or questions to projects and the MDB responses, or to the plan in general. Similar systems are available also on websites of the participating MDBs, typically storing information using its project identification number.

Of course, many of the CTF programmes require or necessitate private sector actors, including investors and project developers, and so fewer project-level documents will be available for these private sector projects. The public sector nature of the CTF sustainable transport programmes, however, means that many of the documents are freely available and include such information as lending rates, tenors, grace periods and so on. By mandate, MDBs and other development finance institutions support projects in both public ("sovereign") and private sectors ("non-sovereign") and this, as a result, affects (e.g. limits) the information that is available.

Disseminating lessons through and with existing institutions. Working in the context and architecture of MDBs offers the CIF a means to draw on its established, on-the-ground experience and capacities to attract and mobilise finance at scale. Keeping processes and documentation replicable, standardised and transparent allows the CIF to develop investment plans in many countries (76 to date across its four funds, with faster disbursement than other climate funds (Trabacchi et al., 2016[29])) and its common investment frameworks help improve coordination across all actors (Trabacchi et al., 2016[29]). In addition, the CIF process is tuned to match the needs of MDBs; for instance, by filling concessional funding gaps and offering targeted support to "first-of-a-kind" projects with high potential but few precedents in the country.

The CIF is, to date, the only climate fund that prioritises a programmatic national investment planning process (Trabacchi et al., 2016[29]).[35] The investment plan offers recipient countries a source of knowledge and funding that, in some cases, will be open and used to support future planning and investments. The CIF administration and donors often expect investment plans to be scaled up in the future and send signals that future opportunities can happen without needing catalytic support. Indeed, the ADB explains that enhancements to the urban rail system Hanoi will be "directly and immediately replicable for other lines in Hanoi, and certain aspects, such as the low-carbon technologies and policy measures, will have the potential for replication in other cities and towns" (CIF, 2013, p. 19[25]).

3.3.3. Summary: What can governments do to ensure more transparent processes?

The above discussion highlights how a multilateral instrument like the Clean Technology Fund makes use of transparent processes to develop low-carbon infrastructure project pipelines (specifically, sustainable public transport and mobility projects in two of Viet Nam's largest cities). The CTF formed a platform on which it convened actors, mobilised investment, and bolstered planning across and among institutions in Viet Nam. Transparency – specifically transparent decision-making processes that influence investment – was a key ingredient to this platform.

Transparency appears to have worked effectively in the context of Viet Nam's CTF programme. More generally, transparency and its potential use in developing robust project pipelines depends greatly on a number of important factors, such as the scale of investment required, scope of planning (city, country, regional), number of actors involved, or public or private nature of the investment.

The aim of this case study was to highlight an existing use of transparency in developing project pipelines. Given the global scope of investment, and range of good pipeline practice and factors, as discussed in this chapter, there are other approaches beyond those highlighted in this case study (see, for instance, Box 3.6 which includes some other examples of transparency applied in various contexts). Table 3.4 summarises the elements of the CIF's approach relating to transparency in the CTF programme.

Table 3.4. Overview of transparency elements and application in Viet Nam's Clean Technology Fund programme

Element of transparency	Application in this case study
Clarity in decision-making	Providing clear rationale and justification of project selection and associated interventions
Co-ordination of and coherence between actors	Making efforts to involve and convene actors to develop relationships, discuss needs, secure buy-in, and agree on action
Feedback into policy	Informing and linking to national (and sub-national) processes to provide evidence on what worked and what needs support
Tracking and measuring progress	Providing indicators and data that can be used to assess risks and identify opportunities prior to project commissioning, and measure performance and progress afterwards
Replicability and scaling up	Offering lessons to help replicate successes and scale up activities, particularly shifting from public to private funding of projects
Predictability of public and private finance flows	Providing another financing source to overcome investment barriers and, ultimately, mobilise private finance by highlighting opportunities
Standardised templates	Establishing and streamlining documentation processes to foster access to programme data and project information

Table 3.4 shows that transparency of the Viet Nam CTF programme may address many investment barriers as identified earlier in the report and support more robust project pipelines in the country. However, the application of transparent processes will be potentially even more important globally. Transparency is important for a number of reasons, such as better coherence of actors, clearer decision making and lower search costs, all of which ultimately help engage and mobilise private sector participation. Based on the above, the following observations could be explored in more detail:

- *How can more transparent public investment planning processes translate into increased participation from the private sector?* In the above case, the Viet Nam CTF transport programme was driven in large part by the public sector (the government of Viet Nam as recipient, ministries/government agencies to implement, city transport authorities, and so on). The private sector was not expected to source or plan projects freely within the Viet Nam CTF programme. But such a situation may change going forward, particularly because of expected scale-up and mobilisation of finance from the private sector.
- *How can "local" risks to transparency be mitigated?* The ADB assessed risks in the Ho Chi Minh City programme as "medium" across project risks.[36] Without the expertise and technical capacity of the ADB, and its transparent information and communication systems, domestic institutions may need further technical support to ensure the success of ongoing and future efforts to infrastructure investment. This is especially important if there is a significant shift to private sector project developers and investors. The OECD *Investment Policy Review*, for instance, suggests that, to meet its green growth strategy, Viet Nam could bolster local capacity to undertake investments in low-emissions infrastructure, including sustainable transport. The CTF transport programme of USD 150 million included grants of USD 2 million to support capacity building and feasibility studies in sustainable transport.
- *How can data on private sector-based projects be sourced, managed or assessed if participants are unable or unwilling to share such data?* Information was freely available given the public sector nature of the Viet Nam CTF. Many MDBs also support private sector recipients,[37] which limits the availability of project-level data. Likewise, the World Bank Group's International Finance Corporation has a private sector funding focus. Access to data and investment information will

likely be reduced significantly as the private sector increases its share of total investment (e.g. it is expected to provide the vast majority of infrastructure investment to meet climate objectives – see, for example, Chapter 2 or (WEF, 2013[34])). The OECD's Research Collaborative on Tracking Private Climate Finance is one such effort to monitor progress in this area.[38]

Box 3.6. Examples of transparency in infrastructure project pipelines

Queensland, Australia

Established in 2015, Building Queensland is an independent statutory body charged with *inter alia* creating and managing the project pipeline of priority infrastructure in Queensland, Australia. The pipeline is published and updated biannually to provide visibility for investment opportunities, to highlight the potential and direction for capacity building, and to reflect current infrastructure priorities of the government. A published project pipeline, according to Building Queensland, also fosters public engagement and allows confidence building that public money is being judiciously spent.

Sources: *http://buildingqueensland.qld.gov.au/wp-content/uploads/2016/06/Infrastructure_Pipeline_Report_June_2016.pdf* [PDF]; *http://buildingqueensland.qld.gov.au/wp-content/uploads/2017/07/PIpeline-Report-June-17.pdf* [PDF]

Mexico

In 2017, the federal government of Mexico launched the **Mexico Projects Hub (Hub)** to provide investors with: 1) improved visibility of projects sponsored by government entities; 2) a transparent view of project performance; and 3) the ability to compare investment opportunities. The Hub is a digital platform that aggregates and publishes a database of priority infrastructure projects, across sectors, which involve investment by the federal government and seek to leverage additional private capital. The database is created and managed by the national development bank, BANOBRAS, on the basis of the information received from line ministries, private developers and other external sources. BANOBRAS reviews projects on a continuous basis for modification, inclusion or exclusion from the database.

Sources: *http://www.proyectosmexico.gob.mx/en/projects-hub/*, *http://cdn.presidencia.gob.mx/pni/programa-nacional-de-infraestructura-2014-2018.pdf?v=1*; *http://pnd.gob.mx/*

3.4. The importance of prioritisation for building robust project pipelines: The case of infrastructure investment in the European Union

To promote and support pipelines of low-carbon and resilient projects, governments can foster regulatory mechanisms and infrastructure planning tools. These tools could be used to: 1) expedite good projects today; and 2) optimise portfolios and prioritise better projects in the future that align to the long-term pathways.

Expediting, optimising strategically valuable projects and shepherding them through development processes – "prioritisation" for the purposes here – constitutes a critical element of a government's efforts to build robust project pipelines.[39] Meeting objectives, like the Nationally Determined Contributions (NDCs), more effectively (e.g. at least cost, or improving the performance of infrastructure assets) or quicker (e.g. overachieving and increasing ambition) demands a good understanding of what infrastructure investments are needed, where, and how best to prioritise action and optimise available resources (as highlighted in Chapter 2).

Prioritisation efforts in their various forms can be powerful if rooted within, rather than in conflict with, existing regulatory processes and experienced institutions. The processes through which projects are selected, promoted and expedited can be strengthened through strong due diligence measures and tracking of key performance indicators over time. Providing prioritisation for certain projects using transparent processes (see, for instance, section 3.3) can reduce inefficient decision making and resource allocation by the private sector. These prioritisation processes should also follow independent and fair methods throughout.

Investment in network infrastructure, such as transport or energy networks, that spans country borders and involves many institutions, is becoming increasingly important for regions, like the European Union, to enable collective action on climate. This case study looks at two initiatives to promote low-carbon infrastructure investment in the European Union (EU): the Investment Plan for Europe (IPE),[40] and the Projects of Common Interest (PCI) within the Connecting Europe Facility (CEF).

Prioritisation case study summary box

What is it? Processes to expedite and prioritise project investments and ensure project pipelines are aligned to long-term climate objectives.

Why is it essential to building robust project pipelines? Developing and implementing low-carbon projects at scales and rates far beyond current levels is hindered by complex institutional arrangements and misaligned regulatory processes. This is particularly true of infrastructure in connected networks that may also extend across national borders.

Who is involved? The EU addresses infrastructure investment gaps across its 28 member states, offering public guarantees and channelling funds through existing institutions like the European Investment Bank to carry out due diligence, optimise investments, promote strategically important projects, and mobilise public and private actors.

Key messages and actions for governments to consider on prioritisation

- incorporate infrastructure priorities into national (and wider regional) strategic planning, ensuring that such plans are aligned to long-term climate objectives and promote suitable investments
- overcome non-financial barriers by placing prioritisation mechanisms within, rather than separate from or in conflict with, existing regulatory and institutional arrangements
- employ experienced institutions with high capacity and expertise to assess project eligibility, determine strategic value, and bridge investment gaps by allocating funding and other policy tools
- use prioritisation as a means to feed into policy processes and align project pipeline development to changing investment requirements.

3.4.1. Case study context

Climate targets and infrastructure financing gap

The EU communicated a common NDC on behalf of all its member states in 2015. It has undertaken to unconditionally reduce economy-wide emissions by at least 40% by 2030, compared to 1990 levels.[41] The commitment precludes offsetting using credits from any international market-based mechanism. The EU NDC does not have an adaptation component.

While the NDC sets an EU-level target of 40%, obligations of member states are determined by the Effort Sharing Decision 2021–30 of the European Commission. Building on the Effort Sharing Decision 2013–20,[42] the updated decision was adopted by the European Parliament in April 2018 and pertains to emissions not covered by the EU Emissions Trading System: transport, buildings, agriculture and waste. It fixes the reduction target of member states based on gross domestic product (GDP) per capita, while allowing them to determine and implement, nationally, the policies and measures to achieve it.

Long-term mitigation targets of the EU warrant additional yearly investments of EUR 179 billion for the next couple of decades (European Commission, 2017[35]). While the

current investment rate in climate change mitigation, of 1.2% of the GDP (EUR 175 billion in 2016) has managed to keep the EU on track to meet its 2020 target, an increase in investment is pivotal to achieving the NDC and the 2050 target of reducing emissions by at least 80% compared to 1990 (EIB, 2017[36]).[43]

EU initiatives to stimulate infrastructure investment

In 2014, the European Commission (EC) launched the IPE to remove obstacles to investment, provide visibility and technical assistance to projects and make smarter use of financial resources across Europe (European Commission, 2018[37]). The plan has three pillars: 1) the European Fund for Strategic Investments (EFSI); 2) the European Investment Advisory Hub and the European Investment Project Portal; and 3) targeted efforts to remove national and EU-level regulatory barriers to investment.

The EFSI, which is the cornerstone of the IPE, seeks to leverage private capital and catalyse investments by providing EU-backed guarantees to finance projects. It aims to dedicate at least 40% of its infrastructure and innovation investments to meet the EU's commitment to the Paris Agreement. Launched in 2015 with an initial mandate to mobilise a total of EUR 315 billion by mid-2018 (so-called "real economy" impact), the EFSI is managed by the European Investment Bank (EIB) to invest in a range of sectors, including environment and resource efficiency, energy, transport, forestry, fisheries and aquaculture. As of July 2018, the EIB had mobilised EUR 335 billion, which is more than the intended target of EUR 315 billion (European Commission, 2018[38]). In December 2017, the funds' initial target was increased to EUR 500 billion by end of 2020, including an increase of the guarantee component from EUR 16 billion to EUR 26 billion. Under the prolonged EFSI ("EFSI 2.0"), greater overall focus was put on sustainable investments in support of the EU bloc's Paris Agreement commitments. Indeed, at least 40% of EFSI projects under the infrastructure and innovation window will have to contribute to these commitments.

The Connecting Europe Facility (CEF) was launched in 2013 to finance and support selected pan-European infrastructure projects in energy, transport and telecoms. The facility uses an array of instruments including guarantees and grants, with some project loans and project bonds to attract further investment from the private and public sector. Of its EUR 30.4 billion budget, the CEF allocates EUR 5.4 billion to target energy projects. Some of these projects under the CEF can be designated as PCI, which are key to integrating and strengthening the EU's energy system and, to some extent, fostering investments in low-carbon energy. The PCIs are reviewed and communicated every two years by the European Commission. The third and latest list of PCIs, published in November 2017, identifies 173 energy infrastructure projects spanning transmission, storage, smart grids, oil, gas and cross-border CO_2 networks.

Despite concerted efforts to unlock investment in infrastructure, the financing gap across the EU persists. Sizeable investments are required to meet the European 2020 targets and even more so for the 2030 targets. The IPE, launched to address underinvestment in the aftermath of the financial crisis (European Commission, 2018[37]), and the project pipelines of the EFSI and PCIs provide a means to identify and prioritise strategic projects while clearly communicating investment opportunities. In June 2018, and outside the scope of this case study, the European Commission announced efforts to streamline EU infrastructure funding programmes into the proposed 2021–27 InvestEU Regulation[44] – see also Box 3.8.

3.4.2. Focus on prioritisation factor

Expediting and prioritisation to support low-carbon infrastructure across the EU

A large pipeline of new projects, attractive to investors and – importantly – aligned to the long-term needs of the country, is an anticipated output from government climate action. Low-carbon and resilient infrastructure assets face numerous investment barriers, such as those arising from political, commercial and market risks. These barriers are particularly common when developing large, capital-intensive and greenfield projects, like onshore wind, or network infrastructure like water, electricity, road and rail. Long-term climate objectives imply that investment in low-carbon projects will be implemented at a far higher rate than before and that they will be deployed at a greater scope and scale. For example, electricity grids may be extended beyond existing routes to connect remote populations and offshore energy facilities.

Local regulations and planning consent procedures can play an important role in mobilising and scaling up investment by supporting the development of suitable greenfield projects (in line with national and local concerns). An important concept explored here, and the focus of this case study, is the ability to work within existing regulatory frameworks to streamline, source and originate good projects, prioritising those that align well with long-term objectives. A prerequisite for good practice infrastructure policy is to have coherence and co-ordination in regulation at all levels of government and sectors (OECD, 2017[11]).[45] Such regulations typically only apply within country borders, or even at local region and city level, meaning that large and often international and cross-border projects, like those promoted within the EU, can present additional development difficulties to both national regulators, planners, project developers and investors.

The EU is facing significant investment gaps across its 28 member countries.[46] For instance, as a percentage of total GDP, total infrastructure investment in the EU-28 reduced on average around 11% in the period 2008–16, and some countries are facing infrastructure investment levels 50% lower than before the economic recession in 2008.[47,48] Upgrading existing and developing new electricity and gas transmission networks alone may need over EUR 200 billion by 2020, but these investments are still "[unlikely to be] commercially viable" (European Commission, 2017[39]). In response, the EU has adopted a broad institutional approach to aligning European regulations, mobilising investment and sourcing projects across member countries (Gärdfors, 2015[40]).

The value that the EU attributes to mobilising energy sector investment derives largely from the EU's position as the world's largest energy importer: more than half of energy in the EU is imported[49] at a cost of more than EUR 1 billion per day (European Commission, 2017[41]). Improving the efficiency and management of "domestic" resources offers clear financial and strategic benefits to the region as a whole. As the executive branch of the EU, the European Commission has therefore taken specific steps to close the investment gap and build a more integrated European energy system, such as strengthening energy security, reducing dependence on imports, and establishing an internal energy market. It does this by, for instance, implementing an EU Energy Union to bring cohesion to existing planning schemes and maximise financing impacts, and enhancing interconnections within the EU and with neighbouring countries.

A comprehensive study by law firm Norton Rose Fulbright on the EU arrangements to fund energy infrastructure (Gärdfors, 2015[40]), identified at least seven EU initiatives to

promote and incentivise investment in energy infrastructure, including the two in this case study; EFSI (managed by the European Investment Bank, EIB) and the PCIs (under the Connecting Europe Facility, CEF).[50] Given the large scope of these institutional and funding efforts in the energy sector, there is a particular need for EU institutions to take steps to avoid uncoordinated investment across the 28 countries that could result in substantial investment risks. In this context, it is important that EU institutions take steps to ensure project funding and other public support is targeted, aligned and clear.[51]

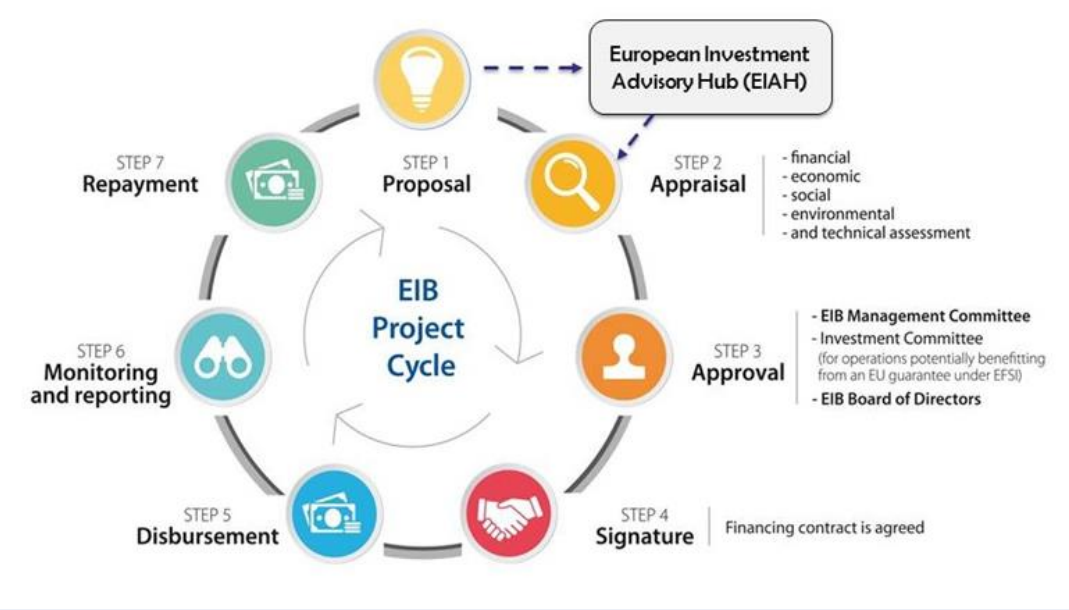
Of interest to this case study is not only how to fill the funding gap, but how these EU efforts can provide institutional support, source suitable projects in adequate volumes and co-ordinate and prioritise investment in the right locations across its 28 countries. Chapter 2 discussed the lack of bankable projects being a critical barrier to reaching climate objectives and pointed to the value of a holistic view on investment needs and co-ordination. A good example of such a holistic approach is the EFSI and CEF project cycles and related institutional support and co-ordination (see Box 3.7).

Box 3.7. Project investment cycles and institutional support in the European Fund for Strategic Investments the Connecting Europe Facility

To mobilise investment across countries, the European Union must address challenges in managing national needs and addressing imbalances in access to institutional support. The European Fund for Strategic Investments (EFSI) and the Connecting Europe Facility (CEF) offer project developers funding and access to experienced institutions.

Projects supported under the EFSI, for instance, follow the typical European Investment Bank (EIB) project cycle shown in Figure 3.4 from proposal to loan repayment. They can also access the European Investment Advisory Hub (a joint venture between the EU and the EIB) to provide critical support to projects at early stages of the existing EIB project support cycle. EFSI projects are then approved through EFSI processes in parallel to those of the EIB.

Figure 3.4. European Investment Bank project cycle and link to European Investment Advisory Hub



Source: European Commission (2018[42])

Similarly, the CEF project life cycle includes key interactions between the programme administrator, the Innovation and Networks Executive Agency (INEA), and the European Commission to provide feedback, create synergies among EU programmes, and improve future phases of CEF and PCI project selection. This process is updated every two years to keep project pipelines pertinent and adaptable (see also the case study on water infrastructure planning and financing in section 3.7, which focuses on this factor).

What are the elements of EU methods to expedite and prioritise projects?

The EFSI and the CEF share certain commonalities. They both have objectives to overcome barriers to investment, mobilise finance and impact the "real economy" and

funding available to support key infrastructure across Europe. Additionally, both use established public institutions to administer, manage and deliver the funds. The EIB has over 60 years of experience, the Innovation and Networks Executive Agency (INEA) has 10; and both, to some extent, provide access to technical assistance if needed.[52] The key differences are in the way that funds are delivered – as summarised in Table 3.5 – and how projects are selected and deemed eligible for funding.

Table 3.5. Summary of funding differences between the European Fund for Strategic Investments and the Connecting Europe Facility

		Funding to technologies				Other criteria		
	Main funding instrument	Renewable energy	Energy efficiency	Smart grids	Innovation	Long-term investment	Single authority	Requires investment across countries
EFSI (managed by EIB)	Guarantee and EIB funding (including loans)	Yes	Yes	Yes	Yes	Yes	No*	No – individual country eligible
CEF (funding the Projects of Common Interest)	Grants (guarantees and project bonds to a minor extent)	Not specific	Not specific	Not specific	Not specific	Yes	Yes	Yes – PCI stipulates at least two EU members

Notes: See text and source for details. * The European Fund for Strategic Investments (EFSI) is an independent and separate facility governed by EFSI regulation, under European agreements, the European Investment Bank (EIB) is the implementing agency. PCI: Projects of Common Interest; CEF: Connecting Europe Facility.
Sources: Adapted from (Gärdfors, 2015, p. 42[40]), personal communication with the European Commission.

With respect to prioritising climate-aligned projects, both the EFSI and CEF are presented with two different challenges. The first is how to determine and evaluate the funding eligibility of individual projects under the Europe-wide EFSI programme, when each project can be located in one of many countries. The second is how to promote and expedite Projects of Common Interest that are strategically important to European objectives but affect more than one country and potentially face or come up against various regulatory barriers. In light of those challenges, EU efforts to scale-up infrastructure investment, including the effective use of institutions, policy and funding, provide a useful case study to illustrate and review methods to quicken deployment and prioritisation of project assets across a broad geographical area and complex political landscape, and examine specific links between project prioritisation and investment planning (discussed in turn below):

- assessing funding eligibility
- balancing national and regional needs
- accounting for regulations.

Assessing funding eligibility. The overarching objectives of the EFSI and CEF are to provide financial instruments and institutional support to overcome barriers and mobilise infrastructure investment gaps in many sectors (but particularly energy). By providing the management of the EFSI to the EIB, the EU is able to take advantage of existing architecture and capacity to assess projects and allocate funding accordingly. Importantly, the EIB is well-placed to assess projects and allocate funding for several reasons:

- The EIB has a long history with investments in every EU member country; deploying EUR 70 billion in project funding across the EU 28 in 2017 alone,

including EUR 1.1 billion multi-country financing (EIB, 2018[44]). Since it was established 60 years ago, the EIB has invested over EUR 1 trillion. It also has increasing experience in investments outside of the EU.

- The EIB has a strong commitment to funding climate action. By 2020, more than 25% of its financing will be in climate mitigation and adaptation measures, and up to 35% in developing countries.
- The EFSI programme fits in and is complementary to existing EIB funding architecture,[53] meaning it is subject to existing EIB eligibility processes (discussed below). In addition, the independent EFSI management and investment committees[54] ask the EIB to carry out further eligibility assessments on the mobilisation potential of EFSI financial instruments.

To benefit from EFSI resources, projects undergo the standard EIB due diligence process and appraisal steps to determine eligibility and to check for quality and soundness of projects. This process can adjust as EIB operational plans are updated and covers a number of detailed steps, including but not limited to,[55] alignment to EIB lending priorities; size and scale (e.g. the EIB can fund a maximum of 50% for one project); economic viability (e.g. the EIB requires projects to generate an economic rate of return over 5%, otherwise further qualitative checks are required); expected socio-economic benefits like jobs; assessment of risks, including permitting and regulations; market uncertainties including from the supply chain, and so on.

Once a project is eligible for EIB financing, the operational department can propose that it be backed by the EFSI and the independent Investment Committee[56] decides on the use of the EU guarantee element of the EFSI. In addition, EFSI projects need to satisfy a number of complementary criteria (EIB, 2018[45]; Gärdfors, 2015[40]): be economically and technically sound; be in EFSI eligible sectors; be consistent with wider EU policies on sustainable development and employment; be priced in a manner commensurate with the risk taken; be "additional";[57] and maximise the potential for mobilisation of other sources of funding (e.g. leveraging the EIB's existing institutional capacities to reach EUR 15 in "real economy" investments from every EUR 1 from the EIB/EFSI). Under the Group Transparency Policy, the EIB is obliged to publish so-called EFSI Scorecards that detail the rationale and justification for use of the EFSI guarantee.[58]

To receive support under the CEF and be included in the PCIs requires various selection and re-assessment processes over an eight-month period (Gärdfors, 2014[46]). In general, there are five key criteria that a PCI in the energy sector should meet in addition to successfully winning the CEF funding and selection process (European Commission, 2017[47]):

1. has a significant impact on at least two EU member states
2. enhances market integration and contributes to the integration of member states' networks
3. increases competition on energy markets by offering alternatives to consumers
4. enhances security of supply
5. contributes to the sustainability objective, e.g. by supporting renewable generation.

Following an open call for proposals, the European agency in charge of the CEF considers PCIs on a project-by-project basis and updates the PCI list every two years and

allocates funding. This allows the agency to update the selection according to changing priorities and public approval (the selections are not final until they are subject to open consultations). For instance, in the period 2014–16, PCIs were given precedence if they made progress to address isolation in the energy network, energy bottlenecks and supported the energy internal market (Gärdfors, 2015[40]). In addition, energy PCIs are assessed according to their support of "priority corridors", nine key energy areas as described and updated in the Ten-Year Network Development Plans for electricity and gas (Gärdfors, 2014[46]).[59]

Balancing national and regional needs. Action across 28 countries presents investors and fund administrators with several challenges to co-ordinating investments and ensuring collective action. Various high-level country "starting points" might be used to determine what infrastructure should be promoted and prioritised (as described in Chapter 2). Project pipelines are very country context specific, involving many interconnected political, institutional and economic factors. Those developed under the EFSI and CEF/PCI programmes, for instance, undergo broad project assessments and appraisals. Much of the responsibility to balance national and regional needs rest with programme administrators, like the EIB or the INEA.

The purpose of this case study is not to evaluate the performance of the EFSI or PCIs in this respect, but to highlight that determining success goes beyond how much funding has been disbursed (indeed, many of the projects are yet to be built). Fund administrators will be expected to make efforts to distribute funding fairly across countries or at least be clear on the allocation decisions taken. The latest results of the EFSI, for instance, show that total finance mobilised (EUR 335 billion) has exceed what was initially targeted (EUR 315 billion)[60] and all 28 EU countries have received or are due to receive approximately EUR 2 billion on average (ranging in disbursements from EUR 11 million to over EUR 10 billion).

Under the EFSI, project support is demand-driven, meaning there are no support targets or quotas at regional or sectoral levels. That explains why, therefore, looking only at absolute EFSI funding by country does not present a clear picture of how funds have been allocated or how programme administrators are accounting for national and regional needs (discussed in more detail in Box 3.8). Around 50% of the EFSI's mobilised funds to date on an absolute basis have been channelled to four countries (in order of magnitude: France, Italy, Spain and Germany). However, when EFSI funding is measured in proportion to national GDP, 50% of this funding has been channelled to 11 countries, many of which have seen great reductions in infrastructure investment since 2008 (Greece, Estonia, Lithuania, Bulgaria, Finland, Poland, Spain, Portugal, Latvia, Italy and France). In a similar manner, the CEF shows large geographic variations, despite its smaller size and narrower scope. To date, the CEF has allocated EUR 1.6 billion in grant funding to energy projects in 21 EU countries. Four countries (Poland, Romania, Estonia and Luxembourg) account for almost 50% of the funds disbursed to date on an absolute basis.[61]

Box 3.8. Recent efforts to streamline EU funding programmes

In June 2018, and outside the scope of this case study, the European Commission announced efforts to streamline the EU infrastructure support programmes. The proposed 2021–2027 InvestEU Regulation* combines 16 existing equity, risk sharing and guarantee instruments from eight programmes under one umbrella, that will have four specific policy windows: 1) sustainable infrastructure; 2) research, innovation and digitisation; 3) small and medium-sized enterprises; and 4) social investment and skills.

The European Commission has also explored steps to improve the geographic disbursement of its support. These include combining the use of the European Fund for Strategic Investments (EFSI) with other EU funds (see below), setting up investment platforms (e.g. national, regional, cross-border) and more targeted outreach from the European Investment Advisory Hub. Also in terms of regulation, the Commission is aiming at removing barriers to investment at national and European level, as part of the "Third Pillar" of the Investment Plan for Europe.

Projects suitable for financing under the EFSI could also receive other funding from other sources in the EU budget, for instance the European Structural and Investment Funds (ESIF) or, as discussed in the text, the Connecting Europe Facility (CEF). These sources may finance part of the project – in the form of a grant – while EFSI-backed financing may cover the remaining costs of the project. Examples already exist (European Commission, 2016[48]): in Riga (Latvia), for instance, CEF grants and EFSI loans were combined to support a sustainable transport project using hydrogen fuel-cell buses.

* For more information on InvestEU, see the European Commission website at: www.ec.europa.eu/commission/publications/investeu-programme_en
Note: Box prepared with assistance from colleagues at the European Commission.

Accounting for regulations. The Energy Union aims to bring a stronger overarching focus to investments across the EU and close gaps between national regulations. Investments that span countries can be significantly hampered by regulatory delays and institutional bottlenecks, potentially increasing uncertainty and impeding project development.

The PCIs were envisaged as a means to verify that EU-important projects could and should be fast-tracked through national regulations and promoted because they demonstrate socio-economic benefits to the EU energy system. If a project is accepted onto the list of PCIs, it can benefit from regulatory and planning advantages that, in theory, can expedite investment over equivalent non-PCI projects in similar regulatory frameworks. The five core benefits of PCIs include fast-tracked regulatory processes across country-borders and within national regulations, improved access to information, and even agreed processes to share costs and benefits from the projects (European Commission, 2017[47]):

1. streamlined permit granting procedures (a binding 3.5-year time limit)
2. improved, faster and better streamlined environmental assessment
3. access to a single national competent authority (one-stop shop[62]) coordinating all permit-granting procedures and other administrative issues: setting and

monitoring time limits; decision-making powers (under integrated and co-ordinated scheme); and reporting to the regional groups

4. a procedure allowing for the allocation of investment (construction) costs and benefits among member states benefiting from the PCI
5. subject to assessment, receive financial assistance under the CEF in the form of grants and innovative financial instruments (up to 10% of CEF funding).

Despite the advantages offered to PCIs, national and European administrators and investors face implementation challenges not least because, to date, progress in reaching agreements on PCI implementation has been slow. To some extent, the alignment of regulatory processes between countries has not been uniformly applied across all member countries in the PCI process (Gärdfors, 2015[40]). A 2014 survey on risks facing PCIs, commissioned by the European Commission (AF and REF-E, 2014[49]), concluded that, of approximately 30 risks identified, the three most significant challenges facing PCIs were all related in some way to cross-country regulation (cross-border co-ordination issues, future regulatory uncertainty and complex financing issues).[63]

The Norton Rose Fulbright study (Gärdfors, 2015, p. 16[40]) summarised a selection of regulatory complexities facing PCIs, including: the establishment of contracts to determine which laws govern construction agreements, operation and maintenance, funding, partnership, intra-government and any other relevant contractual arrangement. While risks are intrinsic to all energy infrastructure projects, risk profiles may be higher in cross-border projects like PCIs compared to similar projects within national borders. For example, inherent in improving interconnections is the challenge to allocate benefits and costs to countries in an effective way. So-called asymmetric impacts may be hard to quantify on an *ex ante* basis for projects involving large networks with many actors and may place risk on actors that are unwilling or unable to manage them.[64]

Improving the EU regulatory environment is also an objective in the Investment Plan for Europe (IPE) as mentioned above. Through a series of national and EU actions, the IPE aims to remove regulatory barriers at national and EU levels and provide investors with regulatory predictability. These actions include encouraging national regulators to identify bottlenecks and learn from best practices from across the EU. The IPE is expected to have implications for other infrastructure programmes in line with the long-term EU Energy Union.

3.4.3. Summary: What can governments do to expedite and prioritise valuable projects?

The above discussion explains how the European Union took action to help bolster the development of national and regional infrastructure project pipelines. Facing a widening investment gap, and diverse country infrastructure "starting points", the EU provided institutional access and public funds to expedite and prioritise investment in low-carbon technologies in line with long-term objectives. The EFSI is one of the largest funding instruments to support infrastructure in Europe (initially targeting EUR 315 billion mobilised over three years, implemented by the European Investment Bank and since extended to EUR 500 billion by end of 2020), and the PCI process can fast-track regionally important projects through national regulations to avoid long delays.

All governments are expected to mobilise finance to support the development of many new greenfield projects to meet long-term climate objectives. Since current climate pledges do not put countries on a pathway consistent with the Paris Agreement

objectives, almost all countries are expected to increase ambition and prioritise "green" infrastructure over "brown". In this context, both the EFSI and PCI highlight the value of adapting existing institutional arrangements, including dealing with constraints and working within the boundaries of existing regulations, to organise and prioritise infrastructure investments across and between countries. Not all countries or regions can benefit from access to the arrangements used here, but the EU approach to expedite and prioritise climate-aligned projects can provide important lessons. Indeed, there are other methods beyond those highlighted in this case study (see Box 3.9 which includes some other examples of prioritisation applied in various contexts). In summary, key elements of the EU's approach to prioritising infrastructure projects, are summarised in Table 3.6.

Table 3.6. Overview of prioritisation elements and application in the EU infrastructure programmes

Element of prioritisation	Application in this case study
Meeting national and regional priorities	Incorporating country contexts and infrastructure starting points to make progress towards EU-wide objectives
Regulatory benefits	Addressing non-financial and regulatory barriers to investment
Institutional support	Incorporating existing processes and institutions to assess project eligibility, determine strategic value, allocate funding across regions, and disseminate information
Policy feedback	Adjusting benchmarks regularly to fit changing needs, learning from experience
Financial instruments	Allocating grants and guarantees to help overcome investment barriers in key projects

Table 3.6 shows the potential benefits of prioritisation mechanisms to the development of robust, cross-country project pipelines. The combination of existing national and regional regulatory frameworks greatly helps EU institutions work to select, support and expedite projects of regional importance. While these prioritisation methods prove particularly useful for organising and managing investments across 28 countries and their national/regional needs, more research is needed to test their effectiveness *vis-à-vis* country project pipelines and institutions. In particular, the following considerations could be explored in more detail:

- *How to design project prioritisation criteria to accommodate changing objectives at national and regional levels, balancing needs and a lack of information on long term impacts?* The PCIs are large-scale network infrastructure projects – including gas transmission lines to increase the capacity of gas networks across the EU – that require fast-tracked support through regulations. However, the continued use of gas in energy systems such as in power plants will be, in the long-term, incompatible with climate ambitions for almost all countries unless they are connected to systems that capture and store the greenhouse gas emissions. Following recommendations by the High-Level Expert Group on Sustainable Finance, the European Commission is working on a "green taxonomy" of mitigation technologies which, if updated regularly, could inform wider EU decisions on the eligibility of mitigation projects under, for instance, the PCI and other programmes. In addition, the EFSI Scorecards, as published by the EIB provide an up-to-date evaluation of the EFSI projects and performances that could feed back into future project parameters.[65] Likewise, the EU-EIB European Investment Advisory Hub could provide key information to potential developers – see Box 3.8.
- *How to apply prioritisation lessons to countries that may lack the existing institutional framework?* The EU is an active area for investment in low-carbon

technologies and the EIB has been supporting infrastructure investment in the region for 60 years with a remit to operate in all 28 countries. Given that the European Union has strong capital markets with many private sector institutions becoming increasingly adept at funding such projects, applying the results of the EFSI and PCI programmes to other regions (particularly in emerging markets with less robust investment-enabling environments) requires a better understanding of the national contexts (policies, regulations, institutions and so on) for prioritisation to be effective.

- *How to ensure fairness in prioritising projects?* Governments can employ competitive processes to procure projects and/or should ensure that non-governmental institutions have the capacity and knowledge to manage the selection of projects to prioritise. In countries where state-owned enterprises own and operate the energy systems,[66] expediting largely privately financed projects may face further regulatory or planning challenges.

Box 3.9. Examples of prioritisation in infrastructure project pipelines

Brazil

Launched in 2016, the **Investment Partnership Program** (PPI) aims to identify and execute the infrastructure projects that best further the socio-economic priorities of Brazil. The PPI provides a platform to enhance private sector involvement in public infrastructure projects. Projects are proposed by relevant ministries to the PPI Council, which evaluates and recommends a pipeline of most significant infrastructure projects to the President. All projects included in the PPI pipeline are designated as national priority and are guaranteed to be executed. The PPI Council is assisted by a Secretariat, which oversees the technical aspects and liaises with investors while the National Bank for Economic and Social Development (BNDES) provides financial support to the pipeline. Credit lines are also offered by the Caixa Econômica Federal Bank to projects that satisfy the credit requirements. Examples of prioritised projects include the South Integration Highway, Ferrogrão Railroad (new railway corridor for commodities export from Brazil) and the Transmission Facilities Concession (capacity expansion and installation of 3 954 km of transmission lines spread across 5 regions). All projects are screened for environmental impact.

Source: http://www.avancarparcerias.gov.br/about-the-program

Australia

Infrastructure Australia was established in 2008 to advise the government and *inter alia* create and administer the Infrastructure Priority List (IPL). The IPL comprises projects of national importance and is periodically published by Infrastructure Australia on its website. Projects originate and are identified through a call for proposals as and when required. Proposed projects are assessed according to an Assessment Framework that prescribes a five stage process to prioritise and implement the most strategic projects: 1) Problem Identification and Prioritisation; 2) Initiative Identification and Options Development; 3) Business Case Development; 4) Business Case Assessment; and 5) Post Completion Review. Some examples of prioritised projects are the Brisbane Metro, the Myalup-Wellington Water Project (to address water salinity in the Wellington dam and modernise the water distribution network below the dam) and the Inland Rail (to enhance freight connectivity between Melbourne and Brisbane). All projects are evaluated for their environmental impact as prescribed by the Assessment Framework.

Source: *http://infrastructureaustralia.gov.au/*,*https://ia-priority-list.herokuapp.com/pdf* [PDF]; http://infrastructureaustralia.gov.au/policy-publications/publications/assessment-framework-ipl-inclusion.aspx

World Bank Group: Infrastructure Prioritisation Framework (IPF)

The World Bank Group's Infrastructure Prioritisation Framework (IPF) is a quantitative tool that allows policy makers to compare competing infrastructure projects and prioritise the most viable ones for execution. To date, the IPF approach has been applied in Viet Nam and Panama. Using a visualisation-based tool, projects are evaluated against two indices: 1) the Social and Environmental Index; and 2) the Financial and Economic Index. Component variables of each index are tested with and confirmed by consultations with key stakeholders, in accordance with sectoral and national strategic priorities. Projects are then scored and plotted on a multi-criteria visualisation framework where a measure of public budget constraint is used to determine final positions of projects in one of four

categories (based on their performance on social, environmental, financial and economic indicators). The resulting framework allows policy makers to identify projects that best meet sectoral and national policy goals. The process leaves sufficient room to accommodate further political and economic factors and highlights barriers and gaps that may prevent the bankability of certain projects.

Source: Marcelo et al. (2016[50])

3.5. The importance of project support for building robust project pipelines: Policy incentives and institutions to support large-scale, low-carbon investment in the United Kingdom

Governments can use a wealth of policy tools and regulatory instruments to support project pipeline development and drive low-carbon investments depending on country needs, including: public funds such as grants and loans, risk mitigants like guarantees, other investment promotion measures including incentives, information frameworks or supporting research in new technologies. These are used to bridge low-carbon infrastructure investment gaps, overcome barriers to investment, indicate future investment opportunities and catalyse private sector investment. Of additional importance to project developers and investors is having access to effective institutions to facilitate investments within a strong enabling investment environment (OECD, 2015[51]).

Current practices among governments in providing public funds and institutional support – "project support" for the purposes here – suggests that governments have a vested interest in the success of building project pipelines that align to national objectives. As discussed in Chapter 2, governments want to ensure projects are attractive to investors, added to the pipeline, and not held up before deployment. Project support is often required to get low-carbon projects "over the line" and help them reach an investment-ready or bankable state.[67]

This case study looks at renewable energy project support in the United Kingdom, an early leader in establishing national climate policy including a world-first legally binding Climate Change Act (2008) to reduce greenhouse gas emissions by at least 80% below 1990 levels by 2050 and set five-yearly caps on emissions. One way for the United Kingdom to make progress to reach this emission reduction target is to take advantage of its excellent renewable energy potential, specifically wind resources on land and – the focus of this case study – wind resources in the surrounding seas.

Until recently, however, the development of bankable offshore wind energy projects in the United Kingdom (and elsewhere) was greatly hindered by prohibitively large investment barriers facing early-stage projects. The United Kingdom identified and targeted these investment barriers, employed policy instruments, designed capacity auctions and established institutions to foster offshore wind technologies in the country. Today, the United Kingdom is the world's largest market for offshore wind with almost 40% of the global installed capacity.

Project support case study summary box

What is it? Establishing an investment-enabling environment with policy incentives, public funds and institutional support to overcome low-carbon infrastructure investment barriers, mitigate project investment risks, and ultimately foster and sustain markets for high potential low-carbon technologies.

Why is it essential to building robust project pipelines? Project support is necessary to ensure project pipelines consist of bankable projects that successfully align to climate objectives and are attractive to investors. For projects that are not bankable, securing debt financing and equity investment is typically very challenging, because investors and/or project developers are presented with unacceptable risks.

Who is involved? The United Kingdom government kick-started the offshore wind energy market by establishing dedicated public institutions, policy incentives to target investment barriers, and capacity auctions to indicate future opportunities.

Key messages and actions for governments to consider on project support

- target high-potential and suitable, but as yet under-developed, low-carbon technologies
- mainstream key project support within national long-term climate strategies
- address specific barriers to lower investment hurdle rates
- align existing institutions to help fill knowledge and funding gaps, and disseminate lessons.

3.5.1. Case study context

Being one of the first countries to recognise climate change as an economic issue, the United Kingdom has a suite of policies designed to combat climate change and leverage opportunities arising from it. The 2008 Climate Change Act and ensuing electricity market reforms, the 2017 Clean Growth Strategy complemented by a 25-year Environment Plan, the Industrial Strategy, and the recent update to the National Planning Policy Framework together provide a robust context for the country's low-carbon transition. The common Nationally Determined Contribution of the European Union includes commitments of the United Kingdom, in addition to the recent submission of its mid-century strategy to the UN climate agency.[68]

The United Kingdom has made significant progress to decouple economic growth from emissions, leading the Group of Seven (G7) countries, with United Kingdom economic growth up 45% and emissions down 33% since the early 1990s on a per capita basis (ECIU, 2017[52]). As a result, the country has so far outperformed its carbon budgets (relative to its short-term caps on emissions), providing impetus to increase ambition where economically attractive. The government unveiled its Clean Growth Strategy in October 2017, articulating policies and proposals to accelerate the low-carbon transition and ensure achievement of the fourth and fifth carbon budgets.[69]

The Clean Growth Strategy identifies measures to develop the British low-carbon economy while maximising social, environmental and economic benefits and minimising net costs. Among the key policy priorities are developing green finance capabilities

through the Green Finance Taskforce, low-carbon technologies, ensuring energy security and diversifying the energy mix, modernising and innovating energy infrastructure, and enhancing natural resource management and efficiency. The strategy further details an investment plan for GBP 2.5 billion by the government over 2015-21[70] to catalyse private capital and foster an investment-enabling environment. A Green Growth Inter-ministerial Group will monitor implementation and progress and drive policies promoting green growth. The strategy is dynamic and will be updated annually.

Institutional support for infrastructure development

A varied institutional framework has been put in place to support infrastructure development in the United Kingdom:

- The government provides project support through the Infrastructure and Projects Authority (IPA), the government's centre of expertise on infrastructure and major projects (Green Finance Taskforce, 2018[53]), which creates a pipeline of priority projects in keeping with the National Infrastructure Delivery Plan.
- A financial envelope, the United Kingdom Guarantee Scheme (UKGS), is attached to the pipeline to provide government support to attract private capital as needed.
- An independent assessment of the United Kingdom's long-term infrastructure needs is conducted once every five years by the National Infrastructure Commission (NIC), a non-ministerial government department providing independent strategy thinking, analysis and advice to address the United Kingdom's long-term infrastructure needs (Green Finance Taskforce, 2018[53]).
- Further, the independent Committee on Climate Change is the key institution to advise the United Kingdom government on building a low-carbon economy and managing climate change in accordance with the Climate Change Act. The committee informs the assessments undertaken by the NIC. For instance, in its letter to the NIC in March 2017, the committee highlighted six priority areas for infrastructure investment: 1) smart low-carbon power; 2) electric vehicle charging network; 3) heating; 4) carbon capture and storage; 5) flood risk management and drainage; and 6) water management and supply.

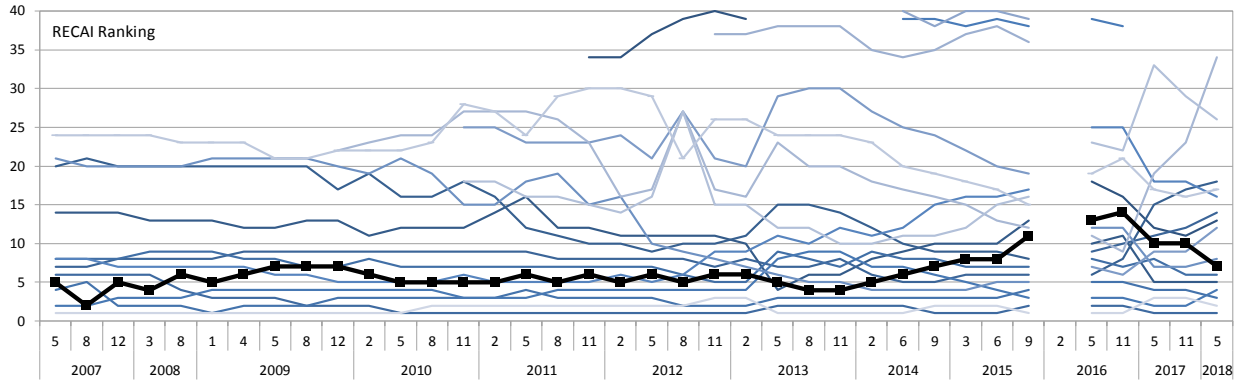
Renewable energy in the United Kingdom

Policy measures like the Renewables Obligation (RO), feed–in-tariffs, and auctions to award "contracts for difference" (CfD; see below), for instance, have been crucial to the development of the renewable energy sector in the United Kingdom (see more details below). According to national statistics, almost 30% of all electricity generated in 2017 came from renewable sources, up from 24.5% in 2016 (UK BEIS, 2018[54]). With nuclear energy providing around 20% of electricity generated in 2017, the United Kingdom generated just over half of its electricity from low-carbon sources of energy.

The United Kingdom has built one of the most attractive investment environments for renewable energy. While "investment attractiveness" comprises many dynamic political, economic, institutional and technological factors, and is therefore difficult to assess, the United Kingdom is regularly one of the highest ranked countries (often in the upper third of G20 countries) in the EY Renewable Energy Country Attractiveness Index (RECAI),[71] which provides an assessment of 40 countries globally (Figure 3.5). The RECAI does not provide a long track record for attractiveness of offshore wind energy projects in the

United Kingdom, but recent rankings across the 40 countries have placed the United Kingdom first for offshore wind in May 2017, first in October 2017 and second (to the People's Republic of China, hereafter "China") in May 2018.

Figure 3.5. EY Renewable Energy Country Attractiveness Index, G20 countries (2007–2018) United Kingdom in bold



Notes: Left axis provides country ranking according to the EY Renewable Energy Country Attractiveness Index (RECAI) where a lower number is higher rank and higher attractiveness. Timeline is given by month and year of index publication (e.g. most recent in May 2018).
Source: EY (2018[55]).

To help create this market to invest in offshore wind, in 2012 the United Kingdom established the Green Investment Bank (GIB). A state-owned financial institution[72] with a specialised mandate, the GIB could provide patient capital and contribute to creating and fostering viable markets for green infrastructure. For instance, the GIB's Offshore Wind Fund, established in 2014, has been able to leverage private capital to acquire operating assets and free-up developers' capital for reinvestment. The GIB will be further explored below.

3.5.2. Focus on project support factor

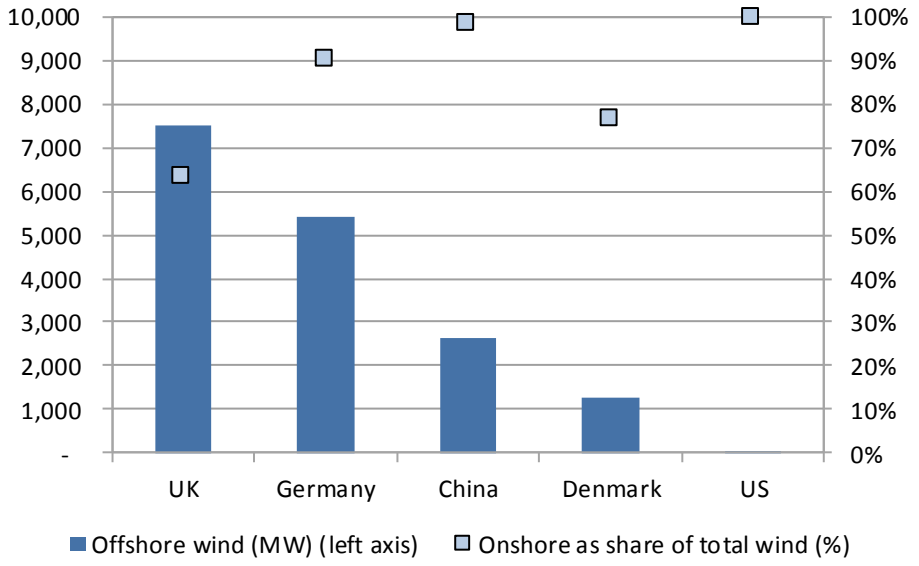
Supporting offshore wind energy infrastructure in the United Kingdom

The innovative nature of clean energy, implying for instance high investment risks and high capital costs, means that developers and investors often need policy and institutional support to deliver economically viable projects. Onshore wind energy projects are a central element to many countries' mitigation commitments, and have been in commercial use for decades. Commercial offshore variants, on the other hand, are relatively recent developments – in the last 10–15 years or so. Unsurprisingly, therefore, onshore wind energy is a leading technology, with the industry adding around 50 GW in new installed capacity globally per year (around USD 50 billion in investments). By the end of 2017, the wind industry reached 540 GW in cumulative installed capacity globally (GWEC, 2018[56]). Importantly, the global nature of energy markets brings with it the wide distribution and commercialisation of onshore wind energy technology and rapid cost reductions, in turn directly influencing the transition of the technology to offshore areas.

The United Kingdom is the world's leading country for offshore wind development. To date, the country has around 7 GW of operational capacity which is almost 40% of global

capacity; 18 GW as of year-end 2017 (RenewableUK, 2018[57]; GWEC, 2018[56]). Last year, the United Kingdom accounted for more than half of new offshore wind capacity built in Europe (WindEurope, 2018[58]). In addition, the United Kingdom has 12 GW of onshore wind installed capacity (RenewableUK, 2018[57]). The approximate 60:40 split between onshore and offshore wind installed capacity is rather unique among countries with large installed capacity of wind energy (see, for instance, Figure 3.6). This ratio is a good indication for the ratio between onshore and offshore wind energy projects in the United Kingdom (see Box 3.10 for more details).

Figure 3.6. Global offshore wind energy installed capacity and ratio of onshore wind to total wind (end 2017, selected countries)



Note: Bars show installed capacity in MW as of end 2017; markers show onshore wind installed capacity as a share of total wind installed capacity (onshore plus offshore). UK (United Kingdom), US (United States).
Source: IRENA (2018[59])

Box 3.10. Wind energy investment challenges in the United Kingdom

The ratio of "onshore to offshore" wind energy capacity can indicate the relative priority of each technology in a country. Most countries have developed their onshore wind sectors to a far greater extent than their offshore wind sectors, pointing to the relative attractiveness of technology and the investment barriers facing their development. A 60:40 ratio in the United Kingdom is a strong outlier with respect to other global leaders in wind energy like the People's Republic of China (hereafter "China"), the United States or Germany where investment has focused on onshore (with ratios of 99:1, ca. 100:0, 90:10 respectively (IRENA, 2018[59]; GWEC, 2018[56]) – see also Figure 3.6).

The balance between onshore and offshore wind in the United Kingdom is more likely due to important barriers facing the United Kingdom onshore wind industry as opposed to the offshore industry. These challenges are not limited to the United Kingdom, but are perhaps more pronounced than in China, the United States or Germany. Despite the United Kingdom's excellent wind resources and on-going experience with the technology, expanding onshore wind investment is limited by the following:

- Dense population centres (in the south) that are distant from the wind and land resources in the north of the country.
- Large-scale onshore wind developments in the United Kingdom often face delays and planning difficulties. For instance, as a relatively small island nation with a high population density it can be challenging to find adequate space or public support for such projects. This includes delays in the connection to or necessary construction of large-scale electricity transmission infrastructure that transfers the wind energy from the north to the demand in the south.
- Limited electricity transmission interconnections to neighbouring European countries mean the United Kingdom's energy system faces additional operational challenges to wind energy development. The electricity system operator has relatively limited options to balance the variable nature of wind energy, for instance by exporting surplus energy through interconnections with neighbouring countries (e.g. to France, Ireland, the Netherlands or Norway). This is unlike Germany, for instance, which has many connections to neighbouring countries.

Despite these challenges, onshore wind is an easier and cheaper alternative to the offshore variant. Offshore wind energy faces several unique challenges mainly resulting from "translating" a land-based technology to a marine environment. It is a rapidly expanding industry, but key remaining issues include:

- challenges from the marine construction and operating environment
- one of the largest capital investment requirements for renewable energy projects
- less operational experience with the technology
- smaller and less developed supply-chains.

Offshore wind technology may face fewer land (seabed) access issues and can often be placed relatively closer to demand centres than onshore wind; for instance, the world's largest offshore wind energy project and Europe's largest windfarm, the London Array, is located only 20 kilometres away from London in relatively shallow water and feeds

electricity directly into the London-area network.

What are the elements of the United Kingdom's project and institutional support to develop a robust pipeline of offshore wind projects?

Despite improvements in the technical and commercial nature of the technology, there are a number of remaining investment barriers. Offshore wind energy projects are characterised as large and capital-intensive investments (often costing EUR 1 billion or more). As a result, project developers face numerous technical and financial risks, including fluctuating costs, varying technology options (e.g. rapidly increasing wind turbine sizes) and a lack of affordable finance. At the same time, investors may be put off by large individual tickets[73] or relatively unstable costs compared to alternatives.[74]

The United Kingdom Department for Business, Energy and Industrial Strategy (BEIS) provides regular updates on United Kingdom electricity generation costs for recently commissioned technologies (and also costs of those expected in 2020 and 2025). In the BEIS's assessments of indicative investment hurdle rates[75] for projects, offshore wind invariably has one of the highest. For instance, the capital costs of an offshore wind project per unit of energy delivered (e.g. GBP per MWh) is typically over 70% of the total cost (UK BEIS, 2016[60]) (only coal power plants fitted with carbon capture and storage are higher in this respect).[76] The cost of financing these capital-intensive projects results in high investment hurdle rates. On a more positive note, offshore wind energy hurdle rates fell more than 30% between the 2013 and 2016 assessments (using central estimates) (UK BEIS, 2016[60]).

The institutional and policy landscape in the United Kingdom has focused on overcoming barriers that hinder the development of potentially important sectors. Recent efforts, for instance, aimed at improving the feasibility of offshore wind energy investments and playing to the country's strengths, such as:

- high average offshore (and onshore) wind speeds (some of the highest in Europe)
- relatively shallow waters
- long coastlines, suitable landing sites for connecting offshore cables and close proximity of projects to land
- a wealth of knowledge from the onshore wind energy industry
- existing offshore engineering knowledge from the oil and gas sector
- suitable electricity transmission capacity along the coasts
- large energy demand near the coasts from cities and industrial centres.

A series of decisions by the United Kingdom government in the following areas were essential to the rapid development of the offshore wind industry:

1. to lower the high investment hurdle rates faced by project developers and investors, the United Kingdom provided financial incentives for 15 years through the "contracts for difference"
2. to align land and seabed leasing processes, the United Kingdom's public land and seabed manager structured bidding rounds for access and construction permissions

3. to highlight future investment opportunities, the United Kingdom designed a series of competitive bidding rounds to auction available offshore wind capacity
4. to overcome key investment gaps, the United Kingdom established a dedicated promotional institution, the GIB, to promote low-carbon infrastructure investment with a key focus on offshore wind and crowd-in investors.

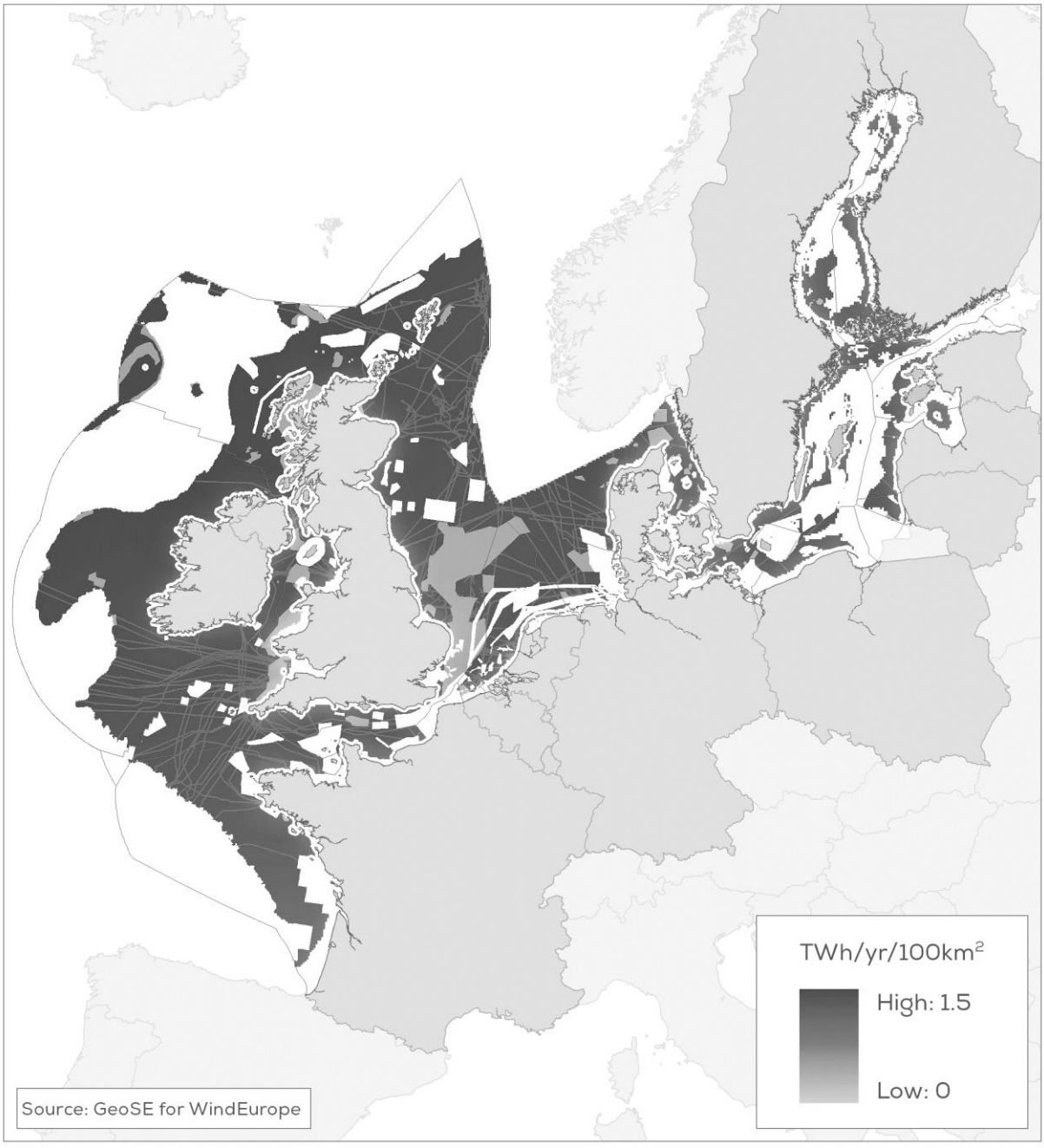
For the purposes of this case study, the following elements of the United Kingdom's support for offshore wind energy will be discussed in turn:

- identifying technologies of high, untapped potential
- targeting barriers with specific policy instruments
- indicating future market demand for offshore wind
- providing key institutional support.

Identifying technologies of high, untapped potential. A recent study into offshore wind potential in Europe estimated that the United Kingdom would likely remain the leading offshore wind market in Europe through to 2030 (BVG Associates and WindEurope, 2017[61]).[77] The baseline scenario estimated that installed capacity would more than triple from the current 7 GW to 25 GW by 2030, to almost 30 GW in a more ambitious scenario.[78]

According to the United Kingdom's renewable energy association, 25 GW in offshore wind capacity could power 75% of households in the United Kingdom (of approximately 20 million homes) (RenewableUK, 2017[62]).[79] The same study found the United Kingdom to host the most technical potential of the technology by 2030 (based on wind speed, cost, transmission access, energy system and so on) – as shown in Figure 3.7.

Figure 3.7. Technical potential of offshore wind in 2030, United Kingdom



Note: Figures show baseline scenario – deeper colours indicate higher potential annual energy production (in terawatt hours potential generation per year) in areas of 100 square kilometres. See source for details on methodology.
Source: BVG Associates and WindEurope (2017, p. 30[61]).

Scaling-up offshore wind plays a central role in the United Kingdom's climate ambitions and its 2017 Clean Growth Strategy (UK BEIS, 2017[63]). Indeed, a major element to the strategy is that the government wants to work with the offshore wind industry to develop a "Sector Deal for offshore wind" to drive investment of GBP 17.5 billion by 2012 and

plan how to invest and develop 10 GW in new capacity (UK BEIS, 2017, p. 15[63]), with room for additional "cost-effective projects" in the 2020s. The strategy also allocates GBP 177 million to support innovation and further reduce the cost of renewable energy through research and development, with a focus on offshore wind turbine blade technology and foundations.

Targeting cost barriers with specific policy instruments. Offshore wind investments inherently face high costs and significant hurdle rates as mentioned earlier. With any energy investment, a predictable cash-flow reduces investment risks greatly. The United Kingdom has experimented with various support tools to help lower hurdle rates for renewable energy, including tradeable certificates, feed-in tariffs and, currently, "contracts for difference" (CfD).

The CfD instrument sets a "strike" price per unit of energy delivered from a project to reflect the costs of investing in low-carbon technologies. The project developer will receive this fixed energy price as a payment **on top of** the energy market price. In this way the CfD has a back-stop, meaning the payments can never go **below** the strike price but, if the market-price goes above the strike price, the project developer pays back the difference to the strike price. This instrument offers investors with more predictability than market pricing alone and the government is less exposed to the costs than fixed payments like feed-in tariffs.

In addition, the CfD provides support for 15 years, which is similar in length to support from feed-in tariffs and sufficient to fit with traditional economic lifetime assessments like cash-flow analyses. To receive the CfD,[80] offshore wind project developers (or more typically consortia) must participate in an auction for capacity, submitting bids.[81]

Indicating future market demand for offshore wind. The results from the auctions for offshore capacity (the first auctioned 1.2 GW in capacity in 2015; second 3.2 GW in 2017; the third is planned for Q2 2019) have shown some significant reductions in technology cost. Winning bids in the second auction were 50% lower than the first (UK BEIS, 2017[64]).[82] The rapidity of this cost reduction outpaced the government's expectations by four years (in: Clark (2017[65])).

In advance of these auctions, the Crown Estate,[83] the land and sea management agency for the United Kingdom, streamlined policy and regulatory activities in the context of sequencing offshore wind developments. It organised offshore wind consents for pre-planning and construction into three "rounds" and the nine project zones to which developers can design bids, apply for access to lease the seabed and build projects. The Crown Estate also manages the so-called Offshore Transmission Owner/Operators who are charged with maintaining offshore electricity grids and transmitting energy to the onshore system operator, National Grid. The first two rounds from 2001 and 2003 each awarded 8 GW in potential developments and the third round announced in 2007 could allocate a further 25 GW. The Crown Estate also collaborates with the offshore wind sector to share data and best practices and take planning lessons from preceding rounds to improve subsequent rounds.

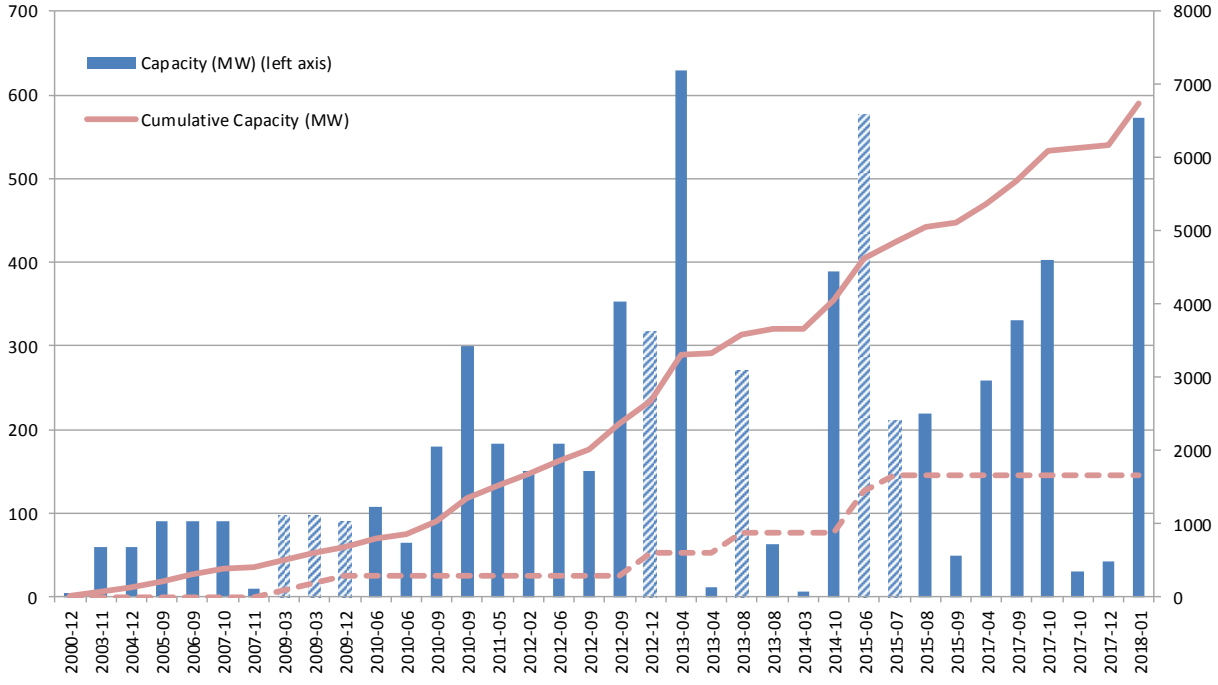
Providing key institutional support. In 2011, the Department of Business, Innovation and Skills (now BEIS) estimated that the United Kingdom needed investments of GBP 330 billion until 2020 to meet its energy and climate obligations; double the forecast investment (UK NAO, 2017[66]). A key institution to scale up green investment was the UK Green Investment Bank, established in 2012 as a dedicated institution to promote investment and provide financial support (in the form of loans rather than risk mitigants

like guarantees) to "green infrastructure" of national importance.[84] With capital of GBP 3.8 billion,[85] the GIB was mandated to identify key barriers, provide funding at commercial terms and focus investments on offshore wind, energy efficiency and other renewable energy (OECD, 2016[67]).[86]

The GIB was an active investor in United Kingdom offshore wind projects, investing approximately two-thirds of its capital into offshore wind projects. The GIB also mobilised approximately GBP 2 in offshore wind investment for every GBP 1 committed by the GIB (Templeton, 2016[68]). Figure 3.8 shows the development of the offshore wind market in the United Kingdom, reaching 7 GW in installed capacity by early 2018. Accounting for both primary and secondary investments, the GIB has co-invested in almost half of the installed capacity in the first 10 offshore wind projects in the United Kingdom. This rate continued to June 2015, with the GIB co-investing in almost 50% of all offshore wind projects in the United Kingdom on a capacity basis.

After June 2015, the market greatly expanded without the same level of public investment. While it is difficult to draw causal links here between the GIB and the United Kingdom's offshore wind market, the GIB was a major primary and secondary investor in the early United Kingdom offshore wind market. It also appears to have played a key role in developing the market to the point where it now does not depend on co-investment by a public financial institutions.[87] A shifting investor base from public to private and increasing involvement of institutional investors is an indication of a maturing market.[88]

Figure 3.8. UK offshore wind by project commissioning date and installed capacity



Note: Hashed bars indicate where the United Kingdom Green Investment Bank (UK GIB) was a co-investor in a project (both primary and secondary financing – see text for details). The line is total cumulative installed capacity, while the dashed line is cumulative installed capacity of projects in which the UK GIB was co-invested.
Source: OECD analysis of Bloomberg New Energy Finance data (see www.bnef.com – subscription required)

The Crown Estate highlights that ownership in the UK market is shifting strongly towards financial institutions, specifically pension funds, as many original project developers sell equity stakes in operating projects (The Crown Estate, 2017[69]; The Crown Estate, 2018[70]). Indeed, in the period 2011–17, the number of financial investors in offshore wind primary and secondary markets grew by 350% (The Crown Estate, 2018, p. 16[70]). By the end of 2017, United Kingdom offshore wind projects were still dominated by utilities and investors, with 62% and 30% ownership respectively (The Crown Estate, 2018[70]), with increasing investor participation expected in the future. The GIB specifically made efforts to bring private sector investors into all of its investments (Matikainen, 2017[71]), including non-traditional investors like pension funds.[89]

3.5.3. Summary: What can governments do to provide project and institutional support?

This case study highlights the importance of project and institutional support to developing the United Kingdom's offshore wind energy market. Identifying a technology which has high potential but faces significant investment barriers, the United Kingdom built a supportive framework of policy incentives, competitive auctions and institutional support to become the world's leading offshore wind market. The growth is expected to continue as costs and risks fall and the projects are attracting a new set of investors such as pension funds.

The aim of this case study is to highlight how project support has been used to develop project pipelines in the United Kingdom for a particularly difficult technology. The challenges faced by the United Kingdom and the successes described above are not unique to developed economies nor are they restricted to offshore wind energy projects. Indeed, even "mainstream" clean energy projects like solar photovoltaic face significant barriers to investment in many sun-rich countries. This is particularly important in the context of many emerging and developing economies where the solar industry could have more potential than offshore wind in the United Kingdom.

There are many possible approaches that governments can take to support projects (Box 3.11 includes some other examples of project support in various contexts). Key elements of the United Kingdom's approach to supporting offshore wind projects are summarised in Table 3.7.

Table 3.7. Overview of project support elements and application in the United Kingdom

Element of project support	Application in this case study
Identifying high-potential technologies	Scaling-up and developing technologies in support of clean energy objectives but lack development on a national scale
Employing specific policy tools to overcome barriers	Understanding investment barriers, learning from what works or worked elsewhere, and targeting investments with specific policy incentives and risk mitigant instruments
Aligning investments to central low-carbon development strategies	Mainstreaming low-carbon investments within the context of national growth strategies
Establishing or enabling institutions	Aligning institutions and providing project developers and investors with access to key support

Table 3.7 illustrates how robust project support plays a central role in developing domestic markets (in this case, in the United Kingdom) of low-carbon technologies aligned to long-term climate objectives. It shows how the United Kingdom identified and overcame investment barriers and supported the development of attractive projects through providing strong investment environments, good policies and supportive

institutions. Moving beyond the United Kingdom, project support may be particularly important and effective when combined with other policy actions like prioritisation or aligned to investor needs including liquidity and sourcing future investment opportunities. In order to better understand how countries can use the lessons presented here, the following considerations of project support could be explored in more detail:

- *How to maintain a link between project support today and long-term objectives?* The United Kingdom Committee on Climate Change is charged with ensuring the government adheres to the five-yearly carbon budgets implied under the United Kingdom's 2050 climate change commitments. It also makes efforts to "translate" carbon budgets into sectoral pathways (like the power sector) on which the government can set domestic policy such as scale and scope of policy incentives. Further research could examine how best to increase ambition of long term national climate commitments and translate this ambition into sectoral policy and project support. For instance, the United Kingdom government has recently announced that it will ask the Committee on Climate Change to provide advice on the implications of the 2015 Paris Agreement for the United Kingdom's long-term targets to reduce its greenhouse gas emissions[90] – see also the section 3.7 on maintaining pertinence of project pipelines.
- *How to unlock global and local economies of scale and bring costs down?* The offshore wind energy market is rapidly shifting towards larger wind turbines (from 4–5 GW per turbine in 2014 to 8 GW in 2018 and growing (WindEurope, 2017[72])) and a more efficient supply chain (installation time from 20–30 days per turbine in 2004 to 5–10 days per turbine in 2014 (The Crown Estate, 2014[73])). Not all countries will be able to transform markets for low-carbon technologies in the same manner as the United Kingdom appears to have done for offshore wind. This is particularly true if the technology is new or of limited scale in the country and so policy-makers could, for instance, consider how best to benefit from technologies with large deployment potential but that are not yet used at commercial scales.
- *How to determine when to end project support?* Project support in the form of policy and financial incentives, like feed-in tariffs, are an element of the wider investment-enabling environment, but ideally should not be used indefinitely to promote private investment. Gaps and investment barriers could instead be addressed in a targeted manner, making selective use of a suite of actions available to governments depending on what is most effective (including regulations, investment or co-investment in targeted projects by state-owned investment, public-private partnerships, and so on). The United Kingdom government is considering, for instance, providing financial incentives only to onshore wind projects in remote islands of the United Kingdom, which rely largely on diesel generators for electricity.

Box 3.11. Examples of project and institutional support in infrastructure project pipelines

Programme for Infrastructure Development in Africa

The Programme for Infrastructure Development in Africa (PIDA) is a blueprint for continent-wide infrastructure development in energy, transport, trans-boundary water and telecommunications. Adopted in 2012 by African heads of states, and spearheaded by the African Union Commission, the New Partnership for Africa's Development (NEPAD) Agency and the African Development Bank (AfDB), the initiative devised a Priority Action Plan (PAP) that identified 51 cross-border projects to boost regional connectivity and growth. Two examples of financial and institutional support for the PIDA are:

1. The **Africa50 Infrastructure Fund**, which was established as part of PIDA, with the AfDB and African countries as key shareholders. The fund seeks to catalyse public finance, leverage private capital and ensure creation and execution of bankable projects. The fund includes PAP projects and other projects sourced through a network of stakeholders.
2. The **NEPAD Infrastructure Project Preparation Facility (IPPF) Special Fund** is another source of support available to PAP projects. It was established in 2005 to provide quality project preparation and address the lack of bankable projects in Africa. Hosted and managed by the AfDB, the NEPAD-IPPF has, upon consultation with relevant stakeholders, unbundled the PAP into a pipeline of 110 regional projects.

Sources: Rohde (2015[74]); *http://nepadippf.org/*; *https://au.int/en/ie/pida*;*www.africa50.com*

Association of South-East Asian Nations (ASEAN) Infrastructure Fund

The ASEAN Infrastructure Fund (AIF) is an example of national and supra-national public intervention to inspire investor confidence and attract financing for much needed infrastructure projects in the region. Formed in 2012, the fund is capitalised by ASEAN governments and the Asian Development Bank (ADB). As the administrator of the fund, the ADB creates a country pipeline of projects financed by the AIF, in light of its Country Partnership Strategy. The ADB further co-finances all projects and provides technical support to ensure bankability of projects in priority sectors including transport, energy, water and sanitation, environment and rural development, and social infrastructure.

Sources : Rohde (2015[74]) ; *http://www.nortonrosefulbright.com/knowledge/publications/61409/new-source-of-funding-asean-infrastructure-fund-aif*; *https://www.adb.org/site/funds/funds/asean-infrastructure-fund*; *https://www.adb.org/projects/fund/ASEAN%20Infrastructure%20Fund*

South Africa

To augment South Africa's energy generation capacity (and reduce its reliance on coal-fired power), and increase private sector participation in the energy market, the country established the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) in 2011. Designed to allow private sector ownership and production of energy, the REIPPPP comprises a reverse auction for capacity where winning projects receive a power purchase agreement (PPA) for 20 years by Eskom (the state-owned energy utility) guaranteed by the Treasury. The programme furthers the objectives of the country's National Development Plan and meeting national climate targets. The National Development Plan envisages the installation of 10 000 MW in additional electricity

capacity by 2025. As on December 2016, almost 6 500* MW had been procured from 112 renewable energy independent power producers in seven bidding rounds.** Qualifying technologies include onshore wind, solar photovoltaic, solar thermal, biomass, biogas, landfill gas and small hydro. To deliver the programme, the Department of Energy, the National Treasury and the Development Bank of Southern Africa established an Independent Power Producer Unit. The unit offers advisory services, procurement management services and evaluation, monitoring and contract management services.

Notes: * 6 327MW sourced from 92 large-scale projects and 49MW from 10 small-scale projects. ** Rounds 1, 2, 3, 3.5, 4, 1S2 and 2S2.

Sources: https://www.iea.org/policiesandmeasures/pams/southafrica/name-38785-en.php; https://ipp-projects.co.za/; https://www.ipp-projects.co.za/Publications/GetPublicationFile?fileid=c68a3b75-1c00-e711-9464-2c59e59ac9cd&fileName=20170215_IPP%20Office%20Q3_2016-17%20Overview.pdf *[PDF]*

3.6. Note on project eligibility criteria and their importance for building robust project pipelines

Developing a pipeline of projects aligned to or in support of long-term climate objectives will necessitate strong systems to assess which projects should be promoted, including clear "project eligibility" criteria. Each of the case studies presented in this chapter include, to some extent, systematic processes for identifying eligible projects and supporting them.

To receive fast-tracked regulatory support as a European Project of Common Interest, for instance, the project needs to have "a significant impact on at least two EU member states" in addition to meeting European Investment Bank criteria (section 3.4). The United Kingdom government provides project and institutional support only to specific types of renewable energy projects (e.g. offshore wind receives different support than solar photovoltaic) and in specific locations (e.g. the sequenced bidding rounds organised by the Crown Estate) (see section 3.5).

Importantly, since current country pledges are insufficient to meet current long term climate objectives, project eligibility guidelines will be expected to change as ambition of the pledges increases.[91] In other words, projects that are eligible to meet a country's Nationally Determined Contribution (NDC) today may not be eligible later to meet more stringent targets at national level, e.g. by 2050 and beyond.

Governments will be expected to set conditions of how the NDCs are translated into a series of projects aligned to the Paris Agreement, and provide guidance on which projects should be built and supported and which should not (to avoid expensive economic stranding of assets or inefficient and costly infrastructure path dependencies). Section 3.7 examines the need for infrastructure strategies to retain an element of flexibility and be dynamic to changing environments. Going forward, countries will want to ensure their project pipelines are responsive and continually adapted to changing conditions, ambitions and uncertainties.

3.7. The importance of dynamic adaptability for building robust project pipelines: The case of water infrastructure planning and financing in the Netherlands and the United Kingdom[92]

Infrastructure is a typically a long-lived, capital-intensive investment. Choices made today about the nature, location and design of infrastructure will have long-lasting effects that influence the extent to which investments deliver anticipated benefits over time and align with broader policy objectives. Having project pipelines characterised by "dynamic adaptability" – the flexibility to adjust to changing conditions and remain pertinent over time – is crucial to adequately respond to shifting economic, demographic, technological or climatic trends and avoid premature obsolescence of infrastructure or costly retrofitting.

This report has placed emphasis on mitigation infrastructure planning and investment. However, the challenges associated with meeting water infrastructure investment needs – and emerging good practices – are extremely valuable beyond the water sector. A number of lessons discussed in this section are important for governments to bear in mind while developing national plans and strategies for all infrastructure, including energy, transport, buildings, water and other types.

Water infrastructure has many similarities to other types of infrastructure. For instance, it is typically very long-lived, lasting 80–100 years for dams and conveyance infrastructure (perhaps even double the expected lifetime of energy power plants). It is very capital-intensive, and this generates considerable path dependencies and network difficulties. At the same time, water infrastructure should be designed to cope with demographic and economic trends and shifting patterns of urbanisation and the associated uncertainties. This infrastructure faces dynamic challenges and must be resilient to shifting hydrological conditions due to climate change, including increasing variability of rainfall, declining snowpack, and more frequent and severe floods and droughts. The unprecedented rate of change and potential novel changes outside of historical experience introduce a greater degree of uncertainty beyond what water infrastructures have traditionally been designed to cope with (OECD, 2013[75]).[93] Historically funded by the public sector, water infrastructure needs to be funded to a much greater extent by the private sector in countries facing public budget constraints, and governments need to foster such investment in order to meet long-term climate and development objectives.

Addressing these challenges requires that efforts to build water infrastructure project pipelines incorporate and are informed by long-term strategic planning of investment pathways that reduce water risks at least cost over time. Well-designed infrastructure projects only deliver expected benefits when they are supported by appropriate institutions (for project design, financing, management, accountability),[94] and when they build on the best available knowledge and information. Effective water infrastructure planning and project pipeline development also requires assessing sequences (or portfolios) of projects and carefully considering how pursuing a specific project may foreclose future options or inadvertently increase vulnerability to water risks. For example, investment in irrigation systems usually reduces the adverse effects of rainfall variability on agriculture, but may also amplify the impacts of drought by encouraging cultivation of water-intensive crops, which cannot be sustained under extreme conditions (Damania et al., 2017[76]).

Addressing the challenge of meeting water infrastructure investment needs also requires that investments in one sector (e.g. flood protection) are not undermined or outpaced by

initiatives in other sectors (e.g. land use, urban planning or property development). Such a requirement may not necessarily be met when projects are assessed, selected and compiled into project pipelines, particularly when consistency or coherence across projects is not considered nor properly valued.

This section briefly examines two case examples of the importance of ensuring infrastructure pipelines are dynamic and adaptable: the Delta Programme in the Netherlands and efforts to improve the resilience of water infrastructure guided by the National Infrastructure Commission in the United Kingdom.

Dynamic adaptability case study summary box

What is it? Dynamic adaptability is the capacity of governments to develop project pipelines that are aligned with policy objectives over time, pertinent and relevant in the long term, responsive to external conditions, and resistant to expensive path dependency or lock-in.

Why is it essential to building robust project pipelines? To develop project pipelines that are dynamic and adaptable, governments should ensure that efforts to build infrastructure project pipelines are informed by and, when possible, embedded within long term strategic planning of investment pathways. Such efforts must also take steps to make investment plans flexible and adjustable over time to reflect shifting economic, demographic, technological or climatic trends, and to avoid premature obsolescence of infrastructure, inefficient path dependencies or costly retrofits.

Who is involved? In the Netherlands, water infrastructure investment is guided by the national government, regional water authorities, and provincial and local municipal planners. Its Delta Programme combines a long-term perspective, an iterative decision-making cycle, and a dedicated fund to guide and implement investments for flood protection. In the United Kingdom, the National Infrastructure Commission was recently established to provide independent, expert advice to the government on infrastructure planning, including for water and flood protection infrastructure.

Key messages and actions for governments to consider on dynamic and adaptable pipelines

- situate project pipelines within, rather than in parallel to, long-term strategic pathways, and medium-term goals like the NDCs, to ensure infrastructure investment remains aligned to long-term policy objectives
- combine long-term strategic infrastructure perspectives with iterative decision making that can be adjusted over time as more information becomes available
- take steps to avoid premature obsolescence of infrastructure, inefficient path dependencies or costly infrastructure retrofits, and consider how short-term actions potentially enable or foreclose future options
- identify actions that promote additional flexibility, and provide opportunities to shift among options depending on evolving trends (economic, climatic, demographic, technological, etc.).

3.7.1. Case study context

Adaptive water management in the Netherlands

The Netherlands has a long and robust tradition of living with water. Located in a delta, more than half of the country's territory and population and two-thirds of its economic activity are flood-prone. Safety against flooding and the management of excess rain have long been the foundation of water management in the Netherlands. Centuries of concerted action and investment helped build and maintain the country's extensive system of primary and regional flood defences (OECD, 2014[77]).

Given its location in a low-lying delta, the main medium- and long-term cost driver related to water management for the Netherlands is the need to adapt primary flood defences to the expected rise in sea and river water levels as a result of climate change. Climate change impacts, such as sea-level rise, imply that considerable efforts of dyke heightening and widening are needed to keep flood safety standards at current levels, while increases in safety standards require even more investment (OECD, 2014[77]).

More recently, a new paradigm towards adaptive water management has put thinking about the future and long-term sustainability at the heart of Dutch water policy. This shift began with the programme "Room for the River" and culminated with the adoption of the Delta Act in 2012. The act established the Delta Programme, the Delta Commissioner and the Delta Fund to advance an adaptive water management approach that places primacy on a long-term perspective (up to 2100) and flexible strategies to cope with future challenges related to water safety and freshwater supplies (OECD, 2014[77]).

Infrastructure planning for water management and flood risk in the United Kingdom

According to the latest report from the United Kingdom's National Infrastructure Commission (NIC), the United Kingdom needs better resilience against floods and droughts to respond to increasing pressures on water infrastructure due to climate change, a growing population, higher environmental standards and aging infrastructures. The NIC emphasises the need to better manage future risks through: improved planning – longer-term and more joined-up planning for flooding, drainage and sewerage; and water and flood management infrastructures that reduce risks and contribute to the environment, including nature-based solutions (NIC, 2017[78]).

Historically, flood risk management in the United Kingdom has been shaped by significant flooding incidents. More recently, some attempts have been made to consider long-term climate change and population pressures.[95] However, despite these long-term assessments, funding to flood risk management has remained disjointed (NIC, 2017[78]). At the same time, England faces water supply challenges (especially in the drier south and east) that require increased drought resilience by combining demand management with long-term investment in supply infrastructure (NIC, 2018[79]).

The NIC was established in 2015 as an executive agency of the Treasury to provide impartial, expert advice on national infrastructure decisions and make independent recommendations to the government on economic infrastructure, including water, wastewater and flood protection infrastructure. The expectation is that more coherent, long-term planning should improve the quality of infrastructure investment.

The NIC is tasked with: 1) developing a National Infrastructure Assessment for every change in government, setting out the NIC's assessment of long-term infrastructure needs with recommendations to the government; 2) preparing in-depth studies into the United Kingdom's most pressing infrastructure challenges, making recommendations to the government; and 3) monitoring the government's progress in delivering infrastructure projects and the programmes recommended by the NIC. Recent reports from the NIC specifically highlight opportunities to improve the resilience of water supply and flood protection infrastructure (discussed in more detail below).

3.7.2. Focus on dynamic adaptability factor

Towards more adaptive water management in the Netherlands

In the Netherlands, the recent paradigm shift towards adaptive water management emphasises taking measures in the short term that will expand capacity to adapt to long term changes and withstand extreme events. This entails integrating a long-term perspective into water management planning with iterative decision making, considering how decisions in the short term potentially enable or foreclose future options, and the use of nature-based solutions, which can avoid or delay lock-in to capital-intensive, conventional "grey" infrastructure.

For example, "Room for the River" was established in 2006 and represented the start of a paradigm shift towards more adaptive water management. Room for the River combines innovative architecture, urbanisation and landscape solutions to build with nature and live with water (OECD, 2014[77]). For the Rhine tributaries, the programme uses flood plain restoration, spatial planning and dyke removal to cope with higher river discharges due to projected impacts from climate change and improve the overall environmental quality. Landscape-based approaches are also central to the "Climate Buffers" programme, which used nature-based solutions to reduce risk of flooding by designing temporary water storage into urban design and recreational sites (see the Netherlands profile in (OECD, 2013[75])).

The Delta Programme combines a long-term perspective, an iterative decision-making cycle, and a dedicated fund to guide and implement investments for flood protection. The Delta Act on Flood Risk Management and Freshwater Supplies that came into effect in January 2012 provides the legal basis for the Delta Programme. It mandates a Delta Commissioner, appointed by the government, to lead the Delta Programme and submit a yearly proposal for action to the Cabinet, in consultation with the relevant authorities, social organisations and the business community. This annual report provides an overview of all measures, facilities, studies and ambitions related to flood risk management and freshwater supplies (OECD, 2014[77]).

The Delta Act also enshrines a Delta Fund, separated from the Infrastructure Fund, to finance the implementation of the Delta Programme and related projects. The Delta Fund provides the Delta Programme with a legally guaranteed budget to cover the costs of planned measures and provisions and therefore addresses the risk of a funding gap. It ensures that sufficient financial resources are dedicated to effectively implement the objectives of the Delta Programme, and, in addition to the regional water authorities' taxation system, frees resources to cover the costs of regular improvement projects. It is expected that at least EUR 1 billion will be made available for the Delta Fund as of 2020, and a total of EUR 10.5 billion for the 2013–28 period in order to cover the costs of measures and provisions for flood protection and freshwater supplies (OECD, 2014[77]).

In addition, new methods have also been developed to explore policy and technical options to support this adaptive planning approach in the Netherlands (Box 3.12).

Box 3.12. Dynamic adaptive pathways: A flexible approach to planning under uncertainty

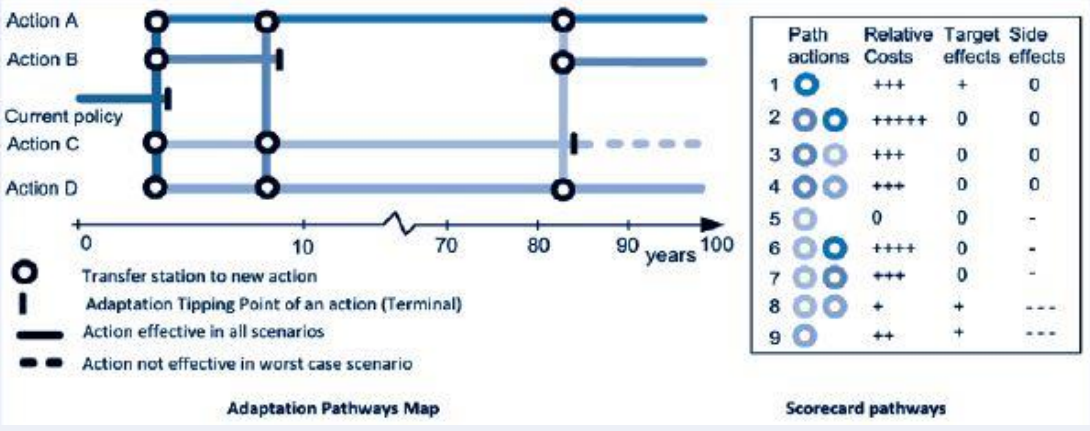
Pervasive uncertainty related to climate change (as well as socio-economic trends more broadly), poses challenges for long-term water management planning, especially when considering investments in water infrastructure. Flexible, dynamic approaches to planning and investment can improve the performance of investments under uncertainty, especially as historical references to hydrological conditions become an increasingly unreliable guide to future conditions.

Haasnoot et al. (2013[80]) set out such a method to support decisions under uncertainty: the Dynamic Adaptive Policy Pathways approach – which can support the development of adaptive policies and plans based on an analysis of possible alternatives over time, under a range of possible future scenarios. The approach considers the performance of each alternative over time and under various future scenarios and identifies opportunities to switch between alternatives ("transfer station"). It also identifies the point in time when the magnitude of change is such that the current management strategy no longer performs "acceptably" as it no longer meets the specified objectives (Haasnoot et al., 2013[80]).

Figure 3.9 provides an illustration of an adaptation pathways map and a scorecard providing an indicative view of the relative costs and benefits of the various pathways. This type of map can support decision makers in identifying opportunities, no-regret actions, possible lock-in, as well as the timing of actions under changing conditions (Haasnoot et al., 2013[80]).

The approach is particularly valuable in highlighting the path dependency of various alternatives, as well as those actions that provide additional flexibility by providing numerous opportunities to shift among alternative actions. From an economic perspective, adaptation pathways that have a number of such opportunities to change course could provide an additional "option" value, by increasing flexibility and minimising path dependency.

Figure 3.9. Interpretation of Dynamic Adaptive Policy Pathways



Source: Haasnoot et al. (2013[80])

Towards more resilient water infrastructure in the United Kingdom

Overall, the NIC reports that long-term planning for water resources and flood risk management is well-established and sophisticated, but discrete (rather than jointly developed) plans have been prepared for different types of water infrastructure. For this reason, the NIC recommends better co-ordination to enable long-term, more efficient and effective planning and delivery, joining up benefits and requirements across different aspects of water management (for example, there might be more opportunities to use water supply reservoirs to reduce flood risk) (NIC, 2017[78]).

To address climate change, as well as uncertainty as how it may develop, the NIC recommends to consider infrastructure needs in different scenarios, and to put in place a framework for decisions that takes account of uncertainty and the lead time needed for planning and construction of infrastructure – thus a "managed adaptive" approach using different climate projections to allow uncertainty to be considered (NIC, 2017[78]).

In addition, the NIC recommends to jointly consider traditional "grey" infrastructures and nature-based solutions, through a more open and strategic approach that ensures that the full range of options are considered at the outset of project development, rather than setting aside separate funding for environmental or natural projects (NIC, 2017[78]).

Funding for flood risk management and coastal erosion is provided by the government from taxation, either directly through grants or indirectly through public sector contributions as part of "partnership funding". In some areas, EU funding is also used for flood management. Furthermore, a levy on household insurance enables subsidised cover in high flood risk areas through the Flood Re scheme.

A capital programme for flood and coastal erosion risk management was set for a six-year period from 2015–21, and funding for maintenance has also been committed to 2021. This allows flood risk management authorities to plan work with greater certainty. However, other resource funding is confirmed on an annual basis. In addition, local flood authorities are in charge of developing local flood risk management strategies in their areas, but local authorities' budgets are under increasing pressure and a more detailed understanding of risks and investments is needed. Moreover, with the forthcoming exit of the United Kingdom from the EU, the fate of EU funds, such as for example, financing from the European Investment Bank (EIB) and the recently privatised Green Investment Bank (GIB), is uncertain (NIC, 2017[78]).

According to the NIC, the six-year capital programme for 2015–21 for flood protection allows greater certainty and should result in more efficient planning than had previously been the case. The plan includes improved protection to 300 000 homes and a reduction of estimated risk by 5%. However, according to the NIC there is still no clear long-term strategy for the level of flood protection that the government is seeking to achieve, and how this will be met in the face of rising pressures. As a result, it is difficult to assess what the right level of spending in future periods should be (NIC, 2017[78]).

In the case of water supply, in England, this service is provided by private sector monopolies with the independent regulator (Ofwat) setting prices. Water companies have invested more than GBP 140 billion over the past three decades, mainly in response to environmental requirements under the EU Water Directives. This investment has delivered improvements to existing infrastructure assets, although limited new supply infrastructure has been built and leakage reduction has stagnated (NIC, 2018[79]).

The NIC estimates that the cost of relying of emergency measures (such as delivery of water supply via road and ship tankers) to address drought between 2020 and 2050 could reach up to GBP 40 billion. In comparison, the cost of proactive long-term resilience measures is estimated in the range GBP 18–21 billion. In light of the strong economic case for increasing supply resilience, the NIC recommends a two-track approach that combines additional investment in water supply infrastructure and demand management (including leakage reduction) (NIC, 2018[79]).

3.7.3. Summary: What can governments do ensure project pipelines are dynamic and adaptable?

The examples of adaptive water management in the Netherlands and the impetus towards greater resilience of water infrastructure in the United Kingdom highlight the need for infrastructure planning that can remain adaptable to future trends, including climate change. The case studies show the importance of governments in ensuring that project pipelines are dynamic and adaptable, informed by long-term strategic pathways, and adjustable over time.

For the Netherlands, the Delta Programme has emphasised integrating a long-term perspective into water management planning with iterative decision making that can be adjusted over time as more information becomes available. Adaptive water management also considers how decisions in the short term potentially enable or foreclose future options. The Delta programme has also emphasised co-ordination and alignment across policy areas, including land use and urban planning, property development, and water management. The method of "dynamic adaptation pathways" illustrates such an approach, which highlights the path dependency of various alternatives under a range of scenarios, as well as those actions that provide additional flexibility by providing opportunities to shift among alternative actions.

For the United Kingdom, the establishment of the NIC as an independent advisory body should provide more coherent, long-term infrastructure planning. The NIC's analysis and recommendations on improving the resilience of water supply emphasises the need for long-term, co-ordinated action among water companies and related investments. For flood protection, the six-year capital programme for the period 2015–21 provides greater certainty and should result in more efficient planning than had previously been the case. However, the NIC recognises there is still more for improvement in flood protection investment and financing.

Finally, both case examples highlight that the type of infrastructure investment can also influence its capacity to adapt to future conditions. In the context of long-term climate objectives, what is feasible today (e.g. based on "current" or best available technologies/processes) should not foreclose consideration of improved performance over time. Project pipeline planning and development efforts should anticipate that not all low-carbon projects that can be considered eligible to meet the NDCs will be considered eligible to meet more ambitious targets over the longer term. Nature-based solutions, which can provide flexibility to adjust to changing conditions compared to more capital-intensive "grey" water infrastructure, provide an interesting model for designing more flexible and adaptable pipeline planning for low-carbon infrastructure.

Key messages

- Situate project pipelines within, rather than in parallel to, long-term strategic pathways, and medium-term goals like the NDCs, to ensure infrastructure investment remains aligned to long-term policy objectives
- Combine long-term strategic infrastructure perspectives with iterative decision making that can be adjusted over time as more information becomes available
- Take steps to avoid premature obsolescence of infrastructure, inefficient path dependencies or costly infrastructure retrofits, and consider how short-term actions potentially enable or foreclose future options
- Identify actions that promote additional flexibility, and provide opportunities to shift among options depending on evolving trends (economic, climatic, demographic, technological, etc.).

Box 3.13. Examples of dynamic adaptability in infrastructure project pipelines

Hutt River flood management, New Zealand

Capital-intensive long-term infrastructure assets face uncertain risks due to climate change. The ability to adapt to a changing environment is thus a crucial hedging mechanism to ensure the long-term socio-economic well-being of communities. The Hutt River Flood Plain Management Plan is a practical illustration of the dynamic adaptive policy pathways approach that provides the latitude to reassess and remodel solutions suited to evolving needs.

The Hutt River covers an area of 655 km^2 and poses flooding risk to assets worth NZD 6 billion. The plan is a product of a consultative process with all relevant stakeholders in the catchment area. It envisages a 40-year time frame to implement effective structural and non-structural flood management solutions. It is designed to be adaptive to respond to changing needs of the community and environmental and other circumstances and establishes a framework to that effect. The plan is a living document which will be reviewed, every 10 years, against stipulated goals and targets to measure success.

Sources: http://www.gw.govt.nz/assets/Our-Services/Flood-Protection/Hutt/FP-Hutt-River-FMP.pdf *[PDF] ;* https://www.floodplainconference.com/papers2016/Sharyn%20Westlake%20and%20Daniel%20Manolache%20Full%20Paper.pdf *[PDF] ;* https://www.tandfonline.com/doi/full/10.1016/j.polsoc.2016.05.002

Bangladesh Delta Formulation Project 2100

Bangladesh is one of the most vulnerable countries to climate change. With over 50 rivers, its delta is susceptible to flooding and ensuing losses. This warrants well-designed short-, medium- and long-term interventions to ensure the economic growth and health of the country. The Bangladesh Delta Formulation Project 2100, prepared with the assistance of the government of Netherlands, employs the dynamic adaptive policy pathways approach to formulate a long-term strategy for water safety, food security and future land management. The project brings together various stakeholders to devise a roadmap for the effective development of the delta. It consolidates all related projects and policies and uses scenario analysis to identify various possible development pathways and their tipping points. The resultant roadmap is accompanied by an investment plan.

Adaptive management is at the heart of the project's vision; thus the roadmap uses various scenarios and adopts flexible strategies that can evolve and remain effective when baseline assumptions change, due to climate change, changes in socio-economic circumstances, etc. The Delta Project has also informed Bangladesh's 7th Five Year Plan (2016–20).

Sources: *http://www.bangladeshdeltaplan2100.org/*; *http://edepot.wur.nl/315175*

Notes

[1] Eligibility criteria does not have a case study since it plays an important role in each of the other case studies and smaller examples. See the "Note on project eligibility criteria and their importance for building robust project pipelines" in section 3.6.

[2] For instance, in line with confidentiality concerns; private sector investors and project developers do not typically "publish" full data due to the confidential nature of project-level information and financial details – see the case study for more information (section 3.3 in Chapter 3).

[3] As explained in the case study, these refer to projects which demonstrate the commercial viability of an important technology or show great potential.

[4] Including employing open and transparent approaches to policies and regulations – see sections 3.3 and 3.4, respectively.

[5] As well as World Resources Institute (Climate Watch Data). See: www.climatewatchdata.org.

[6] For instance, of 137 economies, the World Economic Forum ranks Colombia 87th on the basis of infrastructure quality. See the 2017-2018 Global Competitiveness Index at: weforum.org/global-competitiveness-report-2017.

[7] In addition to, for instance, promoting environmental and socio-economic development in the areas most affected by the recently-ended conflict (IDB, 2017[81]).

[8] As per expansion plans of the Mining and Energy Planning Unit of the Ministry of Mines and Energy; figures quoted in CIF (2017[13]). The Mining and Energy Planning Unit expects an estimated USD 2.6–3.5 billion is needed to scale-up non-hydro renewable energy (particularly wind) by 2029, but coal generation may triple in the same period under a business-as-usual scenario.

[9] Cognisant of its climate ambitions, of course (Lütkehermöller et al., 2018 forthcoming[5]).

[10] Equating to around 0.35% of Colombia's GDP in 2016.

[11] Lütkehermöller et al. (2018 forthcoming, p. 53[5]): "For the effective implementation of its prioritised mitigation actions… better alignment between different ministries and actors involved at all levels of government (national, regional, municipal) will be key, as will be the involvement of the private sector. If these mitigation actions are successfully implemented, Colombia could potentially over achieve [its NDC objectives]."

[12] For instance, over 12 500 non-state actors have submitted climate pledges to the UNFCCC under the Paris Agreement (as of May 2018; see http://climateaction.unfccc.int for more information).

[13] The chair of the Finance Committee, the DNP, was identified as particularly important in the CICC since it is a "strong institution with influential capacity across the government" (Jaramillo, 2014, p. 12[5]).

[14] See also section 3.3 on the role of Multilateral Development Banks to support local capacities and robust project pipelines.

[15] In addition, at the OECD's 2017 Forum on Green Finance and Investment, Findeter announced ambitions to become a green investment bank. See, for instance, www.oecd.org/cgfi/forum/2017-forum-documents.htm on the Forum; and (OECD, 2016[65]) for information on green investment banks.

[16] Their role in meeting climate objectives is further evident in that over 2 500 cities have submitted non-state actor climate pledges to the UNFCCC (as of June 2018; see climateaction.unfccc.int for information).

[17] A recent review of the activities of subnational governments in 100 countries, found that they were responsible for 25% of public expenditure worldwide (equivalent to 9% of global GDP) and 40% of public investment (60% in OECD countries) (OECD/United Cities and Local Government, 2017[79]).

[18] For instance, in line with confidentiality concerns; private sector investors and project developers do not typically "publish" full data due to the confidential nature of project-level information and financial details – see the case study for more information (section 3.3 in Chapter 3).

[19] World Resources Institute (Climate Watch Data). See: www.climatewatchdata.org.

[20] The Environmental Performance Index ranks Viet Nam 159th out of 180 countries in terms of air quality – see hepi.envirocenter.yale.edu.

[21] See, for instance, references in OECD (2018 forthcoming[24]) such as (Nam, Quan and Binh, 2012[82]; GIZ, 2016[83]).

[22] Noting these survey results have not been updated since 2016. See Trabacchi et al. (2016[27]).

[23] In many cases the recipient country also benefits from the development of these plans as they help inform ministries and other domestic actors to potential investment opportunities.

[24] See www.climateinvestmentfunds.org/about and Box 3.4 for more information.

[25] Lending extended on terms more generous ("softer") than terms available in the market. For instance, the Ho Chi Minh City lending of USD 50 million includes approximately USD 1 million in grant, while the rest is provided through the ADB on a "40-year term, including a grace period of 10 years, a management fee of 0.18% per annum on the undisbursed balance of the loan, and an interest charge of 0.25%" (ADB, 2014[31]). More details on CTF lending rates can be found in (CIF, 2015[84]) for private sector operations and (CIF, 2015[85]) for public sector operations.

[26] The words "transparency" and "transparent" were mentioned 104 times in the report.

[27] The IPR is based on the OECD's Policy Framework for Investment (OECD, 2015[86]) which follows three overarching principles, one of which, "transparency in policy formulation and implementation", highlights the importance of transparency to encouraging investment and trust.

[28] Noting that Global Infrastructure Hub data does not cover all infrastructure project investments. See the Viet Nam country profile at: infracompass.gihub.org/ind_country_profile/VNM

[29] At least administratively through, for instance, standardising document and funding procedures, while noting designs and approvals are typically on a project-by-project basis. For instance, the Viet Nam CTF country plan includes annexes prepared by the participating MDB. For each of the six, they provide the same information (CIF, 2009[28]): problem statement; proposed transformation; implementation readiness; rationale for CTF financing; financing plan; preparation timetable.

[30] An additional reduction of approximately 0.5 $MtCO_2e$ per year is expected from the other four Viet Nam CTF programmes. See: www.climateinvestmentfunds.org/country/vietnam for more information.

[31] One of the other Viet Nam CTF programmes, "electricity grid efficiency project", envisages private co-financing of at least USD 1.6 for every USD 1 from CTF funds (CIF, 2013, p. 20[23]).

Care should, however, be taken when referring to such average ratios, as discussed in Jachnik and Raynaud (2015[87]).

[32] See the ADB's project website (www.adb.org/projects/documents/sustainable-urban-transport-ho-chi-minh-city-mrt-line-2-project-rrp and document https://www.adb.org/sites/default/files/linked-documents/45200-002-ra.pdf [PDF].

[33] Except those documents of a confidential nature related to, for example, private sector financing, or pre-appraisal documents from the public sector that may also deemed confidential and so not posted or circulated beyond CIF committees.

[34] See: https://www.climateinvestmentfunds.org/projects.

[35] According to Trabacchi et al. (2016[27]), the Green Climate Fund, one of the main global financing channels under the UNFCCC, is currently undertaking a competitive project-by-project approval process, but may choose to adopt a more programmatic approach in the future.

[36] See footnote 32. Risk mitigation options suggested by the ABD included convening and co-ordinating public actors (e.g. city transport management authorities and regulators), launching a project website and informing the public often according to ADB guidelines.

[37] In 2016, for instance, around 70% of recipients of European Bank for Reconstruction and Development funding to mitigation and adaptation measures were from the private sector (MDBs, 2016[88]).

[38] See: www.oecd.org/env/researchcollaborative.

[39] Prioritising good projects is an important tool for governments to use in infrastructure planning in general – see, for instance, OECD (2017[10]).

[40] Also called the "Juncker Plan" in various informal contexts after the President of the European Commission, Jean-Claude Juncker.

[41] Translating to reduce emissions by almost 2.3 billion tonnes of carbon dioxide equivalents. See: www4.unfccc.int/ndcregistry/PublishedDocuments/European%20Union%20First/LV-03-06-EU%20INDC.pdf.

[42] Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of member states to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020.

[43] "The roadmap for transforming the EU into a competitive, low-carbon economy by 2050", available at: https://ec.europa.eu/clima/sites/clima/files/2050_roadmap_en.pdf.

[44] InvestEU combines 16 existing equity, risk sharing and guarantee instruments from eight programmes under one umbrella, that will have four specific policy windows: 1) sustainable infrastructure; 2) research, innovation and digitisation; 3) small and medium-sized enterprises; and 4) social investment and skills. See more information on InvestEU at the European Commission's website www.ec.europa.eu/commission/publications/investeu-programme_en.

[45] The OECD, for instance, suggests a narrow approach to regulation and planning "can make it difficult to achieve cross-sectoral policy objectives such as regional development or adaptation to climate change and can miss chances for synergies between sectors such as energy, transport, housing and urban development" (OECD, 2017, p. 10[10]).

[46] At the time of writing (April 2018), the EU-28 member countries were: Austria, Belgium, Bulgaria, Croatia, Cyprus,* Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden and the United Kingdom.

* Note by Turkey: The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".

* Note by all the European Union member states of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

[47] Eurostat, 2018: "Dataset: Investment by institutional sectors – % of GDP", reference: tec00132, see http://ec.europa.eu/eurostat/web/products-datasets/-/tec00132.

[48] Given the present rate of investments, the EIB pegs the infrastructure financing gap in the EU to reach EUR 335 billion a year by 2020 (EIB, 2016[89]). About 30% of this shortfall relates to energy infrastructure including transmission and energy efficiency.

[49] Eurostat, 2018: "Dataset: Energy dependence", reference: t2020_rd320, see http://ec.europa.eu/eurostat/web/products-datasets/-/t2020_rd320.

[50] Gärdfors (2015[38]) also reviewed the EU Cohesion Policy Funds, the EIB Project Bond Initiative, the European Energy Programme for Recovery, and financing under the European Structural and Investment Fund, in addition to others that "[pool] resources to finance economically viable investments that counter market distortion and fragmentation."

[51] Indeed, the Norton Rose Fulbright study noted that the EU should adopt "a more straight forward, aligned structure of initiatives and programmes" (Gärdfors, 2015, p. 13[38]). See also, for instance, the case study on project support in section 3.5.

[52] The EFSI administered by the EIB; the CEF by Innovation and Networks Executive Agency (INEA), an independent agency sitting under the European Commission Directorate-General for Mobility and Transport.

[53] For instance, the EIB Group Operating Framework and operational plans. These documents are updated regularly and provide an overview of the EU investment climate needs, set strategic priorities for three-year periods (for instance, the period 2017–19 see (EIB, 2017[90])) and include action on special activities (such as the EFSI).

[54] The EFSI has its own management and investment committee, and is governed by EFSI Regulation (EU 2015/1017 of the European Parliament and of the Council of 25 June 2015 on the European Fund for Strategic Investments, http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2015.169.01.0001.01.ENG) and the EFSI Agreement between the EU and the EIB (Gärdfors, 2015, p. 37[38]).

[55] See, for instance, EIB (2016[91]) for an overview of the due diligence process and EIB (2013[92]) for economic appraisal.

[56] See: www.eib.org/efsi/governance/efsi-investment-committee/index.htm.

[57] Meaning projects that would not occur without such support from the EFSI.

[58] The Scorecard comprises a set of four types of indicators: 1) contribution to the EFSI policy; 2) quality and soundness of the project; 3) EIB technical and financial contribution to the project; and 4) indicators related to the macroeconomic and sector environment. See: www.eib.org/infocentre/scoreboards/index.htm and section 3.3 for a discussion on transparent investment processes.

[59] The Ten-Year Network Development Plans are developed every two years by the European networks for Transmission System Operators for electricity (ENTSO-E) and gas (ENTSOG).

[60] As of July 2018 (European Commission, 2018[36]).

[61] The CEF is still to allocate EUR 3.1 billion in funding to energy infrastructure, EUR 800 million of which in 2017 calls and the balance from 2018 calls onwards (INEA, 2017[41]).

[62] See also section 3.2 for a case study on "leadership" in the context of Colombia's approach to delivering its climate objectives.

[63] Summarised in Gärdfors (2015[38]).

[64] See discussion in Gärdfors (2015[38]). Asymmetric impact is a common issue in electricity transmission investment since electrons freely flow around the network. Investing in one country may alleviate congestion in another and, likewise, interconnection investment can unintentionally increase congestion in third countries.

[65] See: www.eib.org/infocentre/scoreboards/index.htm.

[66] Common in many emerging and developing countries – see, for instance, Prag, Röttgers and Scherrer (2018[80]) for a discussion of the role of state-owned enterprises in the low-carbon transition.

[67] See Annex 2.F for a discussion on project preparation facilities (PPFs). While not the focus in this case study, PPFs are important elements of project support. For reference, in the framing of robust project pipelines, bankable projects mean that the project investments offer investors appropriate return profiles for their risk exposure.

[68] See the submission to the UNFCCC by the United Kingdom government: www.unfccc.int/sites/default/files/resource/UK%20Mid%20Century%20Strategy%20cover%20note.pdf [PDF].

[69] The strategy, in its present form, may not put the United Kingdom on a pathway to meet its upcoming carbon budgets. The latest energy and emissions projections released by the Department for Business, Energy and Industrial Strategy in January 2018 (here), estimate higher emissions in the period covered by the fourth and fifth carbon budgets, than currently accounted for by the strategy. For a discussion on this, please see a commentary by the Grantham Research Institute on Climate Change and Environment at the London School of Economics and Political Science at: http://www.lse.ac.uk/GranthamInstitute/news/clean-growth-strategy-miss-carbon-budgets.

[70] The government is working with the British Standards Institute to develop green standards for financial products in the United Kingdom. It is further promoting investment in energy efficient properties through the LENDERS project, working to support green mortgages and has committed to provide GBP 20 million in early-stage financing of clean technologies.

[71] Established in 2003, the RECAI tracks five parameters of renewable energy investment attractiveness, including technology attractiveness, and accounts for the various factors that can determine the investment attractiveness in a country, such as policy changes and macro-economic environments. See www.ey.com/recai for more information.

[72] The United Kingdom Green Investment Bank was fully acquired by the Macquarie Group in August 2017. The GIB has been renamed the Green Investment Group – see text for details.

[73] However, such investment sizes may suit institutional investors, if the potential risks they face are adequately mitigated, for instance by using government guarantees or first-loss protection. See Röttgers, Tandon and Kaminker (2018 forthcoming[100]) for some examples of institutional investment in offshore wind energy projects.

[74] The capital intensive nature of offshore wind turbines means that technology costs are sensitive to changes in global commodity market prices such as steel and concrete.

[75] The BEIS defines hurdle rate as "the minimum project return that a plant owner would require over a project's lifetime on a pre-tax real basis" (UK BEIS, 2016[58]). In other words, the return a project needs to generate to be investible or bankable on an economic basis.

[76] Carbon capture and storage projects face other significant investment barriers. See Bassi et al. (2015[93]) for more information.

[77] Globally, only China may be a larger market for offshore wind by 2030.

[78] For reference, Germany in second place could see 14–18 GW in total from just over 5 GW today.

[79] Offshore wind could support up to 50% of the United Kingdom's electricity demand by 2050 (GIB, 2013[94]).

[80] The CfD contract is between the project developer and the Low Carbon Contracts Company (a private entity owned by the UK Department for Business, Energy and Industrial Strategy).

[81] Bids are assessed and selected by National Grid, the United Kingdom's electricity transmission system operator

[82] Comparing lowest clearing prices for successful projects commissioning in 2017–19 (auction one) and those commissioning in 2022/23 (auction two).

[83] Crown Estate (for England, Wales, Northern Ireland) and Crown Estate Scotland (for Scotland).

[84] See also section 3.2 on why, for instance, leadership is an important element to champion the development of robust project pipelines.

[85] GBP 3 billion in the period to 2015, GBP 0.8 billion in the 2015-16 Spending Review (UK BIS, 2015[95]).

[86] Note: the United Kingdom GIB was privatised in 2017 but the interest here is on the support provided to developers and investors since its establishment as a public financial institution in 2012.

[87] Indeed, more research is required to better understand the other investors and their rationale for investing in offshore wind projects. Green investment banks (and GIB-like entities – see (OECD, 2016[65])) can and do seem to play important roles in the development of nascent markets – which will be the focus of a forthcoming OECD working paper.

[88] A forthcoming OECD working paper covers this topic in more detail – particularly on the role of green investment banks to foster and promote markets for low-carbon energy technologies.

[89] The GIB's first offshore wind transaction, for instance, was to contribute to the refinancing of Walney Offshore Windfarm, a large offshore wind project that initially received direct, primary investment from pension funds (Hervé-Mignucci, 2012[96]; GIB, 2013[94]). A forthcoming OECD paper (Röttgers, Tandon and Kaminker, 2018 forthcoming[100]) catalogues the GIBs use of cornerstone stakes to leverage institutional investment and capitalise dedicated funds like the United Kingdom Greencoat Wind to foster new markets.

[90] See the submission to the UNFCCC by the United Kingdom government on its mid-century strategy: www.unfccc.int/sites/default/files/resource/UK%20Mid%20Century%20Strategy%20cover%20note.pdf [PDF] and response from the Committee on Climate Change www.theccc.org.uk/2018/04/18/lord-deben-welcomes-news-that-government-will-seek-ccc-advice-on-uks-long-term-emissions-targets.

[91] For instance, if countries still have significant volumes of carbon-intensive technologies in their energy mix.

[92] Author: Kathleen Dominique, Policy Analyst, Environment Directorate, OECD.

[93] See discussion of non-stationarity in Milly et al. (2008[97]).

[94] See, for instance, section 3.2 for the value of leadership in championing robust project pipelines.

[95] For example, the Foresight Future Flooding study for the Government Office for Science in 2004. This study led to a new government strategy, but substantial progress was only made until the floods in 2007 and the Pitt review.

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