WORKING PAPER

ALIGNING INVESTMENTS WITH THE PARIS AGREEMENT TEMPERATURE GOAL

CHALLENGES AND OPPORTUNITIES FOR MULTILATERAL DEVELOPMENT BANKS

NEW CLIMATE INSTITUTE

GERMANWATCH

Acknowledgments:

The authors are very grateful for the many inputs, comments and suggestions received during the course of the project. The following persons and institutions have been consulted at workshops or individually as part of the expert consultation process. Their review does not imply an endorsement of this working paper and its findings. The contents of this working paper, as well as any errors, are the sole responsibility of the authors

African Development Bank // Asian Development Bank // Asian Infrastructure Investment Bank // Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) // European Bank for Reconstruction and Development // European Investment Bank // Federal Ministry of Economic Cooperation and Development of Germany (BMZ) // Finn Robin Schufft // Fundación Avina // Dr. Gerrit Hansen // IDB Invest // Inter-American Development Bank // International Finance Corporation // Nikolas Mattheis // World Bank // World Resources Institute // Dr. Helena Wright

Cite as:

Germanwatch & NewClimate Institute (2018). Aligning investments with the Paris Agreement Temperature Goal – Challenges and Opportunities for Multilateral Development Banks. Cologne/Bonn/Berlin.

This working paper is published as part of a project financially supported by GIZ on behalf of the Federal Ministry for Economy Cooperation and Development of Germany (BMZ). Germanwatch and NewClimate Institute are solely responsible for the content of this publication.

Supported by the

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Supported by the

Federal Ministry for Economic Cooperation and Development

GERMANWATCH

NEW CLIMATE INSTITUTE

Working Paper

Aligning Investments with the Paris Agreement Temperature Goal

Challenges and Opportunities for Multilateral Development Banks

Sophie Bartosch, Julia Bingler, Katrin Enting-Pauw, Hanna Fekete, Aki Kachi, Leonardo Nascimento, Frauke Röser, Lutz Weischer with contributions from Christoph Bals, Markus Hagemann, Niklas Höhne, Katharina Lütkehermöller, Paula Schäfer

This working paper is published as part of a larger research project examining the role of MDBs in supporting the implementation of the Paris Agreement. The key findings will be incorporated into the final report covering all aspects of Paris alignment to be published by the end of 2018. The authors welcome feedback and suggestions and can be reached at bartosch@germanwatch.org and h.fekete@newclimate.org.

Executive Summary

Operationalizing alignment with the Paris Agreement temperature goal

Multilateral development banks (MDBs) have committed to aligning their operations with the Paris Agreement. A crucial aspect of this is the alignment of all future investments with the global warming limit set in Paris, namely to limit average temperature rise to well below 2°C and pursue efforts to limit it to 1.5°C (the "Paris temperature goal"). Doing so is not only an obligation flowing from Article 2.1c of the Paris Agreement, but also carries many advantages for the banks and their client countries: It will enable the fulfilment of the Banks' broader development mandate and can support their client countries in meeting their national goals and in realizing development gains from leapfrogging to modern, zero-carbon technologies. It will also avoid a lock-in of high-carbon infrastructure and reduce exposure to climate-related financial risks due to stranded assets.

This paper proposes a definition of alignment with the Paris temperature goal and actionable decision-making tools for assessing alignment and shifting portfolios. Aligning investments with the global temperature goal of the Paris Agreement concerns the entire pipeline of future MDB investments and therefore goes beyond growing the share of "climate finance". The objective is that entire portfolios will be aligned, i.e. will only consist of investments that either actively support or do not undermine the Paris temperature. The challenge is not only to grow "green" investments at the necessary speed and scale, but to shift from "brown" to "green". Aligning with the Paris temperature goal requires a long-term perspective, looking beyond countries' nationally determined contributions (NDCs), which largely cover the time period until 2030.

Global investments in infrastructure need to increase in the near future to enable social and economic development, particularly in poorer countries. Many infrastructure investments have a long lifetime, so decisions taken today will have a decisive impact on long-term emission trends. It is critical that when trying to close the infrastructure investment gap, investments are aligned with the Paris Agreement today, to avoid high-carbon lock-in and the risk of stranded assets in future.

In order to define what it would mean to align investments with the Paris temperature goal, it is necessary to analyze scientific scenarios that show emissions pathways consistent with keeping global warming to 1.5°C. Despite some uncertainties regarding the remaining carbon budget and differences in how to achieve that overall objective, all scenarios show that a drastic change from current trends is required to meet the Paris temperature goal. Paris-aligned pathways show that global energy supply needs to achieve net-zero emissions around 2050. On the demand side, strong efficiency measures are necessary, as well as massive shifts away from fossil fuels. Consumption patterns will also have a substantial impact on how costly the transition will be. Beyond energy, transitions in all sectors are necessary, which implies that solutions for bringing emissions to zero in all sectors have to be developed today so they are widely available by mid-century.

Based on the analysis of Paris-compatible pathways and other relevant scientific literature, investment areas can be grouped into three categories: "Paris-aligned", "misaligned" and "conditional" (see Table ES 1). Paris-aligned means investments in this area fully support the achievement of the Paris Agreement's temperature goal. Misaligned means they undermine this goal. For investment areas and technologies classified as "conditional", whether they can be considered Paris-aligned depends on the exact circumstances and characteristics of a project. In order to assess investments in the "conditional" category, more granular decision-making tools are needed. The classification should become a recurrent exercise, which is updated at least every five years as new knowledge becomes available. Where possible, it should also be forward-looking, i.e. indicate from today the point from which an investment area might move from the "conditional" to the "misaligned" category.

	PARIS-ALIGNED	CONDITIONAL	MISALIGNED
	Fully aligned with Paris Agreement consistently across all scenarios	**Only aligned under certain conditions**	**Consistently Paris misaligned in all scenarios**
Energy supply infrastructure	• Renewable energy (solar, wind, small hydro, tidal, wave and ocean) • Electricity system flexibility option	• Energy transmission and distribution infrastructure • Geothermal[2)] • Gas (power plants, transport of gas)[1)] • Large hydropower[3)] • Biomass, incl. bio energy carbon capture storage[3),4)] • Coal with carbon capture and storage (CCS)[1),3)] • Nuclear[3)]	• Coal fired power plants with unabated emissions over their lifetime • New upstream oil and gas production and exploration • Coal mining • Oil power plants
Transport infrastructure	• Zero-carbon transport fueling infrastructure (electricity, hydrogen, alternative fuels) • Non-motorized transport infrastructure (sidewalks and dedicated bike-lanes, bike sharing infrastructure) • Integration of transport and urban development planning • Electric rail and rolling stock (passenger and freight) • Electric public transport • Inland waterways • Transport and travel demand management measures	• Road infrastructure including tunnels and bridges • Diesel rail and rolling stock • Port expansion for transport of non-fossil fuel freight	• New road, rail, waterway and port infrastructure for fossil fuel transport • New airports/airport expansion[5)]

Footnotes:
1) This investment area causes direct GHG emissions
2) This investment area can cause direct GHG emissions
3) This investment area is subject to critical sustainability and/or security concerns
4) The production of bioenergy can cause substantial GHG emissions. We differentiate this from other investment areas, where emissions occur during the manufacturing process, because the impact of unsustainable production of the fuel is over proportionally larger, and not limited to the manufacturing of the technology.
5) The authors do recognize that alternatives for air travel are more limited compared to, for example, coal or petroleum for electricity. This highlights the need for further investigation of fuel alternatives for air transport.

Table ES 1: Categorization of investment areas in energy supply and transport infrastructure

Building on existing climate tools

All projects should be assessed to ascertain their compatibility with the client country's NDC. However, NDCs have a comparatively short time horizon and, on aggregate, do not yet reflect the necessary level of ambition for the Paris long-term temperature goal. Additional tools should be applied to decide whether the project can be considered Paris-aligned in the long term.

In recent years, MBDs have introduced a number of tools to integrate climate considerations in their decision-making. These tools can be applied either at the level of individual projects or at country, sector or bank strategy level (see Table ES2). Not all tools from the toolbox have to be used simultaneously to ensure Paris-alignment.

BANK STRATEGY LEVEL	COUNTRY STRATEGY LEVEL SECTOR STRATEGY LEVEL	PROJECT LEVEL
GHG accounting + Portfolio emission target	Supporting and enhancing NDCs and LTS	Negative list Positive list
Climate finance target	Country emission pathways	GHG accounting + Emission Benchmarks
Setting standards for financial institutions world wide through financial intermediary lending	GHG accounting + Sector emission targets	GHG accounting + Shadow carbon pricing
Supporting the enabling environment through policy based lending		Decision trees combining several tools (including country & sector decarbonization pathways)

Table ES 2: Climate toolbox - selection of tools that can support alignment with the temperature goal

Note: Tools with a green symbol help to incentivize investments that actively support the achievement of the Paris temperature goal. Tools with a red symbol help ensure that investments that risk undermining the achievement of the Paris temperature goal are excluded.

The way climate tools are currently designed and being used by MDBs is not yet consistently informed by the requirements of the Paris Agreement. However, MDBs can build on these existing tools, expand and refine them, so that they enable assessments of Paris-alignment:

- Greenhouse gas (GHG) accounting for all relevant investments is a prerequisite for Paris-alignment assessment. MDBs should conduct GHG accounting for projects in all sectors, covering Scopes 1 (direct emissions) and 2 (emissions from generation of electricity or heat used). Under Scope 3 (other indirect emissions), at a minimum, for all projects with significant emissions, MDBs should account for emissions from extraction and production of materials used (category 1) as well as induced emissions from use of product/project (category 11). GHG emissions should be publicly disclosed.
- The climate finance eligibility list is a joint tool MDBs use to track their contributions toward the 100 billion climate finance target. Some MDBs apply additional criteria for their own investments. MDBs could modify these lists in such a way that they exclusively include unambiguously Paris-aligned technologies and projects. MDBs should also define clearly aligned investment areas as priorities in sector strategies and promote their inclusion as priorities in country strategies in their interaction with client countries.
- Clearly misaligned investment areas should be added to existing exclusion lists. These lists should become forward-looking and dynamic, with revisions at least every five years.
- Emissions standards and shadow carbon pricing are useful to ensure Paris-alignment of investments in the “conditional” category, if they are set at sufficiently ambitious levels reflecting scientific findings on Paris-aligned pathways. These tools should also be made dynamic: It should be defined and disclosed at which rate the shadow carbon price is going to increase or the emissions standard is going to decline in order to lead to net zero emissions by mid-century.
- Portfolio-wide targets of gross emission reductions should be introduced to monitor the desired development of a bank’s entire portfolio and pipeline.

Decision-making tools for project investment in the energy supply and transport sectors
For the energy supply (electricity generation, transmission and distribution, and gas infrastructure) and transport (rail, road and shipping infrastructure) sectors, a more detailed analysis was conducted in order to propose approaches combining different existing and new tools which enable the assessment of Paris-alignment for individual projects. MDBs would need to pilot-test and adapt the suggested approaches to their exact needs in order to integrate them in their processes.

The suggested approaches allow for the evaluation of projects, taking into account the specific characteristics and the country context. For all sectors, the approaches start with the use of positive/negative lists. Projects that cannot be clearly classified as "aligned" or "misaligned" with positive/negative lists, are then subject to additional considerations:

For the energy sector, a combination of quantitative information on decarbonization pathways and qualitative judgements is used. The approach suggests supporting additional considerations with results from technical modeling exercises showing country-specific pathways to mid-century decarbonization. The feasibility of additional modeling exercises depends on information already available in the country, and capacities available for evaluating a project. The proposed modeling tool is based on downscaled regional data, as country-level data for long-term decarbonization is often not yet available. Where national data is available and compatible with mid-century decarbonization, it would be preferable to use it; the tool allows for changes in the data inputs in order to make this possible.

In the transport sector, it is often not the infrastructure itself that directly emits, but rather the transport activity it induces. The suggested approach for the transport sector therefore focuses on the context, and also considers whether the policy framework in place contributes to a low-carbon use of the infrastructure. Paris-aligned transportation infrastructure investment can be defined as investment in transport systems that follow the "ASI" principle: avoid unnecessary travel, shift modes to the least energy intensive modes available, and improve the energy efficiency of all modes or reduce the emissions intensity of fuel. Some of the factors that implement ASI are features of the transport infrastructure itself (sidewalks, bike paths, room for bus rapid transit/tram); some are more general policy measures – fuel taxes, vehicle registration fees. All should be taken into consideration.

Aligning financial intermediary lending and policy-based lending
Beyond direct project investment lending, MDBs also invest through financial intermediaries (FIs) and provide policy-based lending (PBL). These investments should also be aligned with the Paris temperature goal. MDBs should apply climate tools consistently for FI lending as well as PBL. This might imply, for instance, the development of instrument-specific methodologies for GHG accounting, or requiring FIs to have climate management systems in place.

MDBs should accompany their clients in setting up and strengthening climate risk management systems and aligning policies, procedures and regulations. Client reporting on climate risks using standardized indicators should become mandatory. For PBLs, this would mean all measures and incentives included in the reform as well as all projects with climate impacts (positive and negative) potentially benefitting from the reform. Shareholders should make the additional financial resources available for MDBs to apply climate tools along the project cycle (from preparation to reporting of results), including additional grants and technical assistance for targeted support.

Building a Paris-aligned project pipeline
In order to be able to shift an entire portfolio towards Paris-alignment, it is crucial to develop a pipeline of Paris-aligned projects. In order to influence the project pipeline, MDBs have several options. In country strategy processes, MDBs and their client countries can put more emphasis on climate-compatible investment priorities. MDBs can encourage the development of Paris-aligned projects through internal incentives and by making sure they employ a sufficient number of environmental specialists with the expertise to assess Paris-alignment. MDBs can also increase their finance for technical assistance and project preparation for Paris-aligned projects and ensure that the tools

promoting Paris-alignment are also being used by existing and new project preparation facilities. In the development of individual projects, tools such as mitigation potential analysis can be used to investigate the feasibility and economic viability of substitutes that are less carbon and/or energy intensive.

Improving transparency

Shareholders and stakeholders should be able to assess to what extent MDBs are making progress in aligning their investments with the Paris Agreement temperature goal. Forward-looking disclosure of climate-related risks and opportunities can also be an important driver toward better understanding and management of those risks. Improved transparency on Paris-alignment can build on the existing Joint Methodology for Tracking Climate Finance as well as on the recommendations of the Task Force on Climate-Related Financial Disclosure (TCFD).

Table of Contents

List of Figures

List of Tables

Abbreviations

ADB	Asian Development Bank
AfDB	African Development Bank
AIIB	Asian Infrastructure Investment Bank
ASI	Avoid-Shift-Improve
BAT	Best Available Technology
BECCS	Bioenergy Carbon Capture and Storage
BNEF	Bloomberg New Energy Finance
BRT	Bus Rapid Transit
CCS	Carbon Capture and Storage
CCU	Carbon Capture and Utilization
CDR	Carbon Dioxide Removal
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
FI	Financial Intermediary
GDP	Gross-Domestic Product
GHG	Greenhouse Gas
IAM	Integrated Assessment Model
IDB	Inter-American Development Bank
IDBG	Inter-American Development Bank Group
IDFC	International Development Finance Club
IEA	International Energy Agency
IFC	International Finance Corporation
IPCC	International Panel on Climate Change
ISO	International Organization for Standardization
LNG	Liquefied Natural Gas
MDB	Multilateral Development Bank
NDC	Nationally Determined Contribution
NET	Negative Emissions Technologies
OECD	Organization for Economic Cooperation and Development
PBL	Policy-based Lending
T&D	Transmission and Distribution
TA	Technical Assistance
TCFD	Task Force on Climate-related Financial Disclosure
WB	World Bank
WBG	World Bank Group

Note that this working paper uses metric tons throughout when referring to tons in units (e.g. ktCO2e, or ton per km driven).

1 Introduction: Reasons for multilateral development banks to align their investments with the Paris temperature goal

Key conclusions

There are numerous reasons for Multilateral Development Banks (MDBs) to align their investments with the Paris Agreement. Indeed, they have committed to do so in high-level statements. Alignment with the Paris Agreement has several dimensions, including alignment with the long-term goals on climate change mitigation and adaptation as well as support for the enhancement and implementation of nationally determined contributions and other country-owned strategies and plans. This paper attempts to operationalize one of these dimensions, namely alignment with the long-term mitigation goal or Paris temperature goal of holding global warming well below 2°C and pursuing efforts to limit it to 1.5°C (referred to in the remainder of the paper as “Paris-alignment”).

Alignment with the Paris temperature goal is defined as the process towards a situation where all investments are either supporting the necessary transformation towards greenhouse gas neutrality or have no significant impact on emissions. Any investment that would counteract achieving the Paris temperature goal would need to be phased out. Such assessments need to be based on science, namely on emissions pathways consistent with reaching the Paris temperature goal.

The 2015 Paris Agreement reflects a clear commitment by the global community to address the global climate crisis. MDBs have an important role to play in enabling the implementation of the Paris Agreement. On several occasions (see Box 1), they have committed at the highest level to align their investments with the Paris Agreement.

These commitments now need to be operationalized. Aligning with the Paris Agreement has several dimensions (see Figure 1: Overview of different elements supporting Paris-aligned investments):

- Aligning with the long term goal of “holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels” (Paris Agreement, Article 2.1 (a)), in the following referred to as the "Paris Agreement long-term temperature goal" and the related goal to “reach global peaking of greenhouse gas emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century” (Article 4.1);
- Aligning with the long-term goal of “increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production” (Article 2.1 (b)), and the related global goal on adaptation of “enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change” (Article 7.1);
- Supporting the development, enhancement and implementation of nationally determined medium- and long-term climate plans, including the nationally determined contributions (NDCs, Article 3), as the building blocks of the Paris Agreement .

Box 1: MDB Commitments to Align with the Paris Agreement

- Even before the Paris Agreement was in place, the World Bank Group (WBG), Inter-American Development Bank (IDB), Asian Development Bank (ADB), African Development Bank (AfDB), European Investment Bank (EIB) and European Bank for Reconstruction and Development (EBRD) had already committed to the outcomes of the Paris Climate Summit in 2015, acknowledging: "As a coalition of development banks, committed to common goals, we have a responsibility to respond to these global threats. We will continue to consider climate change across our strategies, programs, and operations to deliver more sustainable results, with a particular focus on the poor and most vulnerable…In accordance with our mandates and resources, we pledge to increase our climate finance and to support the outcomes of the Paris conference through 2020." (AfDB et al. 2015)
- In 2016, the MDBs, now joined by the newly founded Asian Infrastructure Investment Banks (AIIB), jointly promised ".. working with countries to implement their NDCs and develop their adaptive capacities, ... focus on scaling up low-carbon and climate-resilient investments for sustainable infrastructure, including in particular speeding the energy transition consistent with the Paris Agreement ... by aligning our financial flows with the countries' pathways to low-carbon and climate-resilient development ..." Here, MDBs further emphasized the need to align their own activities: "In Paris, countries committed ... towards achieving climate resilience and net- zero emissions from 2050 onwards. MDBs are deeply committed to this agenda and are aligning our organizations and our joint actions with it" (MDBs 2016).
- At the One Planet Summit in Paris, in December 2017, MDBs together with the bilateral and national development finance institutions members of the International Development Finance Club (IDFC) publicly committed to align financial flows with the Paris Agreement. Among other aspects, they set themselves the objectives to "Redirect financial flows in support of transitions towards low-carbon and climate resilient sustainable development.", "Pursue the development of processes, tools, methodologies and institutional arrangements that make it possible to design and implement climate action at the required scale.", and expressed the need for urgent action to "Further support countries and partners [in the] ... development of long-term 2050 decarbonization pathways and strategies to reach zero net emissions and promote shorter-term actions ... for achieving these longer-term development pathways." (IDFCs and MDBs 2017).

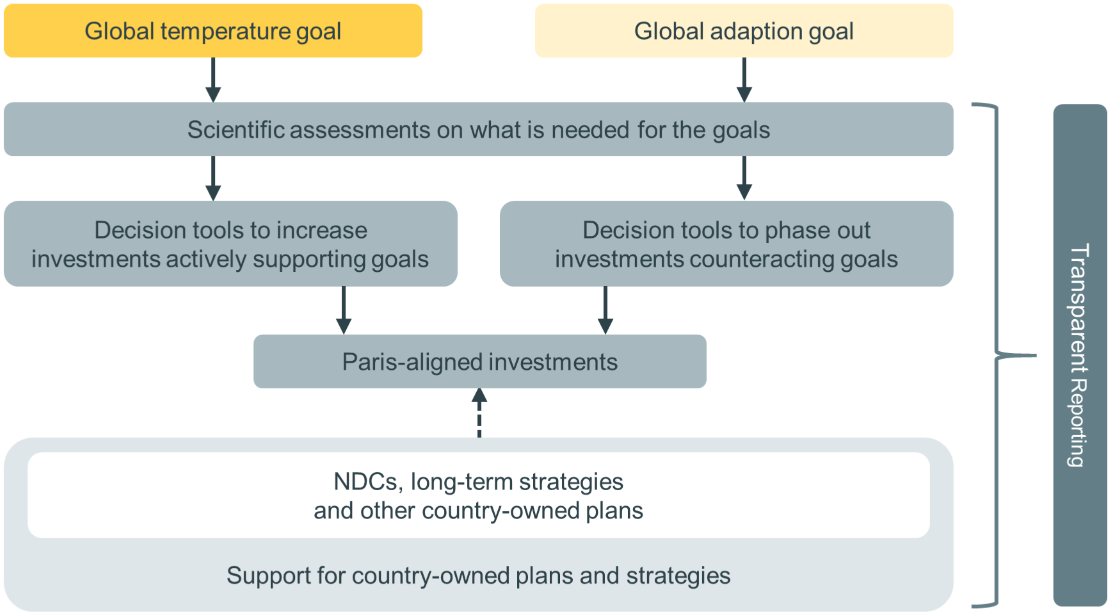

Figure 1: Overview of different elements supporting Paris-aligned investments

This working paper only focuses on the first of these dimensions - alignment with the Paris global temperature goal and in the remainder of the paper, the term "Paris-alignment" is used as a shorthand for alignment with the global temperature goal. This is not meant to suggest that the other aspects are less important. This working paper is published as part of a larger research project examining the role of MDBs in supporting the implementation of the Paris Agreement; the other dimensions are considered in other parts of the overall research project. This research contained in this paper will be further refined, based on feedback received, and key findings will be incorporated into the final report covering all aspects of Paris alignment to be published by the end of 2018.

1.1 The significance of Multilateral Development Banks for achieving the Paris temperature goal

The goal of limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C is crucial. Impacts would still be substantial at this level of warming, especially for the most vulnerable people in developing countries, sensitive systems such as tropical coral or the Arctic, and some food production systems. But the level of risk from extreme events, ocean acidification or long-term sea level rise will be significantly lower at 1.5°C than at 2°C or higher, and chances are better that tipping points in the Earth System might be avoided. Investing to achieve the objectives of the Paris Agreement also presents a huge economic opportunity, particularly for developing countries, who can leapfrog to modern, zero-carbon technologies and enable sustained economic development with low-carbon and climate-resilient infrastructure.

The international community has explicitly recognized the critical role finance plays in the global response to the climate crisis. It will not be possible to achieve the ambitious objectives set in Paris without mobilizing significant amounts of finance and shifting investment towards climate-friendly projects, away from activities that threaten climate stability. This is why the Paris Agreement explicitly sets a goal for shifting financial flows, on par with the global long-term temperature goal and the adaptation goal: In Article 2.1 (c), the Agreement's signatories commit to "making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development". Achieving this objective will require additional efforts that go much beyond the financing explicitly labelled as "climate finance". Aligning investments with the Paris Agreement requires not only growing "green" investments, but also reducing and eventually phasing out those "brown" investments that run counter to climate objectives.

MDBs are particularly well placed to help achieve this goal for a number of reasons:

- MDBs are among the major investors in developing country infrastructure. Infrastructure investments - whether in the energy system, transport or urban development - often have very long lifetimes and are a decisive factor in determining the climate-resilience and emissions-intensity of a country's development pathway.
- MDBs are often lead investors that bring in other, private investors, to invest alongside them, thus leveraging significant amounts of private capital. The banks can also set standards, in terms of the kind of projects they invest in or the safeguards and standards they apply - that will often be replicated by other financial institutions.
- Many MDBs conduct policy research and offer assistance to developing countries to shape effective policies and provide policy-based finance. Through these activities, the banks have an opportunity to enable policy frameworks that will set strong incentives for climate action and an alignment of investments.
- MDBs were created by government shareholders with a mandate to promote sustainable development. As agents of their shareholders, MDBs must actively promote international normative concepts that are closely related to sustainable development (Handl 1998). This includes climate change.

If the MDBs align their operations with the Paris Agreement, governments will be in a much better position to achieve the ambitious goals they set themselves in that agreement. The world's governments are both signatories of the Paris Agreement and shareholders of the MDBs, so they should have a strong interest in encouraging and enabling the MDBs to align with the Paris Agreement.

The MDBs are among many actors in a larger finance landscape. They cannot "solve" the climate crisis on their own, but need to play a specific role, based on their strengths, complemented by other actors - governments, bilateral and national development banks, climate funds, private investors and commercial banks - who must also do their part.

1.2 Interest of Multilateral Development Banks in aligning with the Paris Agreement

Aligning future investments with the global warming limit set in Paris is not only a demand from the international community, it is also in the MDBs' self-interest. Aligning with Paris will enable the fulfilment of their core development mandate and support their client countries in realizing development gains. Ending poverty and enhancing welfare is incompatible with continued global temperature rise. In its Fifth Assessment Report, the Intergovernmental Panel on Climate Change (IPCC) has confirmed with high confidence that unmitigated climate change will erode the pace of poverty reduction, jeopardize sustainable development and undermine food stability (Olsson et al. 2014). The equal impacts of climate change are exacerbated by the fact that countries located in Africa, the Amazon basin and South East Asia, who have contributed the least to climate change, will experience the most extreme temperature variability, which has been found to correlate with negative agricultural, economic and political impacts (Bathiany et al. 2018). Research commissioned by the World Bank concluded that "climate change in a four degree world could seriously undermine poverty alleviation in many regions" (World Bank Group 2012).

On the other hand, investing in climate-compatible solutions has the potential to support further development. The IFC found that there are almost USD 23 trillion in climate-smart investment opportunities in 21 emerging economies alone between 2016 and 2020 ("Climate Investment Opportunities in Emerging Markets" 2016). Modern technology and rapid cost declines in many low-carbon options mean that it is not necessary to choose between climate action and development. For many sectors, there is an important opportunity for countries to leapfrog to the cleanest option rather than follow a dirty development path.

As financial institutions, MDBs also have an obligation to their shareholders to manage and reduce financial risks. Aligning investments with Paris objectives will avoid a lock-in of high-carbon infrastructure and thus reduce MDBs' exposure to climate-related financial risks. Continued investment in new carbon-intensive infrastructure that would have to be retired soon after its construction for countries to achieve the goals of the Paris Agreement bears the risk of stranded assets and economic losses for the MDBs.

In recent years, many banks have introduced a range of climate-related objectives, committed to scaling up climate finance and taken concerted steps to integrate climate considerations in decision-making (Bingler et al. 2017). These are significant achievements, on which the banks can build. However, as will be discussed in this paper, they are not yet sufficient to ensure alignment of all MDB investments with the Paris temperature goal. This is why this working paper will suggest approaches and decision-making tools that could be developed in order to support Paris-alignment.

1.3 The level of ambition the Paris Agreement requires from Multilateral Development Banks

Assisting countries in implementing their NDCs, which generally have a time horizon of 2030, is the first step towards reaching the goals of the Paris Agreement. However, given the long-term nature of many infrastructure investments, MDBs also need to think more long-term, with a perspective up to 2050 and beyond. Taking NDCs into consideration when making investment decisions is therefore a necessary, but by no means sufficient, condition for achieving alignment with the long-temperature goal.

The challenge this paper addresses goes beyond increasing "climate finance"; it affects the entire portfolio. To date, most discussions on the role MDBs can play in addressing climate change have focused on their contribution to mobilizing the USD 100 billion that developed countries have pledged to mobilize annually to support climate action in developing countries by 2020. In other words, these discussions have focused on how to increase the "green" part of the banks' overall portfolio. However, aligning all financial flows with the global temperature goal requires more than increasing the volume of climate-friendly or climate-resilient projects. Projects that are unambiguously Paris-aligned have large investment needs, and making these investments is crucial for reaching the temperature goal. However, continued financing of misaligned technologies in parallel could thwart these efforts.

The Paris Agreement's formulation of "holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels" may leave some room for interpretation with regard to the required ambition level. However, recent research reports higher climate risks occurring at warming levels of 2°C than previously projected in the IPCC's Fifth Assessment Report (C.-F. Schleussner et al. 2016), including the possibility of crossing earth system tipping points that may lead to runaway climate change (Steffen et al. 2018). At the same time, mitigation research has been clear for some time that immediate action is necessary to ensure transformation occurs in a cost-effective and sustainable manner (IPCC 2014a). With continued high emissions, the remaining degree of freedom is rapidly decreasing. The sooner we take strong action, the less disruptive the changes (Kriegler et al 2018).

We consider that MDBs, as institutions explicitly created to promote internationally-agreed goals related to sustainable development, should align their operations with the most ambitious global warming limit of 1.5°C. "Pursuing efforts" should certainly include an obligation for governments to deploy the public money channeled through banks with a policy mandate in a way consistent with the precautionary principle and with the 1.5° goal. Given that other, private financial flows are somewhat more difficult for governments to influence, those flows they control directly should be aligned with the more ambitious temperature goal.

For any limit on global warming, there is a limited amount of cumulative CO_2 emissions the atmosphere can take up, often referred to as the "carbon budget". The remaining carbon budget for the ambitious goal set in the Paris Agreement is very limited. Rapid reductions across all sectors and geographies will be required to stay within the budget.

This paper therefore assumes that investments in emissions reductions would need to happen in all countries. For the time being, the paper does not differentiate the timing of these reductions based on the status of development of a country. In fact, we are observing a paradigm shift, for example with renewables becoming cheaper than fossil fuels in many countries. This means that high-carbon pathways can no longer be assumed the least costly option and in many cases, delaying climate action no longer carries economic development advantages. Nonetheless, equity is a central principle of the Paris Agreement and needs to be reflected in the implementation of our findings. For the transition to greenhouse gas-neutral economies in poorer developing countries to be feasible and equitable, a transfer of financial resources to those countries is required, as well as capacity support and access to technologies. Countries that do not have the necessary capabilities to transform towards decerabonizued and climate-resilient economies on their own, have to be supported by those with large responsibility and capabilities, so as to realize the global public good of a stable climate and the prevention of dangerous climate change. This is precisely the task of development finance, including the investments delivered through the MDBs.

1.4 Structure of the paper

The paper is structured as follows:

- Chapter 2 discusses how scientific Paris-aligned scenarios and research can be used for decision-making at policy level.
- Chapter 3 reviews the relevant existing decision-making tools used by seven major MDBs, namely the African Development Bank (AfDB), Asian Development Bank (ADB), Asian Infrastructure Investment Bank (AIIB), European Bank for Reconstruction and Development (EBRD), European Investment Bank (EIB), Inter-American Development Bank (IDB) and the World Bank Group (WBG).
- Chapter 4 discusses specific tools for Paris-alignment at project level that MDBs could use in two particularly emissions-intensive sectors: energy supply and transport infrastructure.
- Chapter 5 contains recommendations on how to align MDB operations with the Paris Agreement beyond direct investment financing, for example in financial intermediary lending and policy lending.
- Chapter 6 contains an assessment of transparency needs, especially regarding the data needed to successfully apply the recommendations of the previous chapters, to improve reporting on alignment of the overall portfolio and pipeline.
- The paper concludes with a summary of the findings and recommendations to promote Paris-alignment of all MDB activities.

2 Linking the Paris temperature goal with investment decisions

Key conclusions

Pathways aligned with the Paris Agreement's temperature goal require rapid transitions with a long-term, mid-century perspective in mind, in all sectors. Investments today influence the feasibility and costs of this transition and need to be aligned to support activities that actively support the achievement of the goal, and avoid a lock-in of carbon intensive technologies or stranded assets.

Investment in infrastructure is key in reaching both development goals and climate targets: There is already an investment gap which must be filled to address current needs. It is essential to align these investments with the Paris Agreement, given the impact of climate change on the ability of countries to develop and the long-lived nature of infrastructure. In many cases, this opportunity may even lead to net-negative costs, thanks to resulting fuel savings.

Scientific modeling of emissions in line with the Paris temperature goal provides important insights to guide decision-making. It shows that the speed and depth of decarbonization varies between sectors and gases. In the energy sector, it means full decarbonization of the power supply and a high degree of electrification of energy demand by mid-century. In industry, low-carbon solutions must be developed today, to make them available on a large scale as soon as possible. On the energy demand side, efficiency measures and sustainable consumption patterns are essential for a cost-efficient transition. Forests and soil need to become a global net-GHG sink. Most scenarios also suggest removing emissions from the atmosphere through carbon dioxide removal technologies.

Based on this directional guidance, this report classifies some investment areas as clearly aligned (e.g. various renewable energy technologies) or misaligned (e.g. coal infrastructure) with the Paris Agreement's temperature goal. Investments in other areas (e.g. gas infrastructure, diesel trains) may be aligned if certain conditions are met; a case by case evaluation including the exact project characteristics and the country context is required. These investment areas are grouped under the "conditional" category.

The objective of this research is to translate the global temperature goal into tools and metrics that can inform investment decisions on different levels:

- Bank strategy level (e.g. investment targets, GHG emissions targets)
- Country and sector strategy level (e.g. prioritization, investment targets)
- Project level (e.g. positive-negative lists, decision trees)

The starting point for the definition of "Paris-alignment" are modeling results of different scenarios that describe emission pathways compatible with the Paris Agreement's long-term temperature goal (compare section 2.1), as well as required investment needs (compare section 2.2). This is based on previous work which consolidated the information of available emission scenarios in the scientific literature (Höhne et al. 2015). The idea behind using multiple scenarios was to base recommendations on the latest available scientific knowledge. At the same time, considering numerous available scenarios enabled us to reflect diverse perspectives and multiple pathways towards limiting global warming to well below 2°C or 1.5°C considering different technology choices and cost assumptions.

Given their diversity and lack of granularity, for example on required efforts per sector or country, the use of scenarios had to be complemented by additional information and research to derive objective criteria (compare section 2.3).

This chapter describes the scientific evidence that was used in our research to guide investment decisions in different areas. It also shows the resulting general categorization of different investment areas and technologies regarding their Paris alignment.

2.1 What do scientific scenarios aligned with the Paris long-term goal mean for different technologies?

The Paris Agreement sets the long-term temperature goal of "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels" (Article 2.1a). In order to achieve this target, governments agreed to peak global greenhouse gas emissions as soon as possible, and reduce them to net zero in the second half of this century (Article 4.1). This goes clearly beyond the previously agreed "2°C limit", while the wording of the goal has been interpreted in different ways, particularly concerning whether overshooting 1.5°C and then returning to this limit by end of the century is valid (Carl-Friedrich Schleussner et al. 2016).

For our analysis, we looked at a range of scenarios reflecting different temperature outcomes and likelihoods. In spite of differences in how to achieve the overall objective, all scenarios show that a drastic change from current trends is required to meet the Paris temperature goal. The longer we continue a less ambitious pathway (e.g. current NDC levels), the faster the already small degree of freedom will decrease, decreasing the number of options that ensure achieving the goal. The scenarios analyzed for this research consistently show the following characteristics:

Global GHG emissions need to peak as soon as possible and decline quickly. Latest around 2080, global emissions need to be net-negative (compare e.g. (Rogelj et al. 2018)). The extent to which net-negative emissions are needed depends on the speed of reduction earlier in the century: A delay in emission reductions in the coming decades will cause dependency on taking CO_2 out of the atmosphere in the second half of the century. There are variations between sectors in the possible speed and depth of decarbonization. For some sectors and gases, the scenarios show that it is unviable to achieve zero emissions or go below. This is, for example, the case for agricultural emissions, or some industrial processes. This means that other sectors need to do more to meet the global pathways.

Scenarios show that global CO_2 emissions (incl. energy and process related emission) need to reach net zero emissions around 2050, a few decades before global GHG emissions. Within these, again, there is a differentiation of feasibility of deep decarbonization between the different emission sources: Emissions reductions in parts of the transport sector are more difficult to achieve, and some industrial sectors will take more time. In the energy supply sector, more options are readily available, and it is critical to make use of these.

Some key findings for different sectors are:

- Significant transitions in all sectors are necessary with a long-term perspective. For example, low-carbon industrial solutions have to be developed today so they are available as large-scale investment options by mid-century to bring emissions to net zero.
- By around 2050, the energy supply needs to reach net zero emissions. In parallel, on the demand side, strong efficiency measures are necessary.
- Massive shifts away from liquid/gaseous fossil fuels in demand sectors towards electricity are required, as, based on current knowledge, electricity can be produced sustainably on a large scale, while there are limitations for the sustainable production of fuels, such as hydrogen. Such

an early shift does not imply short-term GHG emissions due to the dependency on the supply's GHG intensity. It is, however, essential for a long-term transition to deep decarbonization.

- Consumption patterns will have a massive impact on how costly the transition will be, and the more the demand side is optimized, the more feasible it is to reach the overall goal. It is essential to remember in this context, that a change in consumption patterns should never be detrimental to development or economic growth, particularly in developing countries.
- Forests need to become a global net-GHG sinks.
- Negative emissions through carbon dioxide removal (CDR) (see Box 2) are present in almost all scenarios. Those that temporarily overshoot the 1.5C limit by a large margin especially need very substantial amounts of negative emissions to bring the temperature levels back down and to compensate for residual non-CO_2 emissions.

Within the range of scenarios, those that reflect more stringent limits on temperature increase show three key characteristics, compared to scenarios that are less stringent:

- The increase of zero-carbon technologies happens earlier and faster;
- The relevance of technologies for negative emissions increases;
- Demand side changes are more profound.

This research uses the range of scenarios as an input to developing approaches to Paris-alignment, as one part of the pool of information that supports decision-making. It is essential to reflect on the assumptions behind the data, and compare potentially conflicting conclusions of different analysis. This working paper does not recommend any specific source, but suggests evaluating those that are available, and let the MDB, potentially together with the country, decide if they want to focus on a few, or continue working with the full range.

The scenarios provide a direction, but decision-making tools require additional considerations to convert the more abstract, high-level pathways to a project level. Examples are the planned operation time of the suggested installations or their exact location (see section 2.3 and chapter 4).

Table 1 provides a list of studies that this working paper reviewed in-depth.[1] It is important to note that not all the scenarios are clearly aligned with the Paris Agreement long-term temperature goal. Most of the scenarios in these sources allow for an overshoot above 1.5°C in the 21st century and return to this limit by 2100.

Table 1: List of selected studies reviewed for the analysis

Data source	Scenario name	Main characteristics of the scenario	Temperature group of the scenario
Greenpeace - Energy [R]evolution (Teske, Sawyer, and Schäfer 2015)	Advanced Energy [R]evolution	Assumes a much faster introduction of new technologies compared to 2°C scenarios leading to complete decarbonization of power, heat and transportation sectors by 2050. Excludes nuclear and CCS an option per definition.	No clear temperature definition, scenarios are technology driven and aim to fully decarbonize sectors by 2050.
WWF/Ecofys - The Energy Report (WWF 2011)	100% Renewable Energy by 2050	Assumes strong demand side efficiency improvements and electrification, and quick ramp up of renewable technologies	No clear temperature definition, scenarios are technology driven and aim to fully decarbonize energy sectors by 2050.

[1] There are many more studies and scenarios give insights on specific technologies or sectors and are not listed here, but referenced where we used them.

IEA - World Energy Outlook (IEA 2017b)	Sustainable Development Scenario	Assumes an early peak in CO_2 emissions and a subsequent rapid decline. It integrates the objectives of the three Sustainable Development Goals that are most related to energy: climate change, energy access and air quality.	By 2040, emissions are at the lower end of a range of publicly available deep decarbonization scenarios, all of which estimate a median temperature increase by 2100 of around 1.7-1.8°C.
IEA - Energy Technologies Perspective (IEA 2017a)	Beyond 2°C Scenario	Explores how far deployment of technologies that are already available or in the innovation pipeline could take us beyond 2°C scenarios. Technology improvements and deployment are pushed to their maximum practicable limits across the energy system.	50% chance of limiting temperature increase by 2100 to 1.75°C.
UNEP - The Emissions Gap Report (UNEP 2017)	1.5°C scenario range	Synthesizes available scenarios from integrated assessment models on limited action until 2020 and least-cost emission reduction pathways from 2020 onwards.	50-66% chance of limiting global warming by 2100 to below 1.5°C above pre-industrial levels.
IRENA – Perspectives for the Energy Transition	66% 2°C Scenario	Assumes that policies are implemented to follow a GHG trajectory from the energy sector compatible with the Paris agreement goal. For that it assumes cut of fossil fuel subsidies and carbon price application across all countries in the power and industry sectors. Additional specific measures are assumed for Power, Industry, Transport and Buildings sectors.	66% probability of keeping the average global surface temperature rise throughout the 21st century to below 2°C.
Energy system transformations for limiting end-of-century warming to below 1.5 °C and Scenarios towards limiting global mean temperature increase below 1.5 °C (Rogelj et al. 2015a)	Not applicable	Highlight the differences between 2°C and 1.5°C pathways by assessing several scenarios and their resulting temperature and emissions impacts or their differences under distinct socio-economic constraints	Various
Scenarios towards limiting global mean temperature increase below 1.5 °C (Rogelj et al. 2018)	Not applicable	Based on six integrated assessment models and a simple climate model, under different socio-economic, technological and resource assumptions from five Shared Socio-economic Pathways.	Limit end-of-century radiative forcing to 1.9 W m−2, and consequently restrict median warming in the year 2100 to below 1.5°C
Alternative pathways to the 1.5°C target reduce the need for negative emission technologies (van Vuuren et al. 2018)	Not applicable	Alternative pathways to 1.5°C that do not rely so heavily on negative emissions (compare Box 2) but require strong changes in consumer behavior	Keep warming below 1.5°C (pathways leading mostly to a radiative forcing level of 1.9 W m−2 in 2100)
Climate Action Tracker – 10 short	Not applicable	Review of emission scenarios to identify ten sectoral benchmarks to help aligning	Various

term steps to limit global warming (Kuramochi et al. 2018)		emission pathways with long-term temperature goal	

Scenarios shown above are produced by different tools, such as Integrated Assessment Models (IAMs), energy sector models, or bottom-up analysis. Some, such as the Greenpeace Energy [R]evolution and WWF model, apply additional criteria such as 100% renewable energy or exclude certain technology options (e.g. nuclear, CCS).

Assumptions underlying the scenarios reviewed here vary considerably and are reflected in diverting outcomes. For example, Greenpeace assumes fully decarbonized power, heat and transport sectors by 2050, the IEA presents natural gas as a significant part of the energy mix by 2040 (the last year of the projections) (IEA 2017b). The IEA projections have received criticism mainly because of two points: First, their *Sustainable Development* scenario only has a 50% chance of keeping warming below 2°C and it would exhaust the estimated 1.5°C carbon budget by 2023 (Muttitt et al. 2018). Second, the IEA has historically been conservative in predicting the uptake of renewables and has consistently underestimated actual trends (Shankleman 2016; Metayer, Breyer, and Fell 2015; R. Sims et al. 2014). Differences in assumptions about the uptake of low-carbon options, fossil fuel phase-out and how the energy sector adapts to policy changes, together with distinct modeling approaches can result in different emissions pathways and different probabilities of the temperature goal (Wilkerson et al. 2015).

The following paragraphs summarize the required developments in the energy and non-energy sectors to arrive in a Paris-aligned world across the range of scenarios in Table 1. Chapter 4 on proposed tools and approaches to guide decisions on investments in the energy supply and transport sectors contains further detail on specific technologies that are most critical in Paris-aligned scenarios.

2.1.1 Energy supply and demand

Paris-aligned pathways require moving towards a zero-carbon **energy supply** in parallel to **increased energy efficiency**. The following paragraphs summarize the characteristics of these developments. More detail of the role of different technologies for the focus sectors energy and transport infrastructure is available in chapter 4.

Renewable energy plays a central role in the future energy supply in all Paris-aligned scenarios, with large shares of wind, solar, and hydro energy. The view on nuclear energy and natural gas is less consistent. While, for example, the IEA considers nuclear an important electricity supply technology (IEA 2017b, 2017a), Greenpeace does not include nuclear as a part of the electricity generation mix in 2050 in their *Advanced [R]evolution Scenario* due to their initial assumption of a 100% renewable energy system (Teske, Sawyer, and Schäfer 2015). Similarly, the IEA's *Sustainable Development Scenario* includes natural gas as an important "bridge technology" – presenting it as the largest single fuel by 2040 – while the Greenpeace *Advanced [R]evolution Scenario* highlights the need to completely phase out all fossil fuels by 2050, both for energy conversion as well for energy end-use.

The use of carbon neutral bioenergy is an important component for achieving CO_2 reductions beyond global net zero (Rogelj et al. 2018), and to offset emissions from those sectors, where it will technically not be possible to reduce emissions to zero (e.g. agriculture) (compare Box 2). First, biofuels may help decarbonize sectors where full electrification is more difficult, for example in aviation. Secondly, the use of bioenergy with carbon capture and storage (BECCS) in the power sector could help turn it into a source of negative emissions (IEA 2017a). However, both the size of the sustainable bioenergy potential and the scale at which BECCS (and other NETs) can be expected to be deployed in the future have been subject of considerable debate (EASAC 2018; Edenhofer, Pichs Madruga, and Sokona 2012). The carbon neutrality of bioenergy is also highly dependent on accurate life cycle analysis of the fuel in question and should include land use change and induced land use change. Approaches for life cycle analysis have varied and various methods approved by the International Organization for Standardization (ISO) result in different outcomes (Anex and Lifset 2014). The technical option of BECCS thus comes with critical concerns regarding feasibility, as well as economic, environmental and social sustainability. From today's view, it would be extremely risky to expect to be able to rely on such technologies on a large scale. For a broader discussion on the role of negative emissions see Box 2.

Under Paris-aligned scenarios, energy savings and emission reductions across the **energy demand sectors** (transport, buildings, industry) play an important role (Rogelj et al. 2018). Greater deployment of best available technology (BAT) and investments in innovation and efficiency in these sectors are paramount in achieving the significant decrease of energy use per capita needed in 1.5°C scenarios and are expected to generate considerable savings comparing 1.5°C to reference scenarios (Rogelj et al. 2015a).

1.5°C scenarios highlight the importance of electrification across all demand sectors. For example, under the *Beyond 2°C Scenario*, the share of electricity in final energy demand goes from 18% to 41% in 2060 (IEA 2017a) assuming electrification of end-use sectors buildings, industry and a notable shift in transport. In transport, the increased use of electric vehicles should be coupled with a strategy to avoid and shift traffic, through land use/urban planning and demand reduction, as well as a shift to more efficient modes of transportation, and the introduction of synthetic renewable fuels. Studies also reinforce the relevance of energy-neutral buildings and scaled-up refurbishment of existing buildings to maximize energy efficiency. When thinking about energy efficiency measures, it is critical to avoid increased consumption resulting from efficiency savings as the "rebound effect". This means that demand-side investments need to go hand-in-hand with appropriate measures to manage consumer behavior.

Additional infrastructure development is pivotal to accompany the technology shift in both supply and demand sectors. Scaled-up renewables, for example, demand significant changes in the electricity grid structure. Due to the variability of these sources, it is important to couple the use of renewables with flexibility options, e.g. energy storage technologies. Finally, electrification of the transport sector requires charging infrastructure that must precede the widespread penetration of electric vehicles.

2.1.2 Non-energy emissions

Several of the scenarios studies only focus on energy as the most significant source of greenhouse gas emissions or provide little granularity on non-energy sectors, such as land use and forestry, industry and waste. For some of the non-energy sectors, full decarbonization is not possible, or much more difficult and more costly to achieve. For example, emissions from agriculture are difficult to eliminate, but need to be reduced by 2.7-3.5 $GtCO_2e$ per year in 2050 in order to be consistent with Paris-aligned scenarios (Kuramochi et al. 2018). Additional emissions reductions in agriculture can only be reached by changing patterns in both food production and consumption (Climate Action Tracker 2018b). With better cropland and livestock management and lower food waste, it is possible to tap into the reduction potential of this sector. Dietary changes of consumers, e.g. moving away from meat intensive diets, also present a high mitigation potential for non-CO_2 emissions (Sterl et al. 2018). Reducing deforestation helps close the existing emissions gap between current policy developments and long-term emissions reduction goals consistent with Paris-aligned scenarios, since the forestry sector acts as an important source of negative emissions. Emissions reductions in the industry sector are mainly assumed to be generated through changes in processes, efficiency improvements and the use of carbon capture technologies in the production of cement, chemical, and iron and steel.

Box 2: The role of negative emissions in scenarios limiting temperature increase to 1.5°C by 2100

Along with reducing emissions, another option in mitigating climate change is to actively reduce the CO_2 concentration by removing it from the atmosphere. Several approaches resulting in net negative emissions exist, including afforestation/reforestation, soil carbon sequestration, biochar, direct air capture, enhanced weathering and ocean fertilization (Fuss et al. 2018). Among these technologies, only afforestation has so far been commercially deployed at large scale, however the most prominent technical option in socio-economic research is bioenergy with carbon capture and storage or BECCS (Boettcher et al. 2017). BECCS is based on coupling biomass with CCS technology both for power or fuel production. After being separated from the exhaust stream, CO_2 is stored long-term in geological sites.

All 37 1.5°C-compatible scenarios assessed by Rogelj et al. show negative annual emissions for the energy sector by 2100 (Rogelj et al. 2015b). BECCS is the main choice in IAM scenarios because they assume it to be a cost-effective option for achieving negative emissions. Large-scale feasibility and desirability of BECCs is controversial, given their potential impact on land use, food production, freshwater availability, and the uncertain availability of suitable geological storage sites (Williamson 2016; P. Smith et al. 2016). In the modeling community, there are concerns about the technical, economic and resource constraints of BECCS (Cozzi, Laura, Gül, and Prag 2017) and specifically the economic, environmental and societal sustainability of the technology (Vaughan et al. 2018). The IEA's Sustainable Development scenario also includes BECCS to offset residual emissions in sectors where mitigation is difficult or costly to abate directly, e.g. food production (IEA 2017a). When negative emissions are deemed necessary, BECCS is generally considered the main alternative, although some studies look into enhanced weathering (Schuiling and Krijgsman 2006; Strefler et al. 2015), and direct air capture (House et al. 2011; Lackner et al. 2012). Harper et al find that forest-based mitigation may be more efficient than BECCS for carbon dioxide removal (Harper et al. 2018).

Nonetheless, there is a broader discussion on the need for negative emissions requirements. Kriegler et al. explore the linkages between negative emissions and the uncertainty about the remaining carbon budget. Carbon dioxide removal technologies are paramount in a case where the available carbon budget is smaller than 650 $GtCO_2$. If the budget is higher, it is possible to limit warming to 1.5°C without carbon removal (Kriegler et al. 2018). Tanaka and O'Neill compare emissions and temperature goals and claim the need for negative emissions is heavily influenced by the models' peak and decline shape of temperature projections which may have led to an overemphasis of net-zero emissions (Tanaka and O'Neill 2018).

The land and water use availability is also an important factor, since BECCS is bound by the same constraints as any bioenergy technology. Higher use of BECCS would imply a higher demand for energy crops. The land covered by energy crops would grow by almost four times in a 1.5°C scenario when compared to a reference scenario; this reduces land availability for food and feed crops, pasture, forest, and other natural land (Vaughan et al. 2018). A detailed study from Krause et al. investigates land demand and carbon uptake in scenarios with negative emissions using distinct models. Their research points to the high level of uncertainty resulting from the different model assumptions and highlights the risk of assuming high uptake of negative emissions technologies (Krause et al. 2018).

The efficacy of emissions cuts through other mitigation actions impacts the need for negative emissions. Van Vuuren et al. investigate alternative pathways to 1.5°C that do not rely so heavily on negative emissions, based mostly on these guiding principles (van Vuuren et al. 2018):

- Rapid application of Best Available Technologies for energy and material efficiency;
- Higher electrification combined with faster deployment of variables renewables and declining costs of electricity infrastructure;
- Higher crop yields and more efficient animal husbandry;
- Consumer habit changes, e.g. low meat diet and shift to less emission intensive transport modes.

In scenarios where efficiency measures are sufficient to significantly lower the energy demand, the importance of BECCS is reduced (Rogelj et al. 2018). Even considering reduced demand strategies, several scenarios still rely on BECCS (van Vuuren et al. 2018) since the use of negative emissions can alleviate the pressure on emissions intensity reductions. Ignoring its use results in emission reduction rates well above historical values (Holz et al. 2017). Considering the deployment rate needs, there is need for further R&D into techno-economical aspects in order to mainstream the technology (Kuramochi et al. 2018). Due to the high level of uncertainty around the effectiveness of emissions reduction strategies, the land and carbon budget availability, relying on large-scale negative emissions is a very risky strategy (Krause et al. 2018).

2.2 What does a Paris-aligned development mean for investment flows?

The Paris Agreement has implications for the scale of finance needed and the types of activities that need funding. In Paris, it was confirmed that developed countries would mobilize USD 100 billion of climate finance per year from 2020 through to 2025, beyond which the Parties to the Agreement would decide on a new, higher collective goal. In addition, Article 2.1c of the Paris Agreement explicitly states that finance flows have to be made "consistent with a pathway towards low GHG emissions and climate resilient development". The more stringent goal of "well below 2°C" and 1.5° is likely to require a faster mobilization of finance and increased investments. At the same time the exact scale of investment in particular at the specific country and sector level is unclear.

Independent of Paris-alignment, there is an infrastructure investment gap: In lower and middle-income countries, affordable and reliable access to basic services remains a challenge, while in advanced economies, the ageing infrastructure is worrisome (OECD 2017b). Woetzel et al. state that global investments in transportation, power, water and telecommunication systems should increase from USD 2.5 trillion per year to USD 3.3 trillion per year. This increased amount is equal to 3.8% of global GDP, with 2% of global GDP going into power systems and roads (Woetzel et al. 2016). OECD estimates for additional investments to sustain growth and development are even higher: In a scenario without additional climate action, total investment needs in infrastructure across all areas would be at USD 6.3 trillion per year. With additional climate action this number would increase to USD 6.9 trillion, however the increment would be offset by savings in fossil-fuel expenditures of USD 1.7 trillion per year on average (OECD 2017b).

It is critical that when trying to close this gap, investments are Paris-aligned, to avoid a lock-in of high-carbon technologies, reduce the risk of stranded assets and improve climate resilience. Infrastructure has a particularly long lifetime, so decisions taken today will have a decisive impact on long-term decarbonization options. Increasing the expansion of infrastructure in most cases means increasing the need for construction materials (metals, cement, etc.), and thus the activity of traditionally high-carbon sectors during the time of construction. This potentially negative impact should be mitigated through exploring options in the industrial sectors and in sustainable construction practices, but also by rethinking how to approach infrastructure needs (e.g. increased use of digital technologies for participation in markets, education etc.).

Various attempts have been made to quantify the additional investments needs and required shifts of investments from "brown" to "green" (compare also (McCollum et al. 2018a; OECD/IEA and IRENA 2017; BNEF 2018b)). Overall the studies find a need to divest from fossil fuel energy, and an increase in investments in renewable energy, electricity grids, and demand side energy efficiency measures (transport, buildings, industry).

McCollum, for example, finds that the share of investments in low-carbon energy of total investments in the energy supply sector will need to increase to about 90% in 2050 under Paris-aligned scenarios, compared to about 33% in 2015, with the remaining share of investments still also covering fossil fuels (McCollum et al. 2018b). According to the IEA, 83% of the total cumulative investment in the electricity generation sector (which excludes investment in electricity networks) between 2017 and 2060 will flow to renewables and storage infrastructure in the *Beyond 2°C Scenario* (IEA 2017a). Bloomberg, in their forecast of current trends ("*New Energy Outlook*"), expects that 72% of the new electricity generation investment to 2040 will go to renewable energy (BNEF 2017). According to Greenpeace, SolarPower Europe and GWEC (Teske, Sawyer, and Schäfer 2015) 94% of the entire global investment in the power sector needs to be directed towards renewables and cogeneration by 2030 to align the emissions from that sector with the Paris Agreement.

For the transport sector, the IEA/OECD estimates that in more ambitious scenarios, investments in road, rail, aviation and transport infrastructure do not vary much compared to current reference developments (OECD 2017b, 2017a). However, the working paper does not break down the sectors to concrete investment or technology areas.

Box 3: Defining stranded assets and carbon lock-in

The terms stranded assets and carbon lock-in are commonly mentioned in the context of investment alignment and long-term decarbonization. Both present significant transition risks for investors and policymakers.

Stranded assets refer to resources that are no longer able to produce an economic return prior to the end of their economic or physical lifetime due to changes associated with the transition to a low carbon economy. This may occur as a result of regulatory change, changes in related costs or prices, or could also refer to physical stranding related to climate impacts (see www.carbontracker.org). Stranded assets are mainly associated with fossil fuel supply and generation resources. For example, a gas-fired power plant may be taken off the grid before it reaches the end of its lifetime because of fuel or technology price trends or policy decisions to move to a decarbonization pathway.

Carbon or technology lock-in mainly refers to investment decisions that create system inertia and barriers to the introduction of low carbon alternatives despite economic or environmental advantages. It is mainly relevant for assets with a long lifetime where such investments prevent a policy change to enable more advantageous technologies to enter the system later on. An example would be an investment in a coal or gas power plant without considering longer-term climate policy targets. Once the investment has been made, it may prevent or deter the implementation of an ambitious decarbonization plan.

Stranded assets and carbon lock-ins are linked. The risk of new investment in fossil fuels is twofold: On the one hand, a carbon lock-in increases the risk to of global warming of 2°C or more. Besides extreme effects on ecosystems and human livelihoods, the resulting climate change impacts would increase physical risks to investors. On the other hand, if political action is taken to prevent such an outcome, the use of fossil fuels might be restricted, leading to plants being shut down before the end of their economic lifetime and not delivering the expected returns on which the investment decision was based. An investor will try to avoid letting an existing asset strand; this may not be in the interests of the policymakers who strive for the most effective implementation of their policy goals (e.g. decarbonization).

A shift from fossil fuels to renewables in the electricity sector can already be observed in some regions. Mainly solar investments have increased - in parallel to decreasing costs of the technology - and investments in coal power plants have substantially decreased over the last three years, with China and India contributing the largest absolute decrease in investments. Investments in other renewable energy technologies have varied from year to year. Investments in onshore wind power decreased in 2016 and 2017, which is only partially made up by a decrease in technology costs. At the same time, for the first time since 2014, investments in upstream oil and gas show a slight recovery in 2017 from 2016, as well as a forecast increase in 2018, driven by rising oil prices and sustained oil demand. In 2017, an average of 30% of investments in the electricity generation system went into high-carbon technologies (IEA 2018). Despite decreasing investments, coal consumption is still projected to increase in various countries, at specifically high rates in the region of Asia (*Climate Action Tracker - Country Assessments* 2018).

This mixed picture shows that more effort is needed to sustainably shift investment away from fossil fuels toward renewables. For Paris-alignment, the trend away from fossil fuels must be rapidly accelerated and expanded across all sectors. This working paper uses the insights from this chapter to categorize investment areas in different categories of Paris-alignment, and provides options of how MDBs can further build on existing climate tools to integrate the requirements illustrated in the scenarios. Wright et al. provide further recommendations to MDBs, mostly on an overarching structural/policy level, on how to support sustainable infrastructure (Wright, Dimsdale, et al. 2018).

2.3 Turning scenarios into decision-making tools

Based on the analysis of scenarios and associated research, we grouped investment areas into three categories: "Paris-aligned", "misaligned" and "conditional". Paris-aligned means investments in this area actively support the mitigation goals of the Paris Agreement and will remain part of the system in the long term. Misaligned means they undermine those goals and need to phase-out quickly. For investment areas and technologies under "conditional", whether it can be considered Paris-aligned depends on the exact circumstances and characteristics of a project.

The "conditional" category exists due to

- The fact that multiple pathways can lead to 1.5°C.
- Different assumptions on technological development.
- National context and sector interlinkages.

This category includes investment areas that generate some level of greenhouse gas emissions, or that carry significant risk for other sustainability criteria[2]. It also includes investment areas essential for the Paris Agreement and actively supporting its implementation, such as efficiency improvements or electricity grids. The question here is how ambitious the project should be and how to ensure it does not negatively interfere with aligned investment areas, not whether there should be an investment at all. The conditions the investment would need to meet to be considered aligned are:

- Alignment with cost-efficient transformation to net zero in the second half of the century.
- Ensuring around mid-century as a cut-off date for energy-related emissions.
- No negative interference with aligned investment areas or sustainable development.

The main characteristics of 1.5 C vs 2˚C pathways previously mentioned – faster decarbonization, more profound demand-side changes and a more important role for negative emissions technologies - impact the overall investment volumes and the timing of those, but there is only a limited effect within this framework on the development of investing criteria in the energy supply and transport sector on a project level. For most technologies, the classification of whether they are Paris compatible is not affected by the stringency of the climate goal (i.e. 1.5°C or 2°C limit). Some technologies, however, are affected, mostly unabated gas-fired power, where less stringent scenarios provide slightly more space for deploying the technology, while stringent 1.5°C scenarios require faster phase out.

The categorization of technologies is based on the review of available Paris-aligned scenarios, as described in the previous chapters. A summary of the categorization of investment areas in the energy supply and transport infrastructure is shown in

[2] The Paris Agreement emphasises the need to see mitigation in the context of sustainable development and poverty eradication. For evaluating the Paris-alignment of investment areas, potential impacts on environment, economy and society beyond greenhouse gas emissions need to be part of the considerations.

Table 2 below. Transport and energy sector infrastructure are the two sectors covered in detail in this working paper, chapter 4 describes further detail on the categorization of specific investment areas. Other areas, such as investments in forestry and land use, agriculture, waste, demand side improvements, are equally important, however not considered within the scope of this working paper.

This research relies on global scenarios, with limited regional detail. Where national scenarios in line with the long-term Paris temperature goal (e.g. full decarbonization by mid-century) exist or can be developed, they can and should be used to further redefine the tools and approaches and adapt them to national circumstances, and to particularly provide more clarity for the technologies categorized as conditional in the global context. With more detail at a national level, for example, it may be possible to move the categories now defined as “conditional” to “misaligned” or “aligned”.

The categorization may change over time, with new emerging technologies or insights into existing ones. It also seems likely that many technologies in the conditional category will remain there but, with increasing pressure on mitigation, will have to comply with stricter criteria to be eventually rated Paris-aligned. This may, for example, be the case for investments in energy efficiency, where efficiency standards need to increase over time (compare (Höhne et al. 2015)). The categorization should receive regular updates, e.g. every five years.

Table 2: Categorization of investment areas in energy supply and transport infrastructure

	PARIS-ALIGNED	CONDITIONAL	MISALIGNED
	Fully aligned with Paris Agreement consistently across all scenarios	**Only aligned under certain conditions**	**Consistently Paris misaligned in all scenarios**
Energy supply infrastructure	• Renewable energy (solar, wind, small hydro, tidal, wave and ocean) • Electricity system flexibility option	• Energy transmission and distribution infrastructure • Geothermal[2)] • Gas (power plants, transport of gas)[1)] • Large hydropower[3)] • Biomass, incl. bio energy carbon capture storage[3),4)] • Coal with carbon capture and storage (CCS)[1),3)] • Nuclear[3)]	• Coal fired power plants with unabated emissions over their lifetime • New upstream oil and gas production and exploration • Coal mining • Oil power plants
Transport infrastructure	• Zero-carbon transport fueling infrastructure (electricity, hydrogen, alternative fuels) • Non-motorized transport infrastructure (sidewalks and dedicated bike-lanes, bike sharing infrastructure) • Integration of transport and urban development planning • Electric rail and rolling stock (passenger and freight) • Electric public transport • Inland waterways • Transport and travel demand management measures	• Road infrastructure including tunnels and bridges • Diesel rail and rolling stock • Port expansion for transport of non-fossil fuel freight	• New road, rail, waterway and port infrastructure for fossil fuel transport • New airports/airport expansion[5)]

Footnotes:
1) This investment area causes direct GHG emissions
2) This investment area can cause direct GHG emissions
3) This investment area is subject to critical sustainability and/or security concerns
4) The production of bioenergy can cause substantial GHG emissions. We differentiate this from other investment areas, where emissions occur during the manufacturing process, because the impact of unsustainable production of the fuel is over proportionally larger, and not limited to the manufacturing of the technology.
5) The authors do recognize that alternatives for air travel are more limited compared to, for example, coal or petroleum for electricity. This highlights the need for further investigation of fuel alternatives for air transport.

The categorization of aligned and misaligned investment areas can be used to inform positive and negative lists in order to evaluate a project's Paris-alignment. Existing lists in the MDBs could be modified accordingly (see chapter 3.1.1). Chapter 4 builds on the categorization to develop decision-making tools that can be used by investors to evaluate project proposals in the transport and energy sector.

3 Building on MDBs' existing climate tools

Key Conclusions

MDBs are already using numerous climate-related decision-making tools. These existing climate tools can be further developed to support Paris-alignment of MDB investments.

Existing negative lists, such as exclusions or strict restrictions for certain types of fossil fuel projects; or positive lists, such as the eligibility list for climate finance, can be updated to filter projects that are unambiguously aligned or misaligned. Benchmarks such as emissions standards can also be applied to exclude clearly misaligned projects in a specific sector if they reflect science-based levels. Alternatively, benchmarks can be set at a strict level that only allows for aligned activities. Negative lists or benchmarks should have a forward-looking component, as emitting projects that are conditionally aligned today may be misaligned by the second half of this century. Five-year milestones could be set until 2050 and the investment tested against these for its entire lifetime.

Forward-looking shadow carbon pricing is increasingly applied by MDBs. Prices should be set at a sufficiently high level, informed by scientific analysis. Ideally, prices would reflect country and sector-specific mitigation costs.

A portfolio-wide gross emissions target can incentivize alignment of the entire portfolio. Through GHG accounting, compliance with the cap can be tracked. GHG accounting at both project and portfolio level is an important precondition for a number of tools (e.g. benchmarks, shadow carbon pricing, emission caps and targets). Disclosure of gross emissions is necessary to understand whether a project as well as the entire project pipeline is aligned with a decarbonization pathway per sector. It is important that GHG accounting includes induced emissions as well as supply chain emissions of purchased goods and services, where these are significant.

Over the last decade, MDBs have made efforts to integrate climate aspects into investment decisions, using tools such as climate finance targets, GHG-accounting, internal carbon pricing, negative lists and others. Banks can build on these efforts as they strive to align their operations with the Paris Agreement. This chapter assesses lessons learned from the application of existing tools: how well they are suited to support Paris-alignment, and how they might need to be modified or strengthened.

We differentiate between tools implemented at project level and tools implemented at the country, sector or bank strategy level (see Table 3). Tools implemented at project level can be directly applied to an individual investment decision, such as a carbon price or an exclusion list. Tools at strategy level typically influence the composition of the entire portfolio or, alternatively, of country or sector portfolios. Examples are quantitative targets for specific investments, targets for GHG reductions or other forms of priority setting, such as in country or sector strategies.

Table 3: Climate toolbox - selection of tools that can support alignment with the temperature goal

BANK STRATEGY LEVEL	COUNTRY STRATEGY LEVEL SECTOR STRATEGY LEVEL	PROJECT LEVEL
GHG accounting + Portfolio emission target	Supporting and enhancing NDCs and LTS	Negative list Positive list
Climate finance target	Country emission pathways	GHG accounting + Emission Benchmarks
Setting standards for financial institutions world wide through financial intermediary lending	GHG accounting + Sector emission targets	GHG accounting + Shadow carbon pricing
Supporting the enabling environment through policy based lending		Decision trees combining several tools (including country & sector decarbonization pathways)

Note: Tools with a green symbol help to incentivize investments that actively support the achievement of the Paris temperature goal. Tools with a red symbol help ensure that investments that risk undermining the achievement of the Paris temperature goal are excluded.

Not all tools from the toolbox have to be used simultaneously to ensure Paris-alignment. Chapters 3 and 5 discuss under which circumstances and for what kind of activities the specific tools are most useful. In this chapter, we focus on tools applied to traditional project lending. It analyzes the degree to which current climate tools can be used to assess whether an investment is Paris-aligned. It also elaborates on the suitability of existing tools to assess the alignment of the entire sector, country or bank portfolio. Chapter 4 contains suggestions on how several tools could be combined to assess Paris-alignment of direct project investment in the energy supply and transport sectors. To what extent the tools can be applied to financial intermediary lending and policy-based lending will be discussed in more detail in chapter 5.

3.1 Assessment of project-level tools

Project-level climate tools are applied to the individual project during the project approval process. Depending on their nature and design they can have a critical influence on whether an individual project enters the project pipeline and eventually the portfolio of a bank or not. Table 4 shows the most important climate tools currently used in various banks at the project level.

Table 4: Climate tools implemented at project level

Tools	MDBs	State of play	Starting points for Paris-aligned design	Suitability for alignment with Paris temperature goal
Negative list	ADB AfDB WBG WBG EBRD All	• Exclusion of exploration and/or extraction and/or upstream infrastructure for oil and/or gas • Relatively broad exclusion of coal, but remaining exceptions for "rare circumstances" • Exclusion of commercial logging of primary forest and/or logging equipment	• Prerequisite: Adjust according to scientific Paris-aligned scenarios • Exclude all new fossil fuel exploration, coal mining, all new coal infrastructure, upstream oil and gas infrastructure • Negative list should be forward-looking i.e. signaling what will be on future negative lists in five year steps, or at least dynamic i.e. should be reviewed at least every five years	• **High** for clearly misaligned projects.
Positive list	ADB AfDB EBRD EIB IDBG WBG	• Harmonized eligibility criteria for climate finance projects • Incentivize emission reduction activities and investments • Currently not informed by full decarbonization pathway	• Prerequisite: Adjust according to scientific Paris-aligned scenarios • Positive lists should only include technologies/projects defined by sector decarbonization pathway (the "fully aligned" category) • Adjust climate mitigation finance eligibility criteria accordingly, (remove "conditionally aligned" activities or add quantitative criteria for alignment)	• **High** for fully aligned projects. • Not an instrument to mainstream.

Benchmarks	EIB
	EBRD
		• EIB emissions performance standard for electricity generation: 550gCO_2e/kWh
		• EIB/EBRD: require Best Available Technology (BAT) benchmarks
			• Prerequisite 1: GHG-accounting or energy audits (depending on type of benchmark)
			• Prerequisite 2: Adjust level according to scientific scenarios, so that it allows
			  • Either only for fully aligned investments
			  • Or also for conditionally aligned investments (excl. misaligned)
			• BAT (Best available technology) can serve as benchmark only if informed by Paris-aligned scenarios
				• **High,** for clearly misaligned projects.
				• **High,** for conditional projects, if benchmark is set at a level to allow only for fully aligned investments. **Low** for conditional projects, otherwise.
				• **High**, for aligned projects, if benchmark is set at a level to allow only for fully aligned investments.
				• **Low** for aligned projects, otherwise.

Shadow carbon price	ADB EIB EBRD WBG (AIIB)	• Currently ranging from USD 36 to 77 (high value) • Rising to USD 48 to 100 in 2030 (high value) • ADB and EBRD work with central value only • EIB and WBG also have high and low values • EBRD applies the shadow carbon price to infrastructure projects where relevant • AIIB plans to use different carbon prices to test robustness and sensitivity of economic analysis	• Prerequisite 1: GHG-accounting • Prerequisite 2: Adjust price levels e.g.: Stern-Stiglitz report: at least USD 40-80 in 2020, at least USD 50-100 by 2030, ideally differentiated per sector / country (reflecting mitigation cost) • Include Scope 3 emissions, where induced effects are calculated as benefits in the wider cost-benefit analysis • Include Scope 3 category 1 & 11 for all infrastructure projects • Projects not economically viable / least cost using the shadow carbon price should automatically be excluded from financing	• **Low to high,** for all projects, and depending on sector, for all projects. • Suitable when cost of mitigation accurately reflected in carbon price.

GHG-accounting	ADB
	AfDB,
	EBRD
	EIB
	IDBG
	WBG
	(AIIB)
		• All 6 MDBs: account for gross emissions & net/avoided emissions
		• Only EIB and IDBG disclose gross emissions
		• All 6 MDBs: incl. Scope 1 & 2 emissions
		• ADB, EIB, IDBG, WBG: incl. Scope 3 in some sectors or "where relevant"
		• AIIB: will use a shadow carbon price in the energy sector. Internal guidance documents under development for energy sector
			• Include Scope 3 emissions, in particular:
			  • category 1: "purchased goods and services" (value chain emissions from extraction and production of materials)
			  • category 11: "use of sold products" (induced emissions)
				• **Prerequisite for other tools.**
				• Prerequisite for emissions standard and shadow carbon price, (project level) and GHG targets (bank strategy level). By itself does not ensure Paris-alignment.

3.1.1 Negative lists and positive lists

What this tool does and how banks currently use it

Negative lists define projects and technologies which banks choose not to finance and are therefore very straightforward to implement and monitor. MDBs that make use of climate-related negative lists are: the AfDB (AfDB 2012), excluding financing for exploration of new oil and gas fields, the ADB (ADB 2009a), excluding financing for the exploration of new oil and gas fields as well as extraction of oil, and the World Bank Group (WBG 2017a), excluding financing for all upstream oil and gas activities, such as exploration, drilling and operating wells after 2019. The World Bank Group has explained this exclusion with its ongoing support to developing countries to achieve Paris goals (WBG 2017a).

Some MDBs also use policies similar to exclusion lists to withdraw (or drastically limit) their support for coal-fired power plants. Both the World Bank and the EBRD set out their policies on coal in their energy sector strategies and commit to not funding greenfield coal plants except in rare and exceptional circumstances where no other viable electricity or financing options are available (EBRD Energy Sector 2013; WBG Energy Sector Strategy 2013).

Although not always on an explicit climate negative list, there are other safeguard policies that banks have adopted that de facto expand the climate relevant negative list. For example, all analysed MDBs do not finance commercial logging and/or the purchase of logging equipment for use in primary tropical moist forest, which has major deforestation - and therefore climate change - implications ("Environmental and Social Framework" 2016; ADB 2009b).

At the other end of the spectrum, positive lists can incentivize the necessary financing for clearly aligned activities. Climate-related positive lists, also called eligibility lists, are currently used in the context of climate finance. The ADB, AfDB, EBRD, EIB, IDBG, Islamic Development Bank, and WBG, have agreed on the activities accountable as climate mitigation finance or as climate adaptation finance (see chapter 6.2.1 for detail on the climate finance methodology used). The banks will prioritize these activities or projects as they account towards their respective climate finance targets (see chapter 3.2).

What else could be done for Paris-aligned decision-making

Both negative and positive lists would need to be updated to reflect the requirement of full decarbonization by mid-century. Negative lists should include all misaligned investment areas (e.g. new coal plants with unabated emissions, new upstream oil and gas exploration, new transport infrastructure for coal and petroleum transport); positive lists only aligned investment areas (e.g. solar, wind, non-motorized transport infrastructure) (see chapter 2.3). They should be forward-looking, as some investments areas will move from conditionally aligned to misaligned in the future.

A frequently perceived challenge in implementing negative lists is that they may restrict the options for development banks' and governments' other potential goals, such as improving access to energy.

Forward-looking announcements can help to ease the transition. In 2017, the World Bank Group announced that it will no longer finance upstream oil and gas after 2019, leaving project developers two years to adapt. If the banks were to set out a timeline until 2050, including milestones (every five years) indicating what investment areas will be added to the negative list at each of those milestones, this would send a clear signal to client countries and investors, thereby decreasing the risk of stranded assets. Such an announcement would also imply that significant capital is made available to be used for renewable energy or other sectors.

In order to avoid a "rush" to implement misaligned projects as long as they can still be financed, the tool should be combined with portfolio-wide emission caps or emission reduction targets (see chapter 3.2).

A further challenge is that the overlap of access that countries have to several MDBs may reduce the effectiveness of just one bank excluding one investment area. MDBs should therefore consider harmonizing their exclusion lists to level the playing field. Harmonized lists would also send a stronger signal to the market.

Similarly, existing positive lists for climate finance activities need to be adjusted. Switching to a less GHG-intensive thermal power fuel, currently categorized as climate mitigation finance (AfDB et al. 2018), says little about whether the new level of emissions is ambitious enough to be in line with a pathway towards full decarbonization by mid-century and may bear the unwanted consequence of prolonging useful life of a misaligned investment. The same is true for efficiency improvements, switches to co-generation technologies or cleaner industrial production, coal mine methane capture, the reduction of gas or methane fugitive emissions flaring, etc. Only activities that are unanimously seen as "Paris-aligned" in scientific pathways should be eligible (see e.g. decarbonization tools proposed in chapter 4.2.2 and 4.3.2). Conditionally aligned investment areas, such as energy generation from fossil fuels that are described as a transition fuel within the NDC of a specific country, could receive financing from MDBs without being categorized as "climate finance", but only if they are part of the country's decarbonization plan by mid-century.

Changing the eligibility list of climate finance is challenging, because this could hinder the goal of tracking the development of climate finance over time. The Joint Methodology to identify and track climate finance investments shared to date by seven MDBs[3] was developed in 2011, well before the Paris Agreement and goals were set for the year 2020 (see chapter 6.2.1). Gradual updates in the methodology have, however, taken place several times since its development (AfDB et al. 2018). A good opportunity to adjust the eligibility criteria list for climate finance tracking would be the planned review of the methodology for the period after 2020. For the next period, new goals will be set, and their achievement could be traced using the new eligibility criteria from the outset. In addition to the joint climate finance eligibility lists, individual positive lists for prioritization should be developed or updated as soon as possible.

3.1.2 GHG accounting

What this tool does and how banks currently use it

GHG accounting measures the carbon footprint of a bank-financed project. In itself, it does not lead to emission reductions nor investment decisions in line with trajectories informed by the Paris global temperature goal. However, an effective GHG-accounting system is a prerequisite for a number of other tools. It has to be combined with targets or tools at project level (see emissions standards, shadow carbon pricing in the next subchapters) or at bank-strategy level (see targets in chapter 3.2) in order to go beyond solely reporting purposes.

The AfDB, ADB, EBRD, EIB, IDB and WBG all have experiences with GHG accounting at project if not portfolio level. In 2012, these banks agreed on common minimum requirements for the methodology used in - and reporting of - GHG accounting (IFIs 2015). This was an important step, as the outcome of a GHG calculation critically depends on the choice of methodology. The framework includes a commitment to account for the GHG emissions of directly financed projects. However, the MDBs are free to develop minimal criteria determining for which projects GHG-accounting must be applied. Analogously, they can exclude entire sectors and investment types from this exercise. All MDBs use thresholds for GHG accounting, meaning that the GHG analysis is conducted only for projects above a predefined expected level of emissions.

[3] ADB, AfDB, EBRD, EIB, IDBG, IsDB, WBG

Table 5: Overview of GHG accounting methodology by MDB

Institution	Category	Emissions & Sectors included in GHG accounting
ADB	*Scopes Covered*	Scope 1 for all clean energy (including energy efficiency) projects.
		Scope 2 for all clean energy (including energy efficiency) projects.
		Scope 3 only for transport projects.
	*Gross or net**	Net* emissions are accounted for.
	Thresholds	Gross emissions of 100,000 tCO_{2e}/year for emitting projects. All mitigation projects that reduce emissions (no threshold).
	Sector Applied	Sector specific guidance publicly available for Clean Energy & Transport. Not clear if a formal policy for further sectors has been adopted.
EBRD	*Scopes Covered*	Scope 1 for all projects.
		Scope 2 for all projects.
		Scope 3 only in case of emission savings from mitigation projects.
	*Gross or net**	Both, if considered quantifiable and necessary. Net* emissions otherwise.
	Thresholds	Net* emissions of 25,000 tCO_{2e}/year.
	Sector Applied	All sectors and projects considered to be above threshold.
EIB	*Scopes Covered*	Scope 1 for all projects.
		Scope 2 for all projects.
		Scope 3 for road, rail & public transport.
		Considers adding scope 3 for airports & ports.
	*Gross or net**	Both.
	Thresholds	Gross emissions of 100,000 tCO_{2e}/year and/or net* emissions of 20,000 tCO_{2e}/year
	Sector Applied	All sectors and projects considered to be above threshold.
WBG (including IFC)	*Scopes Covered*	Scope 1 for all projects.
		Scope 2 for all projects.
		Scope 3 for projects with material emissions. When induced benefits are accounted in cost-benefit analysis, then emissions from induced effects are counted as costs.
	*Gross or net**	Both.
	Thresholds	World Bank: Net* emissions of 25,000 tCO_{2e}/year. IFC: Gross emissions of 25,000 tCO_{2e}/year.
	Sector Applied	World Bank: Energy; Transport; Agriculture; Forestry; Water; Solid waste
		IFC: Cement; Thermal power; Chemical industry (pilot phase for all sectors)
IDBG	*Scopes Covered*	Scope 1 for all projects.
		Scope 2 for all projects.
		Scope 3 for emissions generated during the first year of full operation/production if emissions are within geographic boundaries. May include construction emissions averaged over the project's lifetime.
	*Gross or net**	Both.
	Thresholds	Either net* or gross emissions of 25,000 tCO_{2e}/year.
	Sector Applied	Energy; Industry; Agriculture; Water & Sanitation; Transport; Urban Development & Tourism
AfDB	*Policy TBD*	Not clear if a formal policy has been adopted. Began piloting project-level GHG accounting for the energy sector using the IFI methodology in 2016.
AIIB	*Policy TBD*	To be conducted in the energy sector. Internal guidance documents are under development.
Notes*	*Net Emissions Definition*	Estimated gross emissions with the project -minus- Estimated gross emissions without the project (baseline scenario).

Sources: ADB 2010, ADB 2016a, ADB 2017a, ADB 2017b, AfDB 2016, AIIB 2016, AIIB 2018, Climate Investment Fund 2016, Climate Investment Fund 2017, EBRD 2017, EBRD n.d., EIB 2014, EIB 2015, IDB 2016b, IFC 2011, IFC 2017c, WBG 2016

Under the agreed framework the banks have committed to account for Scope 1 emissions (direct emissions from the financed projects) and Scope 2 emissions (GHG emitted during generation of electricity or heat used by the financed project), as defined by the GHG Protocol developed by the World

Resources Institute (Ranganathan 2004). Scope 3 emissions (other upstream and downstream emissions that are a consequence of activities by the company, but not under the control of the company) can be included on a voluntary basis.

All MDBs under the IFI framework have agreed to estimate gross (or absolute) emissions. For mitigation projects these MDBs also estimate net (or avoided) emissions against a baseline. The baseline reflects a "without project" scenario or an "alternate" scenario reflecting the most likely alternative.

The AIIB has not yet committed to the IFI framework. As the bank has only been in operation since 2016, some tools and practices have yet to be determined. In its Environmental and Social Framework, the AIIB commits to financially supporting clients in GHG accounting and reporting - if requested ("Environmental and Social Framework" 2016).

The energy strategy also requires banks to use "GHG reductions in [metric] tons CO2e/year" as a project result indicator. Supporting internal guidance notes are being developed (AIIB 2018). It is considering GHG accounting for other sectors alongside the development of the respective strategies. It remains to be seen what this methodology (scope, thresholds, application to all energy or only to mitigation projects) will look like and whether the AIIB will join the IFI framework.

What else could be done for Paris-aligned decision-making

With regard to Paris-alignment - and for risk management purposes - it can be necessary to include Scope 3 emissions. Pathways consistent with the Paris temperature goal depend on all emissions. Consequently, Scope 3 emissions can be critical for a Paris-aligned investment decision and, wherever they are significant, should be integrated into tools like benchmarks, shadow carbon pricing and emissions targets.

For many infrastructure projects, two categories under Scope 3 can be particularly significant: extraction and production of purchased materials[4] as well as induced emissions (e.g. air traffic and more economic activity in the region after construction of an airport)[5]. Data availability and consistency often is an issue for Scope 3, being the broadest of all scopes. However, projections on economic activity development taken from the MDB's economic analysis could be used to assess induced GHG emissions from emission-intensive activities resulting from the project (Hansen, Haas, and Erickson 2017). Some MDB's are taking steps in this direction. For example, the EIB is reviewing its accounting methodology for airports and ports and aims to incorporate induced emissions in the future (EIB 2014).

As calculating Scope 3 emissions is time-consuming, MDBs would benefit from knowledge sharing, for example by establishing a joint database including typical emissions from specific investments by activity and country.

In addition to using ex ante estimates for the investment decision, effective GHG emissions after project realization could be monitored. This would help to improve accuracy of estimates over time. It also would avoid modifications of projects or operation modalities, which would result in more emissions.

The alignment of emissions with a trajectory towards full decarbonization by mid-century needs to be monitored effectively. It is therefore necessary to account for, and disclose, not only "avoided" emissions from mitigation projects but also gross emissions from all projects. The methodology used for GHG accounting should be consistent with that used for scenario modeling.

---

[4] falling under Scope 3 category 1 "purchased goods and services"

[5] falling under Scope 3 category 11 "use of sold products"

Greenhouse gas accounting should be conducted for all bank activities that lead to significant emissions. Depending on the project, this could be the case in all project types, also including financial intermediary lending, policy-based lending and technical assistance (see chapter 5 for more detail).

3.1.3 Benchmarks: Emissions Standards, energy efficiency standards, BAT

What this tool does and how banks currently use it

Benchmarking is a technique that originates from strategic management and involves the measurement of performance according to a standardized format. Benchmarking for emissions intensity (e.g. in gCO_2e/kWh) or energy efficiency (e.g. percentage reduction), sets a particular target based on best performance data, the "benchmark" or "standard" (*Assessing Measures of Energy Efficiency Performance and Their Application in Industry* 2009): In the MDB context an emissions or energy efficiency benchmark sets minimal requirements that an investment must meet. Benchmarks can also be set by national or regional legislation or another common agreement, typically then called "Best Available Technology" or "Best Available Techniques" (BAT), through which their application becomes binding for all economic actors.

The EIB is currently the only MDB that uses its own emissions standard, apart from those required by national or regional legislation. Its "Emissions Performance Standard" is specifically designed for the electricity generation sector. It is therefore used only in this domain, with a current value of maximum 550 gCO_2e/kWh of direct emissions in electricity generation (EIB, n.d.).

The IDB has developed industry benchmarks for high-emitting sectors such as chemical and cement plants. If the GHG emissions intensity of a specific plant is significantly higher than the benchmark, IDB will have to closely scrutinize the planning of the proposed plant for reduction options as part of its engineering review (IDB 2011, 2013). The EIB and the EBRD both require investees to use BAT - as defined in European legislation. Some of these directives do not yet have a link to Paris-alignment, e.g. the Industrial Emissions Directive prescribing emissions limit values for specific activities, designed in 2010 (*European Parliament and Council* 2010). Others - like the Energy Performance in Buildings Directive and its amendment from 2018 setting criteria to achieve a decarbonized building stock by 2050 - are linked to Paris-alignment.

What else could be done for Paris-aligned decision-making

Benchmarks - setting minimum requirements - can be a useful starting point in order to exclude clearly misaligned investment areas from financing. Depending on the level of the benchmark, this tool can be used for two different purposes with regard to Paris-alignment decisions.

First, the benchmark can be set at a level to make a decision on projects in the conditional category, based on the emissions or energy efficiency performance requirements for these technologies or activities to be aligned. For other investment areas only limited quantities of the activity, facility or infrastructure are still in line with a low-emissions pathway. If the bank wishes to finance the latter, more refined and portfolio-oriented tools might be necessary (see chapter 4).

Second, the benchmark can be set at a less ambitious level functioning similar to a negative list - excluding clear misaligned investment areas, as is the case for the EIB Emissions Performance Standard. In this case the benchmark has a function similar to an exclusion list and can be suitable to exclude clearly misaligned projects. It cannot be used as an effective tool to make a decision on Paris-alignment of conditionally aligned projects, for which other tools will be necessary (e.g. shadow carbon pricing, decarbonization tools proposed in chapter 4).

In either case, emissions standards in line with the global temperature goal need to decrease over time. Future levels should be communicated for specific milestones (every five years) until 2050. Newly-approved investments would need to be able to meet this decreasing benchmark over their lifetime. Communicating the development trend of the standard-raising/benchmark-lowering directly affects the design of investments by forcing project developers into a long-term compliance mind-set.

Analogously, energy efficiency requirements will have to increase over time, or will have to be most ambitious right now. This is the case with the EU Energy Performance of Buildings Directive requiring all new buildings to be nearly zero-energy buildings by 31 December 2020 (all new public buildings by end 2018) (*European Parliament and Council* 2018; *European Parliament and Council* 2010; EIB, n.d.). Energy efficiency benchmarks could be defined not only for climate finance, but for all demand sectors.

Not all BAT guidelines have yet been informed by pathways towards decarbonization by mid-century. BAT guidelines should be applied where they are ambitious enough to ensure financing of Paris-aligned investments only, as in the case with the European building sector. MDBs can play an important role in providing the necessary finance and in underwriting risks in the case of new technologies. Where BAT from legislation has not yet been informed by such pathways, they need to be combined with further tools, such as shadow carbon pricing or sector specific decarbonization tools (see chapter 4).

Benchmarks should be used carefully to avoid formal but ineffective compliance. For example, the use of technical efficiency requirements may not effectively avoid higher emissions, when fuel switching e.g. from gas to fuel oil is not avoided. Project contracts should prohibit such switches leading to GHG emissions above the benchmark.

3.1.4 Shadow carbon pricing

What the tool does and how banks currently use it

Shadow carbon pricing can provide a calculatory price incentive to reduce emissions, either by internalizing the negative externality of GHG pollution, or by indicating the mitigation costs of each avoided metric ton of carbon. For informing decisions on Paris-alignment, the carbon price needs to reflect the cost of mitigating emissions to the required levels. Using this price in the economic evaluation of carbon-intensive projects allows a direct comparison with lower or zero emissions alternatives.

Scientific models that are in line with Paris-aligned pathways can help to estimate a carbon price incentivizing mitigation efforts. Mitigation cost curves on a country level would give the most accurate information. Many models predict that with stronger reductions over time, mitigation options will become costlier, implying that a carbon price supporting the Paris temperature goal also has to rise over time.

The High-Level Commission on Carbon Prices, led by Joseph Stiglitz and Nicholas Stern, found that with a supportive policy environment, a range of US$40-80 per metric ton of CO_2e in 2020, rising to US$50-100 per metric ton of CO_2e by 2030, is consistent with keeping temperature rise below 2˚C (WBG 2017d). Extrapolating this further results in price levels of US$78-$156 by 2050 (WBG 2017c). The ranges reflect technical uncertainties as well as equity considerations and varying mitigation cost curves for different countries.

A shadow carbon price is generally applied during the economic and/or financial analysis. Economic or financial viability can be verified using a cost-benefit analysis in the MDB’s project assessment where benefits should be higher than cost including the shadow carbon price. Alternatively, or additionally, a cost-effectiveness analysis can be conducted, where the cost of the project is compared to costs of project alternatives generating the same benefit (e.g. power generation, including energy reliability considerations) and where the least cost option (including shadow carbon price) is chosen. A shadow carbon price is also used as a tool to inform risk analysis. It can be used to test sensitivities of a project’s profitability to varying carbon prices, reflecting different levels of ambition in future climate policy.

The shadow carbon price can be applied to either absolute (gross) or net emissions (relative to baseline). The carbon price can be applied to different scopes of emissions, which typically depends on the scope the MDB chooses for GHG accounting. Importantly, the scope chosen should be applied to both costs and benefits. In other words, if induced benefits are counted in the analysis, then induced emissions (and therefore induced costs) also need to be counted.

Banks currently using this tool include the ADB, EIB, EBRD and WB and the IFC. To date, the carbon price is applied only to projects in specific emissions-intensive sectors. Within the WBG and the ADB, the shadow carbon price is used only to inform the decision-taking. Yet a project with a non-favourable CBA under the high shadow carbon price is not immediately excluded (WBG 2017c; *Guidelines for the Economic Analysis of Projects* 2017), undermining the value of the tool. The EIB states that it will exclude such a project "in principle". The EBRD uses the strictest wording, stating that it is verified that the levelized cost of energy (LCOE) of the proposed project is the least cost option among all realistically available alternatives using the shadow carbon price. However, aspects of energy security enter the analysis in a qualitative manner and it is not clear from the project documents how this could influence a quantitatively unfavourable LCOE analysis.

Table 6: Overview of use of shadow carbon pricing by MDB

Institution	Price…	.. In Base Year	Annual Increase	2020 Price*	2030 Price*	2050 Price*	Threshold for GHG accounting
ADB	$ 36.30	2016	2%	$39.90	$47.90	$71.00	Gross emissions: 100,000 tCO_{2e}/year
EBRD	€ 35	2014	2%	€ 39	€ 48	€ 71	Net emissions**: 25,000 tCO_{2e}/year
EIB	Low value: € 15	2015	€ 0.5 (to 2030) € 1 (2031 to 2040) € 2 (2041 to 2050)	Low value: € 17.5	Low value: € 22	Low value: € 54	Gross emissions: 100,000 tCO_{2e}/year and/or Net emissions**: 20,000 tCO_{2e}/year
	Central value: € 35		€ 1 (to 2030) € 2 (2031 to 2040) € 3 (2041 to 2050)	Central value: € 40	Central value: € 52	Central value: € 121	
	High value: € 52		€ 2 (to 2030) € 4 (2031 to 2040) € 8 (2041 to 2050)	High value: € 62	High value: € 82	High value: € 230	
World Bank Group (incl. IFC)	Low value: $ 38	2018	2.25%	Low value: $ 40	Low value: $ 50	Low value: $ 78	World Bank: Net emissions**: 25,000 tCO_{2e}/year IFC: Gross emissions: 25,000 tCO_{2e}/year
	Central value: $ 77			Central value: $ 80	Central value: $ 100	Central value: $ 156	
AfDB	No Shadow Carbon Pricing Currently Applied						
IDBG	No Shadow Carbon Pricing Currently Applied						
AIIB	Shadow Carbon Pricing under development. Methodology not yet public.						
Notes*	* In base year prices and based on annual increase by bank. Base year differs by bank.						
Notes**	** Net emission = Estimated gross emission with project –minus- Estimated gross emissions without the project (baseline scenario)						

Sources: ADB 2016b, ADB 2017b, ADB 2017c, AIIB 2018, European Commission n.d., EBRD 2013, EBRD 2014, , EIB 2013a, EIB 2014, IFC 2016b, WBG 2017c.

The ADB set a carbon price of USD 36.3/t CO_2 in 2016, rising at an annual rate of 2% in real terms with the price per metric ton CO_2 rising to USD 39.3 in 2020, to USD 47.9 in 2030 and to USD 71 in 2050 (in 2016 prices). The ADB has stated that the shadow price of carbon may be revised in the future according to updated estimates to the social cost of carbon. The ADB applies the shadow carbon price to net (relative) Scope 1 and 2 emissions as compared to no project or a baseline scenario. Scope 3 emissions are included into the analysis where they are responsible for the majority of emissions. Where induced effects of the project are calculated as benefits these are counted also in the GHG analysis (ADB 2016b). The emissions threshold of the ADB is gross emissions of 100,000 t/CO_2e. For emissions reductions (net negative emissions) there is no threshold for accounting. ("Guidelines for Estimating Greenhouse Gas Emissions of Asian Development Bank Projects: Additional Guidance for Clean Energy Projects" 2009)

The EBRD shadow carbon price amounted to 35 EUR/tCO_2e in 2014 (USD 43/tCO_2e), rising by 2 percent annually in real terms (in 2014 prices in 2020: 39,4 EUR/tCO_2e; 2030: 48 EUR/tCO_2e; 2050: 71 EUR/tCO_2e). The methodology used is publicly available only for coal-fired power generation and associated infrastructure projects above a threshold of net emissions (relative to baseline / no investment) of 25,000 t/CO_2e. The methodology includes Scope 1 and Scope 2 emissions. The bank may choose to include Scope 3 emissions in the case of emissions savings from mitigation projects (EBRD, n.d.). The bank has stated that, as economic analysis is applied to infrastructure projects - such as transport and municipal and environmental infrastructure - the carbon price is incorporated where relevant[6].

The EIB compares the outcomes of the cost benefit analysis using a central value, as well as a lower and a higher value. The central value amounted to of 38 EUR/tCO_2e in 2018 (USD 47/tCO_2e) which increases annually and will reach to 40 EUR/tCO_2e in 2020, 52 EUR/tCO_2e in 2030 and 121 EUR/tCO_2e in 2050 (equivalent to USD 150/tCO_2e, all in 2016 prices) (EIB 2013c; European Commission, n.d.). The shadow carbon price is applied in the energy and in the transport sector (EIB 2013c). It includes scopes 1 and 2 for all projects as well as induced emissions (Scope 3) for road, rail, public transport. The methodology for ports and airports is currently under review (EIB 2014). The carbon price is applied to projects above a threshold of gross emissions of 100,000 tCO_2e/year and/or of net emissions (relative to no investment/baseline) of 20,000 tCO_2e/year.

In 2018, the World Bank introduced the shadow carbon price level suggested by the High-Level Commission on Carbon Prices in order to align financial flows with the Paris Agreement, using a high as well as a low estimate of USD 38/77/tCO_2e in 2018, rising annually to USD 78/156/tCO_2e (prices in USD/tCO_2e in 2020: 40/80, in 2030: 50/100) (WBG 2017c). The guidelines explain how high and low values are accounted for in the economic analysis[7]. The carbon price applies to all projects that are subject to GHG accounting, namely to energy, transport, agriculture, forestry, water and solid waste sector projects above a threshold of 25,000 tCO_2/y of net emissions. It includes Scope 1 and Scope 2 emissions. Scope 3 emissions are included in all cases where they are also part of other costs and benefits considered in the economic analysis (WBG 2017c).

The IFC applies the same carbon prices as the World Bank to the economic rate of return analysis for project finance in high emitting sectors, namely cement, thermal power and the chemical industry, and

[6] Information from communication with EBRD staff

[7] For a project that is economically viable and least cost without applying a carbon price, the high and low estimates are applied. If the project is still economically viable, and least cost when applying the high shadow carbon price estimate, the analysis concludes that it is likely to be the most desirable project among alternatives. If the project is unviable / not least cost with the high carbon price estimate, but viable with the low carbon price estimate, the "switching value" (the shadow carbon price until which the project is viable) needs to be calculated and an explanation on why the project is attractive provided. If the project is unviable and not least cost and unviable even when applying the low shadow carbon price estimate, the project might still be financed. However, in this case it would need to be justified why the project is attractive and low-carbon alternatives that could be realized through country ownership (inclusion in NDCs) or concessional finance need to be considered.

includes it in the board report (WBG 2018). On a pilot basis, the shadow carbon price will apply to project finance investments in all other sectors and corporate loans with known use of proceeds in all sectors for projects over 25,000 tCO2e / year (but not reported to Board).

The threshold used amounts to 25,000 tCO2e gross emissions. The IFC, together with the IDB, uses the lowest threshold for GHG accounting, thus including a variety of projects. This is considerably lower than 25,000 tCO2e of net emissions (compared to baseline) which is the typical threshold in other MDBs. The IFC is the only institution that also uses this low threshold for shadow carbon pricing.

The AIIB states in its energy sector strategy that it will test the robustness of its economic analysis using different carbon prices. As a relatively new bank, in operation since 2016 and which adopted its energy strategy in 2017, it is not yet clear to which degree it applies checks to this robustness, which carbon prices it uses, and whether these robustness checks might lead to the bank turning down a project. Together with GHG-accounting, this tool is under development (AIIB 2018).

What else could be done for Paris-aligned decision-making

Some MDBs have set their shadow carbon price levels before research on price levels in line with the Paris Agreement's well below 2˚C if not 1.5°C limit was published. For Paris-alignment, banks should ensure that carbon price levels as well as their future values are adjusted in line with the science-based literature. The World Bank has already adjusted its shadow carbon price levels accordingly and the EIB estimates are similar to what has been suggested by the High-Level Commission on Carbon Prices (or Stern-Stiglitz report). Other MDBs should follow these examples, as they are currently at the lower bound or even below those estimates.

Projects that are not economically or financially viable when applying a carbon price should not be considered for approval. Such a strict interpretation of the shadow carbon price should be used by all banks in future, as projects that prove economically unviable when applying a shadow carbon price are likely to be misaligned with the global temperature goal.

A crucial precondition for an effective shadow carbon price is an effective GHG accounting methodology (see chapter 3.1.2). Scope 1 and Scope 2 emissions the carbon price will only be effective for directly-emitting projects. For projects where induced emissions are most relevant, for example for infrastructure projects, a carbon price can only be effective if it is applied to gross emissions that include Scope 3 emissions. How broadly the shadow carbon price is applied depends on the sector it is applied to, as well as thresholds for GHG-accounting. The IFC has set a best practice in this regard, applying the shadow carbon price to all projects above a threshold of 25,000 tCO_2e of gross emissions. e of gross emissions.

Because the cost of various mitigation options varies a universal carbon price is not equally effective as an incentive for mitigation in all sectors. For example, a very high carbon price would be required to provide an incentive to mitigate emissions from air transport if alternative modes of transport have high opportunity costs (e.g. through time). For the road transport sector, carbon pricing for transport fuels such as gasoline or diesel fuel is inelastic - at least in the short run. On the other hand, a relatively low carbon price can incentivize shifts in the merit order in favor of cleaner electricity production. The price level to incentivize mitigation action may also have to be different by country. Nevertheless, a global shadow carbon price can be a first step in risk analysis indicating future, potentially more ambitious carbon prices. For a Paris-aligned investment decision a shadow carbon price is only fully effective if it reflects mitigation cost. In the transport sector, for example, it would have to be very high. If sector and country-specific shadow carbon prices cannot be provided, the tool should be combined with other tools to ensure Paris-aligned decision making (see chapter 4).

There are challenges when applying the shadow carbon price to mitigation projects using net emissions (relative to baseline/no investment). For example, the economic or financial evaluation could result in better outcomes for energy efficiency projects the more carbon-intensive the sector is, as this would lead to higher emissions reductions than in a low-carbon environment. The same baseline could be applied to both alternatives, ultimately meaning that a comparison is possible only in a similar environment (e.g. retrofitting a coal plant or replacing it with a new wind farm). More importantly, the choice of baseline is often arbitrary, which limits the value of the analysis. The application of a shadow carbon price to avoided emissions is a complex task and bears a risk of double counting. This would happen if the shadow carbon price were applied to avoided emissions of, for example, a renewable power plant and then also applied to the emissions of the baseline the project is compared with. Therefore, the application of a shadow carbon price based on absolute emissions is preferable. Otherwise the calculation of the net present value and the baseline should be disclosed.

3.2 Assessment of bank-strategy level tools

Bank-strategy level tools and policies can provide strong incentives for alignment, along with climate tools implemented at project level. To put mainstreaming into practice, an increasing number of MDBs have started to integrate "Paris-alignment" in their guiding documents. For example, the Environmental and Social Framework of the AIIB requests emissions reductions "in accordance with the aims of the Paris Agreement" and the ADB's Climate Change Operational Framework states "the ultimate intent to support this transition, in line with the Paris Agreement". The EIB aims to assess the alignment of its portfolio with the Paris Agreement within the scope of its mid-term review of its Climate Strategy five-year implementation plan.

Targets can set a cap on emissions or technologies, meaning that only a specified quantity or volume of emissions-intensive projects or investments into the technology can be added to the bank's project pipeline. Alternatively, they can set a percentage or volume floor for certain investments. The latter (minimum targets) can be incentivized by project-level tools, such as positive lists. Some banks also set internal incentives for their employees to implement the targets, for example by paying bonuses according to whether the respective share of overall portfolio targets is reached by the individual project manager (Nettersheim and Köhler 2018).

Through GHG accounting or climate finance tracking, quantitative targets can be easily monitored, which then helps to verify whether the intended pathway is actually being reached. GHG accounting should include emissions from all projects that generate significate emissions and be reported on aggregate levels. Targets at the bank strategy level could include a portfolio-wide gross GHG emissions cap, a target for portfolio-wide "avoided" (or net) emissions, a year target for emissions peaking, percentage targets for specific technologies per sector and climate finance targets (see Table 7). Informing these targets by science-based pathways as well as accounting for the gross emissions of all projects are necessary conditions for alignment with the global temperature goal.

Currently, no MDB has a portfolio-wide gross emissions target. Existing targets for avoided emissions, also sometimes labelled "net emissions target" or "emissions reductions target", define emissions reductions compared to a baseline scenario. The baseline scenario typically reflects the situation of no investment by the MDB or the most likely alternative investment for the same development purpose. Avoided emissions are typically not accounted for in the entire portfolio, but only for climate finance projects, particularly for mitigation projects. While this is a way of incentivizing climate finance projects and of illustrating their impact, a target for avoided emissions in specific projects does not say anything about total gross emissions from all bank-financed projects financed. If increased climate finance were accompanied by increased emissions-intensive investments for the non-climate finance part of the portfolio, overall portfolio emissions would increase, yet still meet the target. Some banks, like the EIB and the IDB, have started to report gross emissions as well as avoided emissions, adding to transparency and accountability.

A challenge with the introduction of a portfolio-wide gross emissions target is to define a Paris-aligned level. Such a target could be developed in various ways. It could, for example, be modelled per country and sector and added up to an MDB portfolio target, or be developed through a more top-down analysis based on global emissions goals and the relative MDB share of global GDP. The *Science-Based Target Initiative*, the *2 Degree Investing Initiative* and *Right. Based on Science* have developed - or are currently developing - respective methodologies for banks.

Table 7: Tools implemented at bank strategy level

Tool	MDBs	State of play	Starting points for Paris-aligned design	Suitability for alignment with Paris temperature goal
Gross GHG emissions target	-	• No bank uses this tool	• Prerequisite 1: Portfolio-wide GHG accounting • Prerequisite 2: Use of scientific scenarios • Needs to be based on necessary percentage reduction per sector / country pathways + aggregation to portfolio level	**High** for entire project portfolio
Target for avoided (or "net") emissions (compared to baseline)	IDB, IFC	• IFC: target of 6.91 million metric tons of avoided emissions per year • IDB: target of 8 million metric tons avoided emissions between 2016 and 2019	• Cannot be used as standalone tool to ensure Paris-alignment, because it does not consider the misaligned investments	**Complementary tool**. Low suitability as a stand-alone tool, but helps reach Paris-alignment when combined with portfolio-wide GHG reduction target.
Year target for emissions peaking	ADB	• ADB: Emissions peaking by 2030	• Prerequisite 1: Portfolio-wide GHG accounting • Prerequisite 2: Use of scientific scenarios • Needs to be informed by Paris-aligned scenarios • Announcement of year target serves as signal to investors	**Complementary tool**. Low suitability as a stand-alone tool, but helps reach Paris-alignment when set at a timely date and combined with portfolio-wide GHG reduction target after peaking.
Climate Finance Target	AfDB, ADB, EIB, EBRD, IDBG, WBG	• Commitments to climate finance targets between 20-40% of the entire portfolio by 2020	• Prerequisite 1: Use of scientific scenarios • Eligibility list for climate finance activities should only include aligned investment areas • Should be informed by investment needs resulting from Paris-aligned scenarios • Cannot be used as standalone tool to ensure Paris-alignment, because it does not consider the misaligned investments	**Complementary Tool**. Low suitability as a tool for mainstreaming, but complements efforts of Paris-alignment, if definition of climate finance derived from science-based scenarios.

4 Approaches and tools for Paris-alignment on a project level

Key conclusions

This chapter pilots approaches and tools to operationalize Paris-alignment on a project level for energy supply (electricity generation, transmission and distribution, and gas infrastructure) and transport (rail, road and shipping infrastructure).

The approaches and tools allow for evaluation of the projects in their geographic and societal context, consider the relevance of other sectors or policy frameworks, and evaluate the exact project characteristics. They are meant as an input to the ongoing discussion on Paris alignment of investments, and need to be further developed and adjusted to each institution's focus and processes. For all sectors, the approaches start with the use of positive/negative lists.

For the energy sector, a combination of quantitative information on decarbonization pathways and additional considerations is helpful. The approach suggests supporting additional considerations with results from technical modeling exercises. The feasibility of additional modeling exercises depends on information already available in-country and capacities available for the evaluation of a project.

In the transport sector, it is often not the infrastructure itself that directly emits, but rather the transport activity it induces. The approach for the transport sector is therefore much more context focused, also checking whether the policy framework in place contributes to a low-carbon use of the infrastructure.

This chapter provides suggestions on how to operationalize Paris-alignment at a project level, focusing on investments in physical assets. Chapter 3 elaborates on existing approaches and tools and finds that in most approaches that the banks use today, there is no direct link to the long-term Paris temperature goal. This section intends to close this gap by translating the somewhat abstract findings from chapter - the analysis of Paris-aligned scenarios - into concrete approaches and tools that MDBs or other investors can apply to their projects during the evaluation process.

Previous research developed global benchmarks for investing, and recognized that in many cases, a more contextual approach is required (Höhne et al. 2015). The approaches developed here try to see the projects in the context of the country's circumstances, sector, and where useful even policy framework of where they should be placed. Having said that, the suggested methods do not differentiate the level of ambition by level of a country's development as described in the introduction of this working paper.

This working paper focuses on methods for investments in energy and transport infrastructure, two investment areas that are prominent in the MDBs' portfolios, and where a substantial shift is required to move towards a Paris-aligned pathway. In the energy sector, the research develops tools for investments in the electricity generation system and in transmissions and distribution, as well as investments in gas transport infrastructure (pipelines and LNG terminals). In the transport sector, we focus on road, rail and shipping infrastructure.

It is the aim of this research to provide pilots that can be further developed and adjusted to the banks' purposes, or merely serve as an inspiration while the banks develop their own approaches.

This working paper focuses on mitigating climate change: the approaches and tools suggested here, to a large extent, look at the mitigation aspect in isolation. MDBs will need to make links to other climate change-related aspects such as adaptation and resilience, and broader development questions.

4.1 A general framework for evaluating Paris-alignment of projects

As a framework for evaluating Paris-alignment of a physical asset, building on the existing tools described in the previous chapter, this research suggests three elements.

The investment is first checked against **positive and negative lists**. If the project is neither clearly misaligned or aligned, further **evaluation follows in the context of the country and sector** where the investment is proposed. Further, the approach suggests including a **shadow carbon price** in the financial evaluation, for investments where the physical asset would lead to additional emissions and the structure of the sector allows a meaningful application of this tool.

Positive and negative lists, as well as shadow carbon pricing are tools that some MDBs already use. However, they do not yet carry out the contextual evaluation of the project within the sector and country in the context of Paris-alignment. The following sections provide examples for the transport and energy infrastructure sectors on how approaches to such an evaluation could look.

Positive/Negative lists
Some technologies can be clearly classified as aligned with the Paris Agreement since they do not generate direct emissions and do not pose significant sustainability risks[8]. Other technologies have emissions beyond the threshold considered consistent with the Paris Agreement. In these cases, no additional criteria need to be applied.

Projects that are clearly aligned or have high emissions levels can be included in inclusion/negative lists. This could build on existing negative lists and the positive list approach MDBs use for climate finance projects. Lists can provide clear guidance with straightforward implementation. Nonetheless, they only work for clearly misaligned or aligned projects, and other projects should be submitted to further evaluation. The development of such lists should follow the principles outlined in chapter 3.

Evaluation of investments in the context of the sector and country
Assessing how individual investment decisions align with long-term decarbonization goals is not a trivial task. It demands understanding national contexts and factoring in the interlinkages between activities in different sectors.

The proposed approach starts with a long-term view of what needs to be achieved in the sector, followed by a pathway to reach that target. The methodology aims to combine readily-available, country-specific data with scenario trends to create simplified pathways or strategies for decarbonization. Quantitative evidence from scenarios for long-term decarbonization can be combined with additional information about the country and project pipeline to help in defining alignment.

[8] A thorough assessment of a project should benchmark all types of investments against environmental and social safeguards. There are, however, some specific investment areas with significant sustainability risks (highlighted in Table 2) where banks might also decide to put them on a negative list or apply specific screening processes.

Financial viability under a shadow carbon price

In some cases, a shadow carbon price (see section 3.1.4) can support the assessment of Paris-alignment when used in combination with other tools. A shadow carbon price could be used in financial analysis and / or a cost-benefit analysis for projects with direct GHG emissions.

However, a single shadow carbon price used by a bank may not be equally helpful in all sectors. As mentioned above, overall demand elasticity is highly inelastic in the transport sector, at least in the short term, but also is highly dependent on opportunities for modal shift. The factors affecting induced emissions from a given transport infrastructure project make the application of a carbon price more complicated than in other sectors. While pricing mechanisms such as fuel taxes, vehicle registration fees, company car taxation, and road tolls can play an important role in the transport sector, in order to be a relevant tool for decision making for transport, shadow carbon prices would need to be many times higher than current practice. An internal bank shadow carbon price therefore does not play a primary role in the tool criteria proposed.

4.2 Energy supply infrastructure

The energy supply sector is an important pillar in the transition towards a Paris-aligned future. It is composed of distinct technologies that are categorized into three groups of alignment (compare section 2.1.1). This section provides more detail on the positive/negative lists for the energy sector and explains in detail the approach to further differentiate projects that are neither clearly aligned nor misaligned, but where, for example, national or regional circumstances will influence a final categorization.

4.2.1 Electricity supply sector investment options

Table 8 and the following paragraphs give an overview of the options considered under the energy supply sector, covering electricity generation and distribution of electricity and gas, as well as up-stream energy production.

Table 8: Energy supply investment options overview

PARIS-ALIGNED	CONDITIONAL	MISALIGNED
Fully aligned with Paris Agreement consistently across all scenarios	**Aligned depending on conditions**	**Consistently Paris misaligned in all scenarios**
• Solar energy • Wind energy • Small hydropower • Tidal, wave and ocean energy • System flexibility options (electricity energy storage, demand response, …)	• Energy transmission and distribution infrastructure • Geothermal[2)]	• Coal fired power plants with unabated emissions over their lifetime • Oil power plants • Coal mining • New upstream oil and gas exploration and production
	• Gas (power plants, transport of gas)[1)]	
	• Large hydropower[2),3)] • Bioenergy, incl. bio energy carbon capture storage[3),4)] • Coal with carbon capture and storage (CCS)[1),3)] • Nuclear[3)]	

Footnotes:
1) This investment area causes direct GHG emissions
2) This investment area can cause direct GHG emissions
3) This investment area is subject to critical sustainability and/or security concerns
4) The production of bioenergy can cause substantial GHG emissions. We differentiate this from other investment areas, where emissions occur during the manufacturing process, because the impact of unsustainable production of the fuel is over proportionally larger, and not limited to the manufacturing of the technology.

Paris-aligned investment options[9]

In all analyzed scenarios, **renewable energy technologies** represent a considerable share of the energy mix and play an important role in decarbonizing electricity generation between 2040 and 2060 (63 – 100%). In the IEA's *Sustainable Development Scenario*, renewables represent 67% of the installed capacity for electricity generation by 2040. They are also responsible for 36% of the cumulative emissions reductions by 2040 when compared with a new policies scenario (IEA 2017b).

[9] For a more comprehensive overview of technologies refer to (O. Edenhofer, n.d.)

Table 9: Range[10] of aligned renewable investment options' share in the electricity generation mix for distinct scenarios and power generation increment by mid-century

TECHNOLOGY	GLOBAL SHARE OF ELECTRICITY GENERATION (%)	POWER GENERATION INCREASE 2014-2050 IN SUSTAINABLE DEVELOPMENT SCENARIO (TWh)
Solar PV	17.3 – 39.4	5,908
Solar CSP	4.7 – 10.8	3,887
Hydropower	17.3 – 30.6	4,070
Wind	19.8 – 34.1	7,935

Source: Scenarios review (compare Table 1)

According to bottom-up scenarios presented in Table 1, wind and solar PV alone would account, on average, for 55% of the total worldwide installed capacity for electricity generation by mid-century. Bloomberg forecasts that these two technologies will represent 48% of global installed capacity and 34% of electricity generation by 2040 (BNEF 2017). While the bottom-up scenario back-casts emissions targets to create pathways, BNEF forecasts technology deployment based on current market trends. This comparison highlights how scenarios based on market trends for renewables are in line with long-term, bottom-up pathways.

System flexibility options need to be evaluated together with electricity generation options to assure reliable dispatch. Variable renewable energy increases the supply side variability due to change in resource availability (e.g. wind speed and solar irradiation), while displacing conventional generation (Papaefthymiou, Grave, and Dragoon 2014).

One option that has had positive developments is electrical energy storage (EES). It has become more relevant due to seasonal and intra-day variation in power output of variable renewable sources (IEA 2017a). In systems with 100% renewable energy sources, the energy storage needs worldwide would be below 6% of the equivalent annual electricity demand. This number can be further reduced through sector coupling or the use of dispatchable renewables (Blanco and Faaij 2018). While the large-scale market is dominated by pumped storage hydropower, lithium-ion batteries were the primary storage additions in 2016 (IEA 2017a). Storing the electricity generation is, however, not the only option: Table 10 presents examples of alternatives to complement the electricity flexibility matrix. Given the degree of competition between several flexibility options and the level of variability each system will need to handle, the least-cost solution remains uncertain (IRENA 2017).

[10] Electricity generation is presented in ranges to reflect different assumptions and outcomes associated with different models.

Table 10: Examples of non-storage flexibility investment options (IEC MSB 2012)

Measure	Examples of technical solutions
Grid-friendly RE	Centralized control of a RE cluster
Improved flexibility in conventional generation	Power plants have traditionally provided nearly all system flexibility e.g. gas or hydropower.
Transmission & Distribution	Application of new transmission and distribution technologies and expansion of lines with the purpose of reducing congestion or increasing flexibility.
Operational enhancement	Enhancement of operational tools and practices e.g. reducing gate closure times or expanding market and control zones
Demand response	Advanced metering infrastructure, smart appliances, or bidirectional smart meters.
Modeling and forecasting	Improved generation modeling (including more accurate RE forecast), planning for both capacity and flexibility, and developing transmission planning.

Misaligned investment options

Coal still accounted for about 40% of the global electricity generation share in 2015 and its combustion is the largest single source of CO_2 emissions in the energy system (IEA 2017b). Greenpeace depicts a pathway to a completely decarbonized electricity sector by 2050 (Teske, Sawyer, and Schäfer 2015). Under the IEA's current policy scenario, coal-fired power plants accounts for 33% of total electricity generation share in 2040. The IEA highlights that the use of coal as a fuel source is not compatible with the Paris Agreement and that demand should fall around 3% per year (IEA 2017b). Even in the IEA scenario, there is no room for additional coal capacity. Under current trends, Bloomberg expects coal to provide 11% of world electricity by 2050 (BNEF 2018b). Although wind and solar are cheaper than new coal in some markets and locations, about 280 GW of coal capacity are currently under construction (IEA 2017a) and power plants that are not yet operational will emit more than 141 $GtCO_2$ during their lifetime (UNEP 2017). Short-term measures to stay below the Paris temperature limits involve immediately stopping new coal-fired plants and reducing emissions of existing coal power plants by 30% before 2025 (Kuramochi et al. 2018).

With the objective of phasing out coal-fired electricity generation as fast as possible, it is counterproductive to increase the investment volume bound by this technology, even if the investment leads to short-term emissions reductions in comparison to the status quo. We therefore consider that not only new coal plants, but also efficiency improvements and enhancing plants with co-generation units are misaligned.

Oil electricity generation takes up a small share of the global market. It is used on a large scale mainly in island states, and in oil-producing countries to supply a considerable amount of electricity locally. In Paris-aligned scenarios, electricity generation through oil-fired power plants consistently decreases from today's level. Investments in this technology, including efficiency improvements in such, are therefore in the "misaligned" category. Diesel generators are often used as a decentralized solution for electricity generation, in remote areas or on islands. These small-scale solutions cause a relatively low amount of emissions and, given their rather short lifetime, could, in some cases, be covered under the emissions pathways compatible with Paris-aligned scenarios. Where batteries or other storage options are not available, they may have a back-up function in decentralized renewable grids for a limited amount of time with small full-load hours.

Investments in upstream oil and gas supply have almost halved since 2014 (IEA 2018). However, the WEI2018 also reports a slight recovery of investments in 2017 over 2016, as well as a forecasted increase in 2018, driven by rising oil prices and sustained oil demand. The Carbon Tracker estimates that, on average, oil and gas companies' capital expenditures up to 2025 exceed what would be possible within carbon budgets under 2°C scenarios by one third (Carbon Tracker and UN PRI 2017), let alone the more ambitious range of Paris-aligned scenarios. In the long-term, investments in oil and gas will have to decrease even further (compare chapter 2.2). Overall fossil fuel primary energy demand is projected to decrease in several scenarios, with some variations between studies. At the more ambitious end, in the Greenpeace *Advanced [R]evolution Scenario*, oil demand in 2050 is at 9% of current levels and gas at 7% (Greenpeace, SolarPower Europe and GWEC, 2015). In the IEA *Sustainable Development Scenario*, global gas demand increases and then plateaus up to 2040 (last available year) while all other fossil fuel sources are projected to peak and decrease (IEA 2017c).

Smaller investments in upstream infrastructure will still be required to provide fossil energy during the transition phase, but these will be extremely limited compared with current levels. The role - particularly for development banks in this sector - should be negligible, considering the sustainable development risks beyond climate change mitigation.

Conditional investment options

Most technologies are neither directly misaligned nor aligned; their role differs depending on modeling approaches, broader sustainability considerations or national contexts, e.g. current energy system structure or resource availability. Some technologies mitigate a majority of direct CO_2 emissions, but might result in considerable environmental or social impacts.

Under certain circumstances, **geothermal electricity installations** can emit CO_2 and other GHGs, not through combustion, but through the atmospheric dispersal of geothermal fluids brought to the surface. Given that a geothermal power plant can emit non-negligible amounts of GHGs over its lifetime, contingent upon the technology used and the location, it is considered that geothermal power plants are "conditionally" aligned with long-term decarbonization.

The choice of generation technology has a significant impact on emissions. Closed-loop geothermal systems emit barely any GHGs. Open-loop systems produce quantities of emissions that can vary widely, depending on the age and type of plant and underlying geological conditions. The exact amount of GHGs emitted is difficult to measure - GHG levels from one plant can also vary over time. It is also unclear what share of the emissions geothermal vents would have naturally released without the presence of a geothermal installation (Fridriksson et al. 2017). Literature provides values for emissions intensity ranging from close to zero to about 800 gCO_2e/kWh. Global weighted average is between 38gCO_2e/kWh (Schlomer et al. 2014) and 128 gCO_2e/kWh (Fridriksson et al. 2016). The World Bank has produced approaches to assess emissions of geothermal power plants ex-ante, which suggest different options of determining the average emissions factor of a geothermal electricity plant (see Figure 2). As a simplification, one can say that closed-loop systems ("pumped binary technology" in the World Bank figure) are generally aligned, while open-loop systems should be assessed in more depth.

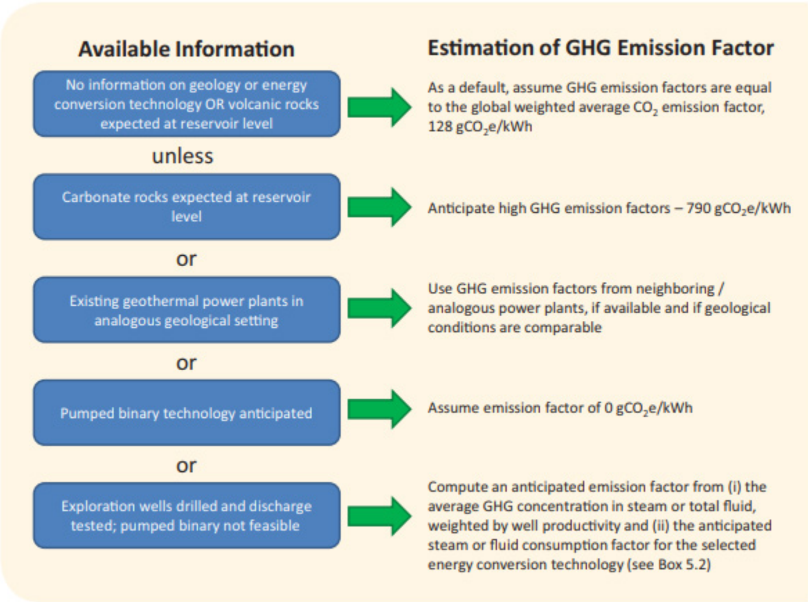

Figure 2: Approaches to define GHG emissions factors from greenfield geothermal projects from (Fridriksson et al. 2016)

Different scenarios project widely varying shares of **natural gas** in the primary energy mix until 2060, ranging from 22 to 267 EJ primary energy consumption per year compared with approximately 100 EJ in 2010 (Rogelj et al. 2018). Gas demand outside the electricity sector is driven mostly by industry and buildings sectors. The regions driving demand in the near future are Europe and Asia (BNEF 2018a). Different factors play a role in the future development of gas demand. On the one hand, displacing coal electricity generation has become a pressing need and gas appears as a potential environmentally friendlier option depending on fugitive emissions, which would elevate the short to medium-term demand. On the other hand, several factors in both the industry and buildings sectors help reduce this demand increase for power, for example fuel switching, electrification, and efficiency improvements.

In Greenpeace's *Advanced [R]evolution Scenario*, by 2050, natural gas is not used for energy purposes at all (Teske, Sawyer, and Schäfer 2015). The IEA's *Beyond 2°C Scenario* considers the use of natural gas in power plants, but only marginally - around 4% of electricity generation in 2060 (IEA 2017a). In the *Sustainable Development Scenario,* natural gas demand will grow by 15% from today's levels and plateau at around 25% of the total primary energy demand in 2040 (IEA 2017b). An E3G analysis on the infrastructure needs for gas use shows that the current available infrastructure is enough to assure matching supply and demand in Europe, and that new investments should take into account that in a scenario in line with the European energy and climate targets, gas use will not be considerably higher than today (Gaventa, Dufour, and Bergamaschi 2016). In other regions, investments might still be in line with long-term temperature targets. Gas infrastructure may - to some degree - be repurposed and used for alternative fuels, such as biogas and syngas.

Large hydropower is another example of a conditional investment option. Greenpeace assumes a limited contribution of hydro in a future energy mix due to the ecological impact of large projects, since large hydro power plants dams flood large areas (Teske, Sawyer, and Schäfer 2015). These projects can also present social impacts if, for example, they displace local communities (IPCC 2014b). They also have a considerable greenhouse gas footprint when the GHG emissions from decomposing biomass in dams or rivers are taken into account (Scherer and Pfister 2016). On the other hand, the IEA *Beyond 2°C scenario* states that hydro energy demand is projected to double between 2014 and 2050. Despite its important role in some decarbonization strategies, hydro additions decreased for the third consecutive year in 2016, partially due to the enhanced competitiveness of other renewable energy options (IEA 2017a). Being a renewable source, large hydropower may still be considered aligned if broader sustainability aspects are taken into account and avoided. Hydropower can also provide flexibility through storage systems and work well in combination with variable renewable sources.

Biomass electricity generation is subject to other restrictions. Higher use of bioenergy would result in higher demand for energy crops. The land covered by energy crops would grow by almost four times in some Paris-aligned scenarios when compared to a reference scenario, reducing land availability for food and feed crops, pasture, forest, and other natural land (Vaughan et al. 2018). Even when considering the use of second generation biomass, important safeguards for environmental, climate and social benefits need to be taken into account in order to assure the fuels' sustainability (Teske, Sawyer, and Schäfer 2015). Only when those are respected can bioenergy be considered aligned with the Paris Agreement (compare, for example, (Searchinger and Heimlich 2015)).

There is also the possibility of coupling power plants with **carbon capture and storage (CCS) or carbon capture and utilization (CCU)** to help offset their emissions. CCS and CCU have high upfront investment costs. Coupling fossil fuels with these technologies does not assure carbon neutrality due to imperfect capture (currently only up to 90% (Rubin, Davison, and Herzog 2015)) and upstream emissions, which makes it a less attractive option in more stringent mitigation scenarios (Rogelj et al. 2018). CCS also implies increased water use, increasing the risk for water scarcity (Fricko et al. 2016). Research shows that CCS is more likely to be financially feasible if the captured CO_2 is used for enhanced oil recovery (Rubin, Davison, and Herzog 2015). Research shows that while CCS results in fewer emissions than CCU, the latter might result in overall lower environmental impacts (Cuéllar-Franca and Azapagic 2015).

Nuclear electricity generation is a low carbon electricity generation technology and is a part of different projections of the future energy mix (Rogelj et al. 2018). Still, not all scenarios include nuclear energy in the long term: Greenpeace considers that nuclear energy should be phased out even faster than coal or gas. The IEA's *Beyond 2°C scenario*, on the other hand, assumes that power generation from nuclear is projected to almost triple between 2014 and 2050 (IEA 2017a). The main reasons against an expansion of nuclear power include the environmental impacts of uranium mining and limited resource availability, safety risks, environmental impacts from radioactive waste and long-term storage (Teske, Sawyer, and Schäfer 2015), concerns that large, inflexible nuclear power plants might not be easily compatible with a high share of renewable energy generation in the system (Teske, Sawyer, and Schäfer 2015), and concerns that large, inflexible nuclear power plants might not be easily compatible with a high share of renewable energy generation in the system.

4.2.2 Evaluation of investments in the context of the sector and country

This section describes decision trees that have been developed to guide decision-making beyond tools currently being used by MDBs. The decision trees build on the instruments described in chapter 3 and reflect a procedure to assess Paris-alignment. They outline how different screening methods come together.

Three types of projects are differentiated for the energy supply sector: electricity generation, electricity transmission and distribution (T&D) and gas infrastructure. Due to the different nature of these projects, three separate decision trees are developed and described in more detail in the next sections. They outline how different screening methods come together to guide decision-making. Three types of projects are differentiated for the energy supply sector: electricity generation, electricity transmission and distribution (T&D) and gas infrastructure. Due to the different nature of these projects, three separate decision trees are developed and described in more detail in the next sections.

4.2.2.1 Electricity generation decision tree

The electricity generation decision tree (see Figure 3) builds on all three building blocks of the methodological framework. The first step involves the application of positive/negative lists. The second considers the financial viability of the project when a price on carbon is applied. The third assesses whether that specific power plant is aligned with a 2050 decarbonization pathway. The integration of the financial feasibility under a shadow carbon price is illustrated here as the second decision item, but in practice, the financial evaluation may be undertaken in parallel, even by a different department in a bank. Similarly, part of the technical analysis could happen elsewhere and in parallel, and the results simply be used in the decision process as indicated below.

Energy efficiency investment alignment is dependent on the infrastructure being refurbished/renewed. Investment in coal-fired power plants, for example, may enhance the risk of stranded assets while displacing investment in renewable sources. Improving efficiency in aligned sources is automatically aligned, but investments in other electricity generation sources should be subject to further assessment. We propose using power plant alignment as a criterion to justify energy efficiency investments.

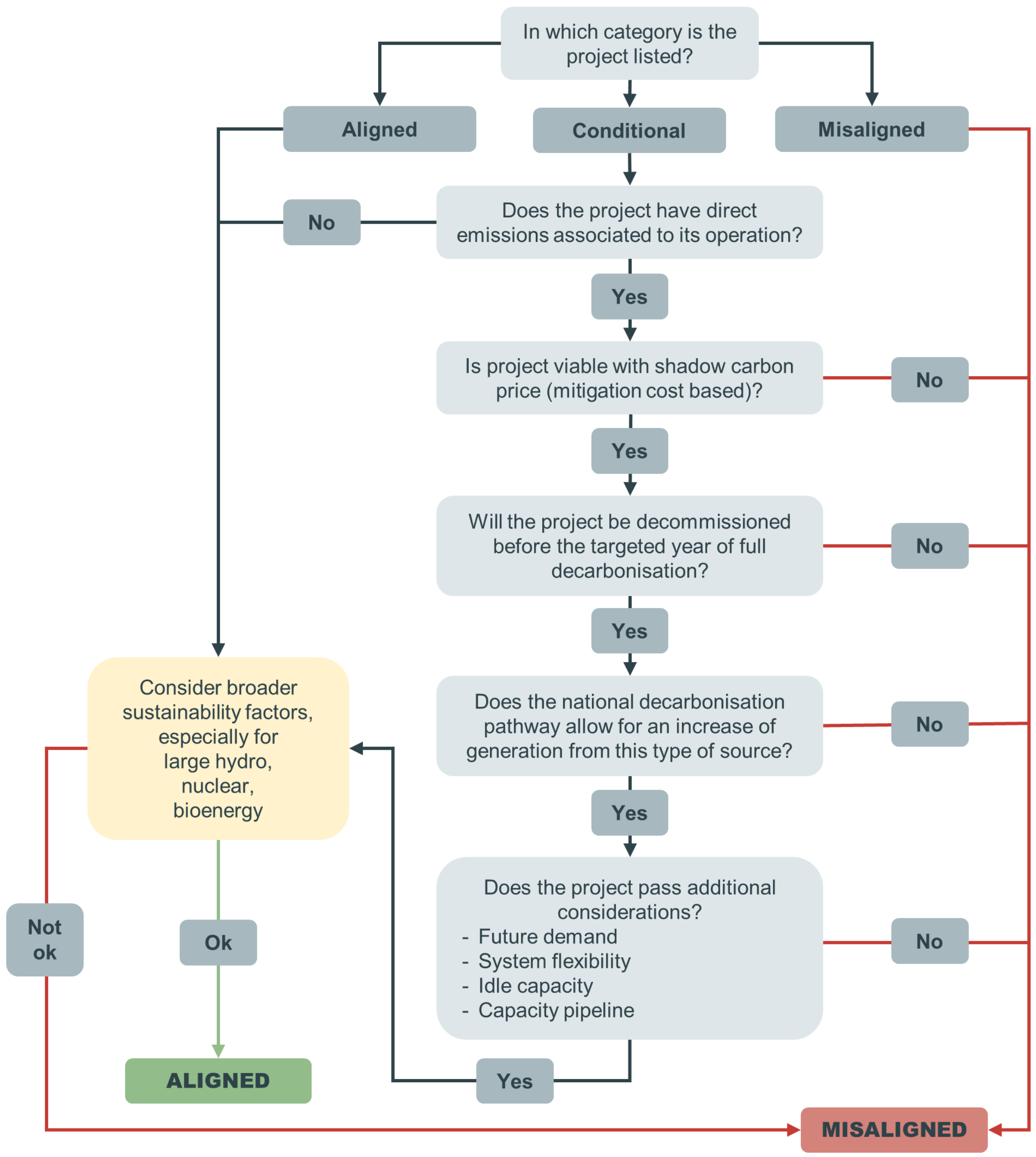

Figure 3: Electricity generation decision tree

Assessment 1: Positive/negative list

If a project is an investment option in a positive list, e.g. wind energy, or negative list, e.g. coal-fired power plants, it is categorized as aligned or misaligned, respectively. The positive list is used to understand Paris compatibility, but further considerations will be needed for all projects, especially those with potentially high environmental or social impacts. Table 8 provides examples of technologies that fall into these two categories in the columns Paris-aligned and Paris-misaligned. Other tools, like the use of emissions standards or BAT (described in 3.1.2), can be used to create positive negative lists or even used as an alternative to define investment options that are clearly aligned or misaligned.

Assessment 2: Shadow carbon price

The evaluation under a shadow carbon price adds to the decision-making process since it considers the mitigation costs under Paris-aligned scenarios. By adding this extra cost in the financial evaluation, one can filter projects that are clearly not aligned with decarbonization pathways. The project feasibility calculation can happen in parallel or before other parts of the assessment are carried out, for projects in the "conditional" category. It should not, however, replace the evaluation of the project in the context of the sector and country, as that allows for more in-depth insights and includes further safeguards for Paris-alignment.

Carbon pricing can be an important tool, but setting up a Paris-compatible carbon price might prove difficult. The introduction of a carbon price at an early stage of the decision-making process allows for exclusion of projects that are misaligned given current carbon price levels, but does not guarantee that the price used is adequate. Adding a further step is needed as a safeguard to ensure that the national context is considered.

Assessment 3: Evaluation of context

Step 1: Back-casting decarbonization by 2050

The third part of the decision tree consists of two elements:

1. *Is the planned operation longer than the time between the commissioning and the expected year of full decarbonization?*
2. *Does the decarbonization pathway assume immediate decrease of electricity generation from this type of generation alternative?*

The first question involves back-casting the target of zero unabated fossil fuels in 2050, by comparing the planned operational lifetime of the project to the remaining time before full decarbonization (before 2050). If the plant is scheduled to go offline before 2050, the second question compares the planned capacity addition to the required short to medium-term development of a country's generation capacities. To that end, the method uses pathways towards 2050, relying on external scenarios and adjusting them to get to zero emissions in 2050 when needed.

The second question relies on the existence of decarbonization pathways. While some countries have submitted ambitious plans to decarbonize their electricity generation sector, others have not yet made these pathways available. To answer the second question, one should rely on a scientifically robust pathway that leads to decarbonization by mid-century. One alternative, when there are no national scenarios, is to build on existing, bottom-up regional pathways, and adjust trends to incorporate national considerations, e.g. fossil fuel stock age. Several approaches may be used to translate regional scenarios into country pathways for the electricity generation mix. One alternative is to identify, from the regions available, which scenario best represents the country considering current electricity mix, assume the country will have the same development (since it departs from a similar electricity mix and needs to be decarbonized by 2050) and scale the results to account for future electricity demand projections. A simplified methodological approach to translate regional into national pathways is available.[11]

Step 2: Additional considerations
The decarbonization pathways, or national scenarios, can be used to help answering additional considerations. Further considerations are not necessarily to be seen as cut-off criteria but as dimensions that contribute to alignment. There are different options with regards to how strictly one wants to interpret the insights from those considerations. Four dimensions are identified as priority areas:

Idle capacity today: 'Are there spare capacities available (idle plants not running at full load) and usable?'

The current structure of energy systems is based on the existence of reserve capacity to help balancing supply and demand using dispatchable technologies. Studies point to a mismatch in some countries between the installed capacity and required capacity (IEEFA 2017). The future electricity system with high share of renewables shifts away from the baseload paradigm, reducing the need for baseload generation (REN21 2017). Ideally, one would assess the status of idle capacities in the country where the project is to be built and assess if services demanded can be supplied by existing capacity. MDBs or countries themselves could conduct this analysis in close cooperation with the involved ministries or electricity sector authorities.

Future demand: 'Is it possible to cover projected electricity demand without investing in new emitting capacity?'

This dimension is intended to assess future electricity demand and relies on Paris-compatible modeling exercises. Up to 2050 there is an upward trend in gross electricity capacity worldwide, but the rate varies across countries (IEA 2017a). By taking into account national supply and demand, as well as trade with neighbouring countries, one can assess to what extent new capacity is needed. Emitting sources should only be considered when the uptake of Paris-aligned sources is not enough to fulfil demand or if the system cannot cope with high share of low-carbon sources.

Capacity pipeline: *'Are other stakeholders already planning capacity additions that would meet demand for this source?'*

Fossil fuel-fired power plants are usually high-profile projects due to the level of investment and the controversy around investment in emitting technologies. To scout the project pipeline and investigate if other capacities of the same source are planned enables identifying if the level of electricity generation from the project is in line with the decarbonization pathway when other investments are taken into account.

System flexibility: 'Is the planned capacity required to ensure system's flexibility?'

Central power plants, e.g. coal, gas, nuclear, oil and hydro have been the main source of system flexibility. If the current energy system cannot handle a higher share of renewables, has high levels of congestion or has experienced unmanageable shortages and peaks, traditional power plants may still be a technical alternative while transitioning to a decarbonized electricity supply. However, other flexibility options (see Table 10) should be considered first, and only if those are unsuited or insufficient, one could consider carbon intensive technologies (mostly gas).

[11] https://newclimate.org/2018/09/28/aligning-investments

Box 4: Example of power generation decision tree application in the case of a fictional 100TWh/a CCGT project in India

Assessment 1: Use of positive/negative lists

A combined cycle gas turbine (CCGT) is not automatically aligned or misaligned, therefore it needs to be submitted to a more detailed analysis.

Assessment 2: Shadow carbon price

Even very efficient installations have emissions due to natural gas combustion, so their financial viability should be impacted by a shadow carbon price. Assuming this project passes the financial stage, the operational lifetime can be compared with the time until full decarbonization.

Assessment 3: Evaluation of context

Step 1: Back-casting decarbonization by 2050

Considering its operational lifetime, this installation would be active until 2052, but if the project only has residual emissions or is no longer operating at full capacity, it can still pass on to the next assessment. Natural gas plays an important role as a mitigation option in India as the country is still massively dependent on coal and has a steep increase in its projected electricity demand. Both the IEA's *Sustainable Development* and Greenpeace's *Advanced Energy [R]evolution* scenarios project natural gas generation increment of around 1,300 TWh in India by 2030, which makes the level of generation for this project in line with decarbonization pathways.

Step 2: Additional considerations

Without gas, over 60% of India's electricity generation would need to be supplied by low carbon sources by 2030, which could be translated to a renewable generation increase of 3.58 p.p. per year while the national target, based on the national electricity plan 2018, is 1.98 p.p. According to this simplified analysis, this project would be eligible for financing provided it complies with other sustainability criteria.

4.2.2.2 Electricity transmission and distribution decision tree

Electricity transmission and distribution (T&D) projects aim to connect power generating units to consumption points. Often T&D infrastructure investments cannot be directly mapped to one specific power plant, limiting the use of quantitative indicators to assess alignment. The decision tree still builds on two of the same building blocks, the application of positive/negative lists and the alignment to a 2050 decarbonization pathway. Figure 4 illustrates a possible decision-making process.

If a T&D line is mainly used to connect to an electricity generation unit that is on the positive or negative list, the investment is automatically classified as aligned or misaligned, respectively. If a project is used to allow access to electricity in rural or remote areas, enabling electrification of sectors like buildings, transport and industry, it is considered to be aligned since reducing emissions from these sectors is a crucial pillar to reducing emissions in 1.5°C scenarios (Rogelj et al. 2015a). Connections to communities can always be repurposed even if initially used to connect to a GHG emitting power plant, but community connections to the grid or renewable sources should be prioritized. Finally, a renewable energy microgrid - not connected to one specific power plant - is also aligned.

The T&D line might connect exclusively to a generation unit neither on the positive nor negative list, e.g. a gas-fired power plant. In this case, the method developed for assessing electricity generation investments can inform the decision-making process. The user would input information about the power plant to find out whether the corresponding transmission and distribution project is aligned.

In many cases, investments in T&D lines that are not connected to one specific power plant will support a Paris-aligned transition, given that efficiency improvements might reduce generation needs, and rapid improvements of T&D are required to support high shares of renewables and flexibility in the grid. An installation supporting one or various of the following points is aligned:

1. **Lower grid congestion**:
   - Investments in grid expansion might lower renewable curtailment caused by grid congestion.
2. **Help interconnectivity of non-fossil supply alternatives**:
   - Connecting flexible generation and non-fossil generation alternatives helps to smooth out variability by exploring the geographic diversity of renewable generation, including cross border interconnections.
3. **Enable renewable supply establishment close to resources**:
   - Expanding the grid helps to explore renewable resources in locations where they are abundant. This facilitates the construction of large-scale renewable capacity.

Other investments may also help the integration of renewables by enhancing the functioning of the grid; these are projects that promote the establishment of smart grids, e.g. advanced metering infrastructure, advanced electricity pricing, distribution automation, smart inverters, and virtual power plants (Kempener, Komor, and Hoke 2013). Some of these technologies also contribute to demand side management, which helps in finding cost-effective measures on the customer side and enables least-cost overall energy system optimization.

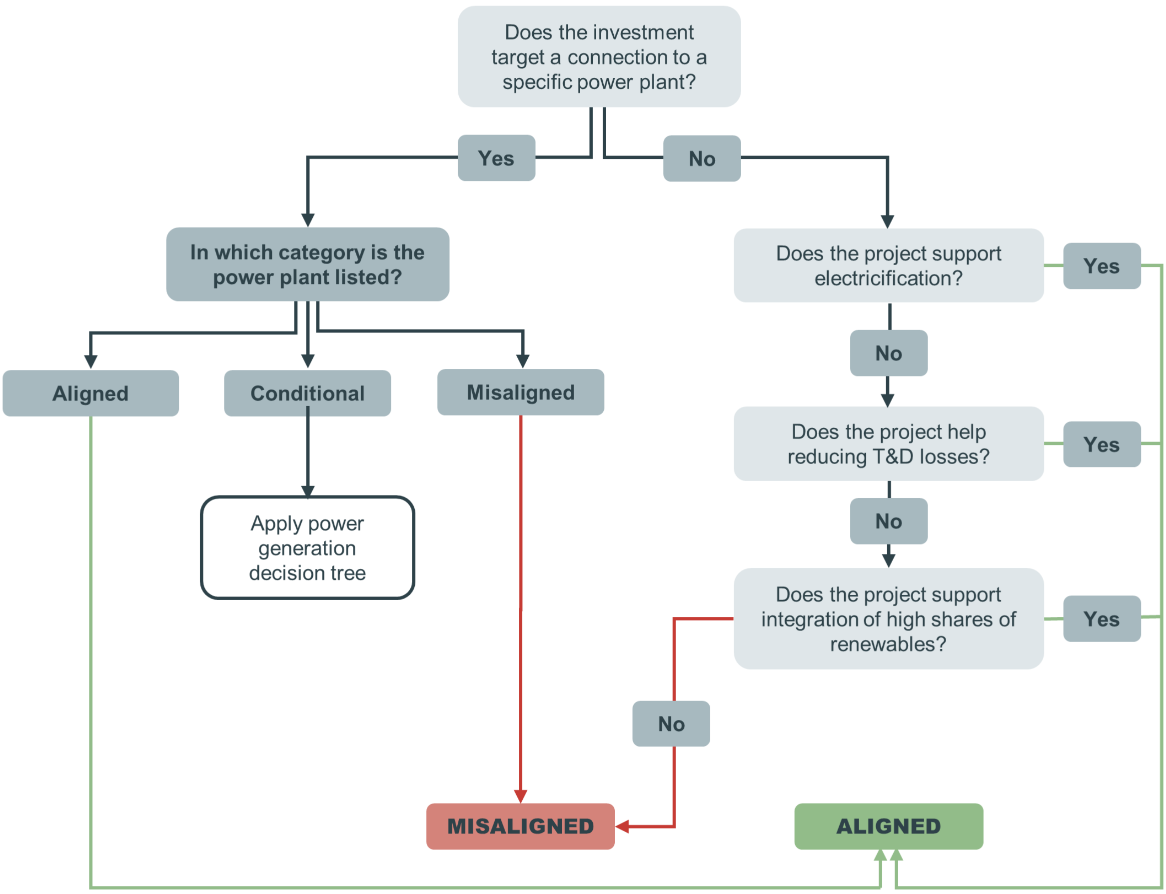

Figure 4: T&D decision tree

Contrary to the electricity generation decision-tree, the T&D decision does not build on the application of a price on carbon for the individual project, given the investment in grid infrastructure does not cause or eliminate direct emissions by itself. Projects that would result in efficiency improvements in a grid with a high share of fossil fuels would be favored by the application of a price on carbon when compared to investments in grids with a high share of renewables. The use of a carbon price in this context does not provide helpful insights on the level of alignment of a grid improvement project.

Box 5: Example of a T&D decision tree application in the case of a fictional cross-border transmission line project, in the Atacama Desert in Chile, with two components: (1) substation transformer replacements and (2) transmission line extension.

In the case of projects with several components, each one can be assessed separately. In these cases, neither project is used to connect to one specific power plant, therefore both are considered under the undecided part of the decision tree.

Component (1): Transformer replacement
Substation transformers contribute to overall system losses, so replacing them helps reduce emission by reducing electricity generation demand. This component is considered aligned. (Since the alignment decision does not involve a financial cost-benefit analysis, further considerations are needed to define if the electricity loss reduction justify the investment.)

Component (2): transmission line extension
Since this project is not directly reducing system losses it can only be considered aligned if it supports the integration of renewable energy sources to the grid. Since this is a cross-border project, it enables connecting countries with distinct power matrices, this enhances grid flexibility and help interconnecting non-fossil sources. Finally, considering that these lines would enable installation of solar powered power plants in a region with high solar irradiation it also contributes to integration of large-scale renewable energy projects.

Based on these two components, the overall project would be considered aligned.

4.2.2.1 Gas infrastructure decision tree

Even when considering fast renewables uptake, some projections show a short and medium term gap between the increase in renewables and the coal capacity reduction (IEA 2017b). In the USA, electricity generation from coal is expected to drop by over 800 TWh between 2014 and 2025 while the projected generation from wind and solar in the same period compensates for 530 TWh. Other factors, like efficiency measures resulting in lower electricity demand in some sectors, can help close this gap, but gas generation is often referred to as a “bridge technology” to support quick coal offset. With accelerated offsetting of coal coupled with high CO_2 prices, it becomes uneconomical to operate gas-fired power plants except in times of high demand, low renewable energy supply, and consequent high electricity prices, so the utilization rate of these installations falls to about half in 2040 in both the USA and Europe in IEA’s Sustainable Development Scenario (IEA 2017b).

This has already started to happen for so-called “gas peaker plants,” which are increasingly unable to compete with battery storage in the USA (Rosenberg 2018), and the same trend is observed in the projections for Europe. The same trend is not observed in developing countries yet, but research indicates that a sharp decrease in costs is expected in the near future, which will make battery storage more cost-effective (Telaretti and Dusonchet 2016). The IEA has received criticism for its projections, including for the role it gives to gas (compare section 2.1). Other sources are more critical of the expansion of existing gas infrastructure. Gas-fired power plants do represent an improvement in countries where electricity generation has a high average emissions intensity, such as India and China, which leads to its use in many scenarios until mid-century (compare section 0).

The electricity generation decision tree provides an assessment of natural gas-fired electricity plants. It is also important to assess the alignment of supporting infrastructure. The proposed methodology guides investment decisions in infrastructure aiming to transport natural gas after extraction to consumption points, focusing on gas pipelines and LNG (liquefied natural gas) terminals[12]. Both aim to transport natural gas over long distances, but with significant differences: while gas pipelines present higher geopolitical risk and lower flexibility, LNG terminals generate more emissions and have a more complex value chain (While 2017).

Gas pipelines are similar to electricity T&D infrastructure since they ultimately aim to connect resources to a generation unit. It is often not possible to assign a gas pipeline or LNG terminal to one specific power plant, so a more qualitative approach is needed. Figure 5 presents the decision tree that outlines the investment alignment decision-making.

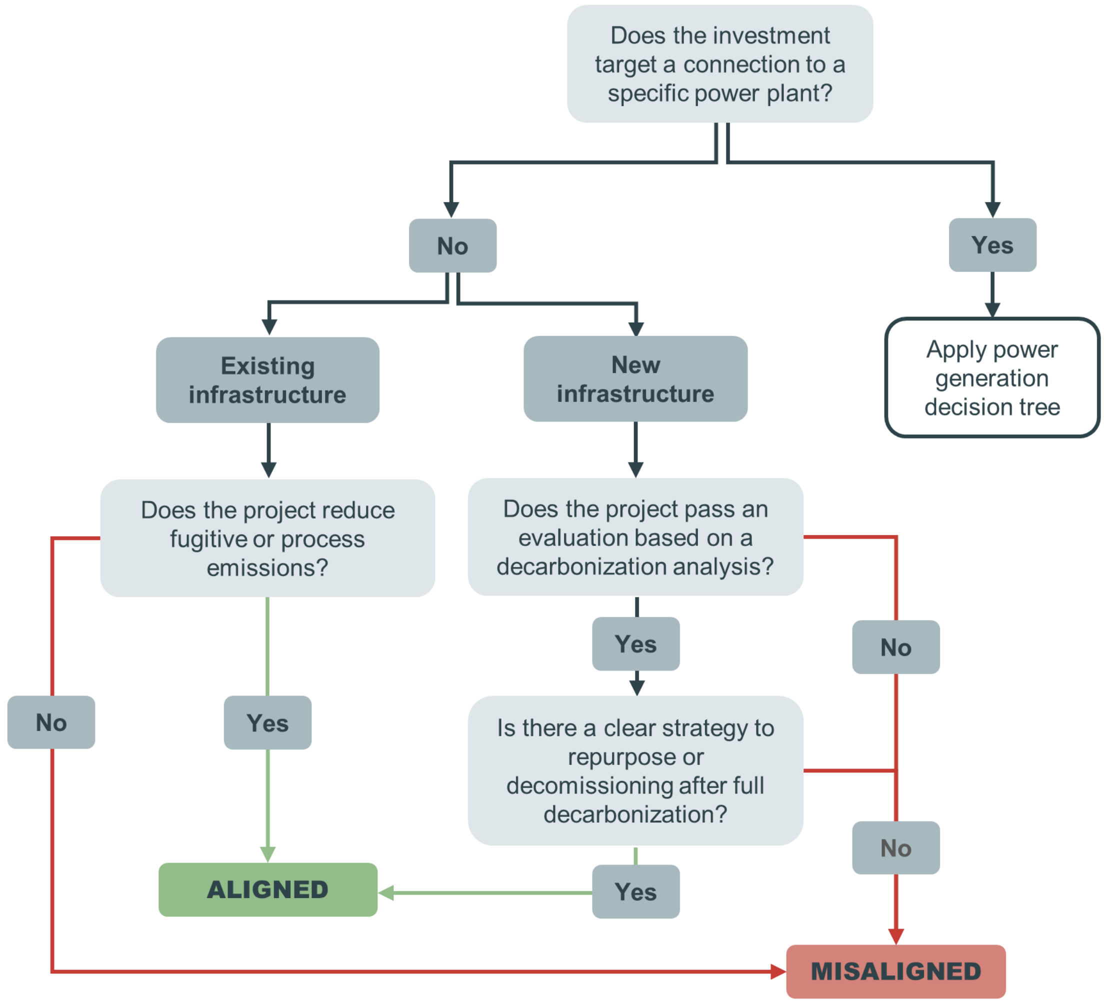

Figure 5: Natural gas support infrastructure decision tree

[12] Other energy related transport infrastructure, such as railway for transportation of fossil fuels, is covered in the transport section of the analysis.

When the investment, gas pipeline or LNG terminal is used to support one specific power plant, the electricity generation decision tree is used to assess alignment; if the power plant is categorized as aligned, the pipeline or LNG terminal is also aligned – this is valid for both new and existing infrastructure. Alternatively, the project might refer to investment in new or existing infrastructure that do not connect any specific power plants.

Projects that aim to refurbish existing infrastructure and result in a reduction of fugitive emissions are considered to be aligned. Gas pipelines may have a lifetime of 80 years (Dodds and McDowall 2013), which is long past the expected decarbonization year. The enhanced lock-in risk associated with new investments in gas pipelines is considered smaller than the benefit of reducing methane emissions during its operation. LNG terminals have higher emissions than gas pipelines mostly due to the fact that the liquefaction process requires removing the CO_2 from the natural gas. This process results in efficiency losses and higher emissions from venting. Therefore, investments that aim to reduce these emissions are considered aligned.

New pipelines could be aligned, due to the very diverse nature of a country's dependency on natural gas; this alignment may be supported by scientific scenarios but should also incorporate additional criteria. Further considerations should not be seen as cut-off criteria but rather as dimensions that contribute to alignment. Two dimensions are identified to be priority areas for consideration:

Future demand: *'Is it possible to cover projected demand without investing in new gas infrastructure?'*

Natural gas demand is subject to several factors: efficiency improvements and electrification of demand sectors, for example, could lower demand significantly. A detailed projection of gas demand in the countries supplied by the project Investments in natural gas infrastructure is necessary to justify the investment that should only be considered if no other alternatives are available. In the EU, for example, projects currently under development would result in a 58% increase in EU gas imports but there is no certainty about demand required, which enhances stranded assets risk (Gaventa, Dufour, and Bergamaschi 2016).

Context evaluation: *'How does the project fit into a national 2050 decarbonization pathway?'*

Any new investment project needs to fit into a pathway that takes into account a mid-century decarbonization target to limit the risk of stranded assets. Ideally, where a country has a strategy for the energy sector that leads to decarbonization around 2050, this can also be used as an indication for investments in gas pipelines. Alternatively, scientific scenarios or bottom-up models can be used to provide insights whenever country pathways are not available.

Energy security is one of the pillars of the 'energy trilemma', ensuring physical supply of energy is considered as important as energy equity or environmental sustainability. Even though this is a critical point, it does not impact the temperature goal directly and does not help defining Paris-alignment. Also, studies point to the fact that, in some regions, existing infrastructure is sufficient to safeguard countries against a wide range of shocks (Dutton, Fischer, and Gaventa 2017). In all cases, investments in natural gas infrastructure have a high risk of becoming stranded assets in Paris-aligned scenarios. Therefore, an important safeguard is to assure that investments have a clear plan to be repurposed or decommissioned before the year of full decarbonization.

Similar to the electricity T&D method, this decision structure does not suggest using a shadow carbon price for the individual project. A cost-benefit analysis with a mitigation-cost-based shadow price covering the complete system could be a technical option. However, given the broad boundaries of the system and the time horizon, it is questionable whether the results will provide sufficient clarity and robustness.

4.3 Transport infrastructure

Globally, the transport sector was responsible for 7 $GtCO_2e$ of direct GHG emissions in 2010, 23% of total energy related emissions in that year. Without aggressive emissions mitigation policies, the IPCC expects these emissions to increase to around 12 $GtCO_2e$ by 2050 (R. Sims et al. 2014). The Paris Agreement calls for overall near-term peaking, decline and reaching net zero emissions in the second half of the century. In order to have a 50% chance of limiting global warming to 1.5°C, Integrated Assessment Models call for transport emissions to be reduced by a third of 2010 levels by 2050. Because of the comparative differences in the emissions intensity of the various transport modes, and the options for decarbonizing them, this means different things for overland transport, shipping, and aviation.

Transport infrastructure makes up a large proportion of MDB lending and, given the long lifetime of transport infrastructure assets, represents both a large risk locking countries into a high emissions pathway and stranded assets. Infrastructure planning presents a major opportunity to structure transport around low carbon options where most future investment is needed (R. Sims et al. 2014).

The tools considered here cover three of the top types of transport infrastructure financing carried out by development banks: roads, rail, and ports (Oxford Economics 2017). While airports also constitute a large transport infrastructure investment, they are privatized to a greater extent than port infrastructure and have better access to capital markets, which means that private sector finance plays a bigger role in airport construction than it does in port infrastructure finance. ICAO finds that in the air transport sector, development banks now focus on capacity building, policy and regulatory support financing activities ("Financing for Aviation Infrastructure" 2016). For different kinds of transport, considerations for what is considered "infrastructure" vary, particularly with respect to the question of whether the vehicle that uses the transport infrastructure is considered part of that infrastructure. For roads, while development banks generally do not finance private passenger vehicle acquisition, they do finance buses for public transit, considered part of the public transport infrastructure. For rail infrastructure, train rolling stock is often financed as well as expanded rails: here, the vehicles are considered part of the infrastructure. In shipping, port infrastructure is often financed, but the ships themselves have other financial partners, often private or national development banks.

With regard to fuel considerations, various scenarios have different roles for electricity, hydrogen, and biofuels as an energy carrier. In theory, all three could play a role in a decarbonized transport future. The technological maturity and speed of improvement increasingly favors electricity.

Hydrogen can technically be formed through electrolysis where electricity is used to separate water into hydrogen and oxygen, enabling it to play a role as an alternative energy carrier or for storage. However, this requires a great deal of electricity generation, and loses a significant amount of energy in the process. The majority of hydrogen produced today is derived from fossil fuels that produce CO_2 as a byproduct and results in significant energy losses (U.S. Department of Energy 2018; OECD; IEA 2007) - but this would change under a transformative scenario.

The overall role of biofuels including land use change and induced land use change remains complex and controversial (Eklof 2011; Anex and Lifset 2014), and is associated with other significant environmental impacts (Lazarevic and Martin 2016). Other alternative fuels are so far only available in small quantities and are currently not cost competitive. Meanwhile, renewable energy has expanded faster than expected and continues to grow rapidly, battery technology has advanced faster and become cheaper than expected, and market integration of electric vehicles has also outpaced expectations (Sterl et al. 2017; Cronin et al. 2015). In the longer term, alternative fuels may play a larger role in climate efforts for international shipping and aviation but are less likely to be competitive for road and rail decarbonization.

Transport infrastructure investment options. Overall, there are three determining factors that affect transport emissions: activity levels, energy intensity, and the emissions intensity of the energy (fuel) used. Activity levels refers to how many people and how much cargo is transported, how far – and is measured in person or metric ton kilometers. Energy intensity refers to how much energy the activity uses – here the modal split of the transport activity is key, as different modes (foot, bicycle, road vehicles, rail, ship, or plane) have vastly different energy intensities per person / ton kilometer. Emissions intensity refers to the emissions factor of the energy used: how many metric tons of GHG are emitted per unit of energy to power that mode.

Important measures to reduce emissions can therefore be categorized as measures to avoid, shift or improve (ASI). These imply reducing activity levels or **avoiding** the need for transport where possible; **shifting** to less energy intensive transport modes; and **improving** - lowering and ultimately decarbonizing – the emissions emitted from the fuel source. Different modes are associated with different fuel options, for example electricity is more readily decarbonized than liquid fuels (taking induced land use change into consideration). Internal combustion engines (ICE) for aviation and road use for with private cars and for freight transport are the most emissions-intensive modes of travel in terms of person km or metric ton km (Chapman 2006), and therefore represent important reduction of overall emissions.

Gota et al (Gota, Huizenga, and Peet 2016) model transport mitigation potential for 60 countries that, in 2010, represented 89% of global transport emissions, 76% of global population and 84% of global GDP. They find that under a BAU scenario, global land transport sector emissions could grow to 13 $GtCO_2e$ by 2050; with transport emissions in non-OECD countries nearly tripling. They estimate that compatibility with a 2˚C pathway calls for peaking of emissions in the first half of the 2020s and residual emissions in 2050 of 4.7 $GtCO_2e$ for 2˚C and 2 $GtCO_2e$ for 1.5˚C (Gota, Huizenga, and Peet 2016). In order to do so, although there is a current bias towards “improve” strategies (fuel efficiency, electrification) in NDCs and national strategies, “avoid” and “shift” also have equally large mitigation potential and come with large sustainable development co-benefits (Gota, Huizenga, and Peet 2016).

Work done[13] by the *Science Based Targets* initiative suggest not only the necessity of increasing fuel efficiency/electrification, but also a large role for modal shift away from light duty passenger and freight vehicles under both a 2˚C and below 2˚C scenario (Science Based Targets 2018). The options for ASI are different depending on the function of the transport activity, which can generally be categorized as passenger or freight transport.

Passenger transport. Passenger transport accounted for approximately 57% of final energy consumption in the transport sector in 2009 (IPCC 2014a), and the IEA's below 2˚C scenario suggests a peaking of passenger transport energy use before 2020. Currently there is a trend of constant and continued growth in passenger kilometers in all modes, although these vary greatly between countries (IEA 2017a). In order to peak energy use and emissions before 2025, a maximum number of passenger kilometers must be avoided, a large-scale shift must occur to more efficient modes of transport (including non-emitting modes such as walking and cycling where applicable), and each mode must also decarbonize.

Some cities in some countries - particularly in large Asian cities - already have high modal shares of public transport and non-motorized transport. In some cases, the challenge is to maintain this modal share and to further promote this shift to largest extent possible – in the face of growing urban middle classes that are increasing interested in private vehicle ownership. Such decoupling of transport activity and emissions is possible, and may have already begun in some OECD countries (Ralph Sims et al. 2014; Goodwin and Van Dender 2013; Headicar 2013). In addition to reducing emissions, such

[13] derived from the mobility model of the IEA

decoupling is also associated with the advancement of sustainable development goals, especially improved public health (Woodcock 2009).

Freight transport. Freight transport accounted for approximately 43% of final energy consumption in the transport sector in 2009 (IPCC 2014a), and overland freight transport in 2016 accounted for over 70% of total freight CO_2 emissions (Climate Action Tracker 2018a). The IEA's below 2˚C scenario suggests a peaking of well-to-wheel freight transport by 2030 (IEA 2017a), and the Climate Action Tracker finds that overland freight transport would have to be decarbonized by 2050 (Climate Action Tracker 2018a). Some freight travel may be avoided through resource efficiency, but that is generally outside the scope of transportation policy.

Options to reduce freight emissions therefore focus on shifting freight transport from high to low emitting modes of transport and reducing and decarbonizing the emissions intensity of all modes more generally, according to the decarbonization options. Shifting opportunities present themselves by avoiding the transport of goods away from air and road and prioritizing shipping and rail, which are far more efficient in terms of emissions per metric ton kilometer.

There are, however, some limitations to the potential of modal shift for a number of reasons. Most "last-mile" transport requires at least some road transport. In many cases, because passenger freight and cargo freight often share tracks, shifting passenger and freight to the same rails presents a challenge without improved logistics and expanded rail capacity. Further, the fixed timing of rail presents a logistics limitation in comparison to trucks which are more flexible (Climate Action Tracker 2018a). In the short term, the limited geographic reach of rail in some countries is also a challenge.

Technological change is having - and will continue to have - a transformational effect on transportation in the next half century. This trend also has important implications for the future of greenhouse gas emissions from the sector. New technologies can equally be categorized into avoid / shift / improve options and vary with regard to how compatible they are with a decarbonization of the sector (see Table 11).

4.3.1 Transport sector investment options

Table 11 and the following paragraphs give an overview of the options considered under the in the transport sector, covering primarily road, rail, and maritime transport.

Table 11: Transport infrastructure investment overview (aviation was not considered)

PARIS-ALIGNED	CONDITIONAL	MISALIGNED
Compatible with and contributes to decarbonization of the sector assuming decarbonized electricity	**Limited compatibility with a decarbonization of the sector – investments in fossil fuel based transport that contributes to modal shift away from higher emitting modes**	**Not compatible, increases emissions and dependency on fossil fuels, contributes to fossil fuel lock-in**
• Non-motorised transport (sidewalks and dedicated bike-lanes, bike sharing infrastructure) • Integration of transport and urban development planning • Electric rail and rolling stock (passenger and freight) • Electric public transport • Inland waterways • Electric vehicles and charging infrastructure • Shore power charging infrastructure • Transport and travel demand management measures	• Road infrastructure including tunnels and bridges • Diesel rail and rolling stock • Port expansion for transport of non-fossil fuel freight	• New road, rail, waterways and port infrastructure for coal and petroleum transport • New airports/airport expansion[1)]

Footnotes:
1) The authors do recognize that alternatives for air travel are more limited compared to, for example, coal or petroleum for electricity. This highlights the need for further investigation of fuel alternatives for air transport.

Paris-aligned investment options

Paris-aligned investment options are those that help avoid transit, promote a shift of transport activity to less energy emitting modes where the energy supplier of that mode is - or can readily be - decarbonized[14], such as with the electricity sector. These investment options can be considered to constitute a positive list, which do not require further evaluation from a climate point of view.

Infrastructure promoting or enabling non-motorized transport fall into this category, including walkable communities and bike pathways. Public transport provides an alternative to private ICE use reducing emissions as well as congestion (Agora Verkehrswende 2017). Electrified public transport is Paris-aligned; other types of public transport also encourage modal shift but will also require decarbonization in the medium term.

The advances in the storage capacity and cost drops in electric batteries combined with a growing share of renewables in the electricity mix is likely to have a large effect on road emissions. It is likely that a tipping point is rapidly approaching, as advances in lithium-ion batteries may spur the adoption of electric vehicles, which may be cost competitive by 2020 (Kittner, Lill, and Kammen 2017). Excluding fuel costs,

---

[14] Hydrogen provides an alternative source of fuel that can be produced from electricity and water. However over 95% of the world's current hydrogen supply is produced from fossil fuels which emit CO2 as a bi-product during production ((Muradov and Veziroğlu 2005; U.S. Department of Energy 2018).

Bloomberg New Energy Finance expects the upfront costs of electric vehicles to be competitive on an unsubsidized basis from 2024 (Bloomberg NEF 2018). Expansion of electric vehicle charging infrastructure is critical to enable this trend.

With the progressive decarbonization of electricity, rail electrification becomes an important climate measure. While on a per metric ton kilometer basis, diesel trains are more efficient than diesel road freight, all rail transport will also require decarbonization. Electrification can take three forms: through an overhead cantilever, through a third rail or through Independent Powered Electric Multiple Unit (IPEMU) which allows a train to run on battery power for limited time while on non-electrified track and can enhance energy security (NetworkRail 2018; Keen and Phillpotts 2010).

For shipping, inland waterways enable an energy and carbon efficient mode of transport. It is however a mode that is not currently readily decarbonized. It is not common practice for ports to supply electricity from the shore to ships at berth, and ships often continue running on their own power, partially out of a lack of infrastructure and because it is generally cheaper for ships to produce their own electricity with their own generators than to use onshore power. Onshore power is a first step toward reducing shipping emissions, and would facilitate the electrification of shipping where feasible, for example for short sea shipping, ferries, and for inland waterways.

Non-Aligned transport investments

Infrastructure for the transport of coal or new fossil fuel extraction, including road, rail, waterways or marine transport.

Conditionally aligned investments

Some investments are important for the development mandates of MDBs. These include road infrastructure, which cannot be automatically categorized as Paris-aligned investments because of the extent of their induced emissions by facilitating transport via ICEs. In such cases, further consideration is necessary in the specific context of the potential transport infrastructure project.

4.3.2 Evaluation of investments in the context of sector and country

The tools suggested below are not comprehensive, but rather suggest a decision-making approach to transport infrastructure investment in areas that make up a large proportion of funding in the “conditional” category. Due to the fundamentally different nature of these projects, three approaches provide a way to consider the Paris-compatibility of such investment options.

4.3.2.1 Road transport

A road in and of itself does not emit greenhouse gases, but road infrastructure can lead to emissions in many ways: clearing forests for the construction of a road or train line; emissions embedded in road and rail construction materials (concrete, asphalt, rails, etc.); emissions from road maintenance and repair; induced emissions through increased traffic from the expansion of transport infrastructure; and there may be emissions related to the increased exploitation of land that made accessible via new transport infrastructure – for example if native forest becomes available for commercial farming. The clearing of forest for road construction and the enabled exploitation of forests may be significant, but are context-specific, and not explored here in depth. However, compared with emissions from construction, building materials and maintenance, the induced emissions from increased traffic generally represents the largest climate impact of a road construction investment (Williams-Derry 2007).

Emissions from internal combustion engines (ICEs) used in road travel were responsible for 80% of the overall emissions growth in the transport sector from 1970 to 2010 (Ralph Sims et al. 2014). The majority of emissions from roads are Scope 3 emissions, induced from the transport activity made possible by the road. Reducing emissions from road transport and especially induced emissions from new roads is therefore critical to addressing climate change. However, roads also play an essential infrastructure role, providing access to vital services and economic opportunities, and play an important role in reaching development goals. The function of roads also goes far beyond being a conduit for ICEs but as it can serve mobility and accessibility for multiple modes of transport as well as playing a broader social and economic role in human settlements.

The induced activity and therefore the emissions associated with a new or expanded road rely on projections for transport activity (person kilometers or metric ton kilometers) on the road. They are influenced by a number of factors affecting demand for transport in general, and the emissions and energy intensity of that activity. These factors include many variables related to a country's demographics and economic growth, commercial activity, transport options, how land is used, as well as options for demand management and prices. Some of these factors are beyond the control of a government or are exogenous to transport policy. Others fall within transport policy planning, and include land use planning, the provision of different modes of transport, as well as fiscal incentives that make flying or the use of private / commercial ICE vehicles comparatively more expensive than other modes, as well as fiscal incentives to promote more efficient modes of transport. Such pricing policies could include fuel taxes, ticket taxes, vignette systems, company car taxation, or subsidized public transport.

Table 12: Factors affecting demand for transport adapted from (Litman 2017).

Demographics	**Commercial Activity**	**Transport mode Options**	**Land Use**	**Demand Management**	**Prices**
• Population of potential users • Employment rate • Wealth/Income • Age • Lifestyle • Preferences • Real estate prices	• Economic growth • Number of jobs • Consumer confidence • Business activity • Tourist activity	• Sidewalks • Cycle paths • Public transit • Ridesharing • Automobile • Taxi services • Delivery services • Ferries • Ships • Rail • Airplanes • Teleworking (not commuting)	• Density • Mixed zoning (residential, commercial, industrial) • Walkability • Connectivity • Transit service proximity • Roadway design	• Road use prioritization • Rail use prioritization • Congestion charges • Parking management • Parking availability • Information campaigns • Ticketing prices	• Fuel prices and taxes • Parking fees • Road tolls • Congestion charges • Vignette systems • Vehicle taxes and fees • Company car taxes • Public transit fares • Airplane ticket taxes

A number of these factors depend on external trends unrelated to the specific project or the policies in place. Many are directly in the purview of transport policymakers whether or not they are directly related to the specific transport infrastructure project itself. When considering the climate impact of financing road infrastructure, it is therefore important not only to consider the specific project's characteristics, but also to what extent the whole context of the jurisdiction in question affects the transport activity and emissions intensity of that activity. The magnitude of different factors will vary depending on the policy and the context.

Although in taking a financing decision for a certain project, a bank cannot necessarily impose policies, it can however set criteria to assess the transport policy matrix of the country in question. For example, does the country or jurisdiction of the project have policies in place to encourage ASI in the transport sector? This can be evaluated both at the national/jurisdictional level and to varying extents specifically within the context of the project in question. Proposed road projects where the road and the overall transport policy of the relevant jurisdiction are in line with best practice can be considered compatible with a Paris pathway for transport. Proposed projects with few or none of what can be considered as best practice transportation policy measures - and lack specific road design features - can be considered as not aligned with the Paris Agreement.

Avoid and shift

The expansion of high-speed internet connections and the ability of workers to telework may also significantly avoid transport activity and therefore emissions by reducing commuting. However, it may also contribute to urban sprawl (Moeckel 2017), partially working against efforts towards more compact urban design. Such investments can be considered as Paris aligned although they are not generally considered a transport sector investment.

The IPCC highlights that urban population density inversely correlates with GHG emissions from land transport (R. Sims et al. 2014; Kennedy et al. 2009; Rickwood, Glazebrook, and Searle 2008) and increases the viability of non-motorized transport options (Newman and Kenworthy 2011; R. Sims et al. 2014).

Urban planning - especially street design and connectivity - can reduce car dependence and use (Handy et al. 2002; Ewing 2011; Cervero and Murakami 2010). It is therefore important to develop urban space and design roads to maximize efficient access to vital services and economic opportunities to help foster opportunity for modal shift and minimize emissions.

One way to encourage such a shift is by promoting urban densification or infill development through urban growth boundaries around cities. Such urban design policies can work with oriented development policies, where zoning and real estate development focusses around facilitating modal shift towards public transportation, walking, and biking. They can significantly avoid transport emissions by encouraging development and densification in areas well-served by public transport.

Transport behavior is heavily influenced by the mix of residential, commercial and industrial zones within a city, as well as the density of land use. Dense urban areas with developed sidewalks and bicycle paths can reduce modal share of ICE road vehicles and reduce congestion on public transport. Bike sharing schemes have recently taken off around the world, with more cities adopting them. The emergence of electric bicycles may also expand the potential distance of trips made by bicycle, extending the distance over which the potential for modal shift from road to bicycle is possible (Fyhri and Fearnley 2015).

Although highly context-specific, mitigation potential through better urban design can reduce emissions by around a third (Haas et al. 2010; Nahlik and Chester 2014; R. Sims et al. 2014). Therefore, one of the factors that should be taken into account in road infrastructure investment decisions is the extent to which the road project location's jurisdiction has policies to promote urban densification and mixed zoning, and plans further development around facilitating transport by public transport, walking or cycling.

Push, pull, and improve

Road transport's emissions and energy intensity is determined by emissions standards for vehicles, emissions intensity of the fuel (petrol, diesel, biofuels, electricity) and the design of the road. Fuel taxes affect both the activity and emissions intensity in both the long and short term. In the long term, assuming a full decarbonization of the electricity supply and full electrification of passenger and freight vehicles, the induced emissions of a road project could reach zero – but not in the short term.

Push and pull measures can have a large impact on transit activity, modal choice, and vehicle fuel efficiency which is related to emissions. Such policies can include dynamic parking pricing, reduced parking in areas with transportation alternatives, transit pass subsidies - and other ways to reduce transit fares, congestion charges, vignette systems, and road tolls. High occupancy toad toll schemes that charge a vehicle with multiple passengers less can be used to increase vehicle occupancy.

Emissions standards for cars will affect the induced emissions of roads in a jurisdiction. A benchmark for good practice can be found in the suggestions of the *Global Fuel Economy Initiative*[15], which calls for a target of 4.2 liters of gasoline equivalent per 100 km by 2030. Policies based on EURO norms should be reevaluated in light of recent revelations that manufacturer testing holds little relevance for real road driving.

Driving behavior, including speed and braking patterns also affect the fuel use of transport. For ICE vehicles and electric vehicles not running on 100% renewable energy, speed limits have an effect on emissions: in 2011, the European Environment Agency found that in Europe, reducing motorway speed limits from 120 to 110 km/h could deliver fuel savings for current technology passenger cars of 12–18%, assuming smooth driving and 100% compliance with speed limits (European Environment Agency 2011). One 2014 study found that a further reduction from 110 to 90 km/h in France could reduce GHGs by 6-10% (Cohen, Christoforou, and Seidowsky 2014). A road transport investment decision-making process should consider policies to encourage improved fuel efficiency, and especially to promote electric mobility and, ultimately, policies that phase out internal combustion engines.

Chile has a tax on the purchase of light and medium duty vehicles that includes CO_2 and NOx emissions standards. Kenya has a vehicle age-based taxation scheme for imported second hand vehicles, with a 150% tax for cars older than three years and 30% for vehicles younger than three years. Thailand's excise tax structure for manufacturers and importers of light duty vehicles includes fuel economy considerations.

Policies to encourage the uptake of electric vehicles can also reduce emissions, especially with an increasingly low emissions electricity mix in line with the sector's decarbonization (see above). Electric cars represent an improvement on ICEs even in countries with a relatively high grid emissions factor (Hall and Lutsey 2018). This is linked to charging infrastructure expansion, but also to other policies that promote the purchase of such vehicles. Some countries offer direct subsidies, or tax exemptions such as in the Ukraine, where electric vehicles are exempt from VAT for 2018 (GFEI 2018).

Linked to the electrification of road transport is the growing trend of car and ride sharing, which will increasingly be in driverless vehicles. In many cities around the world – including in least developed countries – ride sharing has started to have a large impact on transport behavior. This market penetration has been made possible by smart phones that allow passengers to call and pay for point to point transportation. Ride sharing is likely to drive technological and behavioral shifts with the potential for a number of different impacts on emissions. Three likely impacts are:

1) reduced GHG emissions from a shift from private car use to more fuel-efficient shared vehicles;

2) increased GHG emissions when passengers shift from public transport to ride sharing; and

3) reduced GHG emissions from fewer vehicles (Jung and Koo 2018).

A number of ride-hailing apps, including Uber and Lyft, have started to actively promote electric cars (Coplon-Newfield and Dobell 2017; Hawkins 2018). Driverless vehicles are ideal for shared use (Agora Verkehrswende 2017) and more shared vehicles on the road used more will shorten the payback period

[15] An initiative of the FiA Foundation, UNEP, the University of California Davis Institute for Transportation Studies, the International Transport Forum at the OECD, the IEA, and the International Council on Clean Transportation

of electric vehicles when including fuel costs, (Li and Fizgerald 2018). Ride sharing can be further encouraged through including reserved lanes for high occupancy vehicles on the road in question.

How and to what extent these policies and factors can follow the ASI principle also depends on the function of the road. Roads serve a number of purposes - to move both passengers and freight. Transport planners and academics have developed a general categorization that divides roads into three types based on their function in a network: **local roads** also known as land access roads, serve for shorter trips with many interconnections; **arterial roads**, or flow roads, that move large volumes of traffic, but have comparatively few intersections and thus less land access; and **collector roads** that serve an intermediary function bringing traffic from local roads to arterial highways and vice versa (FHA 1968; Baerwaeld 1976; Lauwers 2008; Talvitie 1996). **Highways** can be considered a category of arterial roads built to maximize flow, and have comparatively little land access (through highway exits and entrances). This classification works slightly differently in the urban and rural context and is often subdivided into subcategories in different countries based on local circumstances. The options for ASI therefore differ, depending on the kind of road and if it's in a rural or urban setting.

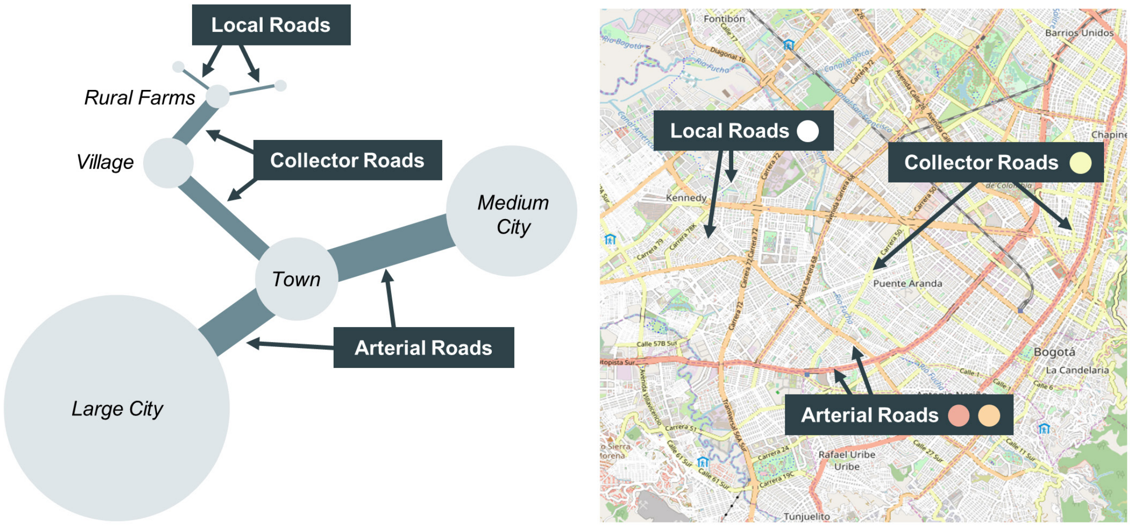

Figure 6: Description of road categories and functions in a rural context (left, adapted from Talvitie 1996) and urban context (right, for Bogota - own depiction based on open OpenStreetmap)

Evaluation matrix tool to compare a road project with best practice

A checklist reviewing the policies the relevant jurisdiction (national or subnational) has in place, and to what extent they apply to the road in question, can indicate if the overall context of a road project is in line with best practice and can therefore indicate Paris-alignment.

The evaluation matrix gives an equal weighting to the effect of policies and measures for a given kind of road: a highway, arterial road, a collector, a local road in either an urban or a rural context. Different policies and measures will have a different effect on a road depending on the context. How they are combined means that an exact weighting may not be practicable, as different road projects may not be directly comparable. However, the evaluation matrix provides a straightforward framework to approach and evaluate the extent to which the context of the road is in line with the ASI principle, and therefore the decarbonization of transport, and Paris Agreement alignment.

Full Paris-alignment would mean having all the relevant policy measures in place. If however, only a few or none of the policy measures are in place, or if they are not enforced, or if the road lacks relevant design characteristics like sidewalks and bike paths for urban local, collector and arterial roads, the road can be considered to be not aligned with the Paris Agreement. In many cases, a country's transport policy regime will only have some of them in place. The tool proposes an evaluation matrix to determine whether a transport policy that affects a road is more or less Paris-aligned on a sliding scale.

Table 13: Tool to evaluate alignment with best practice and likely induced emissions. X's denote applicability of the policy / characteristic applicability.

Policy		Urban roads				Rural roads				Best Practice Road (Artery)	Hypothe-tical Example A (Artery)	Hypothe-tical Example B (Artery)
		High-way	Artery	Collec-tor	Local	High-way	Artery	Collec-tor	Local			
Avoid	Transit oriented development	X	X	X	X	X	X	X	X	1		1
	High speed internet and teleworking promtion	X	X	X	X	X	X	X	X	1	1	1
Shift	Sidewalks and bikepaths		X	X	X		X	X	X	1		1
	Bicycle parking		X	X	X					1		1
	Company car taxation - Bonus Malus Sys	X	X	X	X	X	X	X	X	1		1
	Vehicle taxes and fees	X	X	X	X	X	X	X	X	1		1
	Toll roads	X	X			X				1		1
	Parking pricing	X	X	X	X		X			1		1
	Carpooling promotion	X	X	X	X	X				1		1
	HOV/HOT	X	X	X		X				1		1
	BRT lane/space for a tram	X	X	X		X	X	X		1		1
	Subsidized public transport	X	X	X	X	X	X	X	X	1		
	Vignette system	X	X			X	X			1		
	Congestion charges	X	X	X		X				1		1
Improve	Vehicle retirement programs	X	X	X	X	X	X	X	X	1	1	1
	Fuel efficiency standards in line with GFEI benchmark	X	X	X	X	X	X	X	X	1		
	Speed limits of at least 90 km/hr	X	X	X	X	X	X	X	X	1	1	1
	Promotion of electric vehicles	X	X	X	X	X	X	X	X	1		1
	Fossil fuel vehicle ban	X	X	X	X	X	X	X	X	1		
	Electric charging infrastructure	X	X	X	X	X	X	X	X	1		1
Score:		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**20**	**3**	**16**
Out of possible:		**18**	**20**	**18**	**15**	**17**	**15**	**13**	**12**	**20**	**20**	**20**
Scale of alignment with best practice:										**100.00%**	**15.00%**	**80.00%**

As an example (hypothetical example A in Table 13), consider a 160 km public road expansion and upgrade of a rural arterial road and a number of collector roads in a lower middle-income country. The project would widen the road from two to three lanes in both directions, greatly reduce travelling time in the short term. The road itself has neither sidewalks nor bike paths but would include wider shoulders in many sections that could accommodate sidewalks. The majority of person kilometers on the route are currently via mopeds and private bus companies that run on diesel heavily subsidized by the government, along with petrol. A growing middle class is increasingly buying private ICE vehicles. Large diesel freight vehicles constitute an increasing share of traffic. It is not a toll road. A railway, built before independence, connects the two cities but is unreliable and lacks investment.

A reference scenario including policies predicts an increasing modal share of private ICE vehicles, primarily SUVs. There are no speed limits in place or proposed. Law enforcement does not have the capacity to enforce speed limits.

The country has experienced rapid economic growth in the last ten years, as well as rapid population growth and accelerating urbanization. There is little cable internet infrastructure, but a 4G network is being developed that would cover the major population areas. Electric vehicles do not make up a significant proportion of the car fleet. The country has no domestic vehicle production and primarily imports used cars from abroad. A recent international donor has financed scrappage and replacement of the oldest and dirtiest heavy-duty vehicles. There is a ban on the import of cars and light duty vehicles older than ten years, and higher tariffs for cars older than five years with tax reductions from importing cleaner vehicles.

Based on this limited information, the road project is ***"less"* Paris aligned.** While there are some factors that may contribute to avoided transport (such as 4G internet), the relevant jurisdiction lacks sustainable planning policies. Sidewalks and bike paths have been considered, but there are no effective policies to shift from private ICEs, and transportation fuel is highly subsidized. The road is not a toll road, there are no plans for a HOV or BRT lane. Government efforts to ban older vehicles to increase fuel efficiency, and levy higher taxes on inefficient vehicles are included in the reference scenario and are expected to be insufficient to counteract the prevailing trend towards increased use of larger higher emitting private ICE vehicles.

4.3.2.2 Rail transport

Rail is a lower emitting mode of transport than ICE on a road - or air travel - and reduces emissions to the extent that it contributes to modal shift away from higher emitting modes. Rail transport will however also require ultimate decarbonization to meet the Paris Agreement goals. Here, a decision tree can facilitate decision-making processes for the funding of rail transport, either tracks or rolling stock.

The first question in the decision tree is whether the rail infrastructure is for the dedicated extraction of fossil fuel resources, particularly coal. If so, then it is not Paris-aligned. If not, the next question in the decision tree is whether the investment is electrified (we assume constant progression towards decarbonization of electricity). If the asset is electric, it can be considered to be Paris-aligned (see positive list). If not, it is pertinent to ask if there is a plan for electrification by 2050. If there is, it is Paris-aligned. If not, is the lifetime of the asset longer than the remaining time before decarbonization. If so, the asset is likely to cause fossil fuel lock in or become a stranded asset and is not Paris-aligned. If not, is it likely to displace emissions from higher emitting modes of transport? This is generally the case unless there is accelerated decarbonization of road-based freight. If so, then the investment may be considered to be Paris-aligned, based on an assessment of the probability of electrification before 2050.[16]

---

[16] A similar assessment can be make for Bus Rapid Transit, which would shift transport activity from private vehicles to public transport. If the BRT busses are electric, they can be considered Paris aligned. If they are diesel or run on compressed natural gas, they may be conditionally aligned based on future electrification.

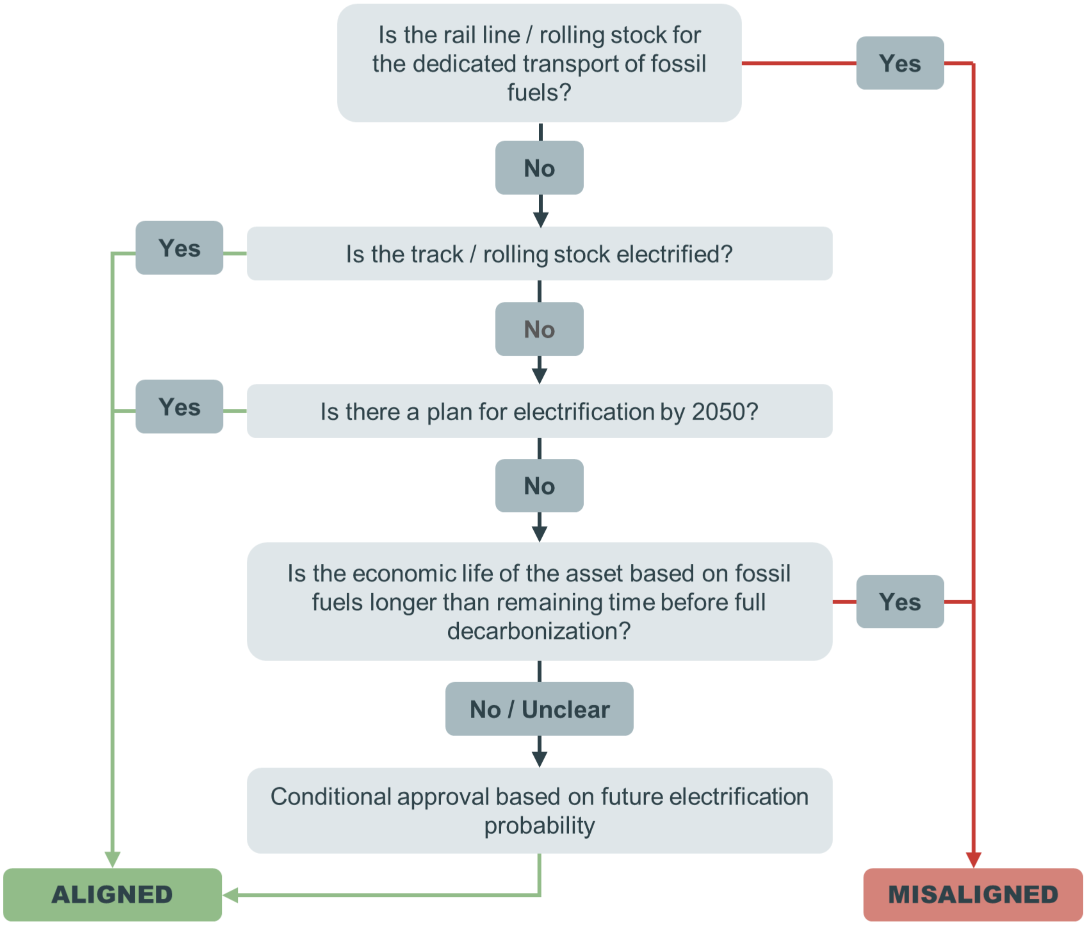

Figure 7: Decision tree for rail infrastructure

4.3.2.3 Shipping

Shipping (especially ocean tanker and bulk carriers) is one of the lowest emission modes of freight transport per metric ton kilometer (R. Sims et al. 2014), it will also require decarbonization to reach the Paris Agreement goals. Shipping emitted approximately one billion metric tons of GHG on average from 2007 to 2012, 3% of global GHG emissions, and is currently expected to increase (Olmer et al. 2017; T. W. P. Smith et al. 2014). These increases, driven by growing trade activity, will necessitate global port expansion and can be equally influenced by incentives for efficiency set by ports (OECD/ITF 2018). MDBs do not play a large role in shipping financing (Hellenic Shipping News Worldwide 2017). However, they do play a large role in port construction and expansion (Oommen 2018; Sustainable Infrastructure Foundation 2017).

Ports can have a great deal of influence over shipping emissions, and have an important role to play in the implementation of climate measures in the sector (OECD/ITF 2018). Therefore, the policies in place around port building and expansion will have an important effect on overall shipping emissions, as well as the GHG emissions of the MDBs' lending portfolios.

Paris-alignment for the shipping industry can take a three-step approach - as outlined in Figure 8 below. A first consideration should be whether the new port investment is dedicated to the export or import of fossil fuels, particularly coal, petroleum or an LNG terminal. For LNG, the investment can be run through the gas pipeline decision tree above. New port infrastructure for the import or export of coal is not Paris-aligned. Given that fossil fuels, including petroleum, petroleum products and coal and coke make up a large proportion of the tonnage of commodities shipped around the world (Panama Canal Authority 2017; Port of Long Beach 2018; Rotterdam 2018), with the increasing decarbonization of economic systems, ports may be at significant risk of stranded assets in excess capacity (Samadi et al. 2016). In some ports this is already noticeable: trans-shipments of coal through the port of Amsterdam fell by 7.5% in 2016, a phenomenon that the port expects to lead to a 29% decrease by 2022. The port of Amsterdam has set a target to be coal free by 2030 (Darby 2017). Depending on increased port capacity needs for other non-fossil fuel goods, any port capacity dedicated for the import or export of fossil fuels is therefore at risk of becoming a stranded asset.

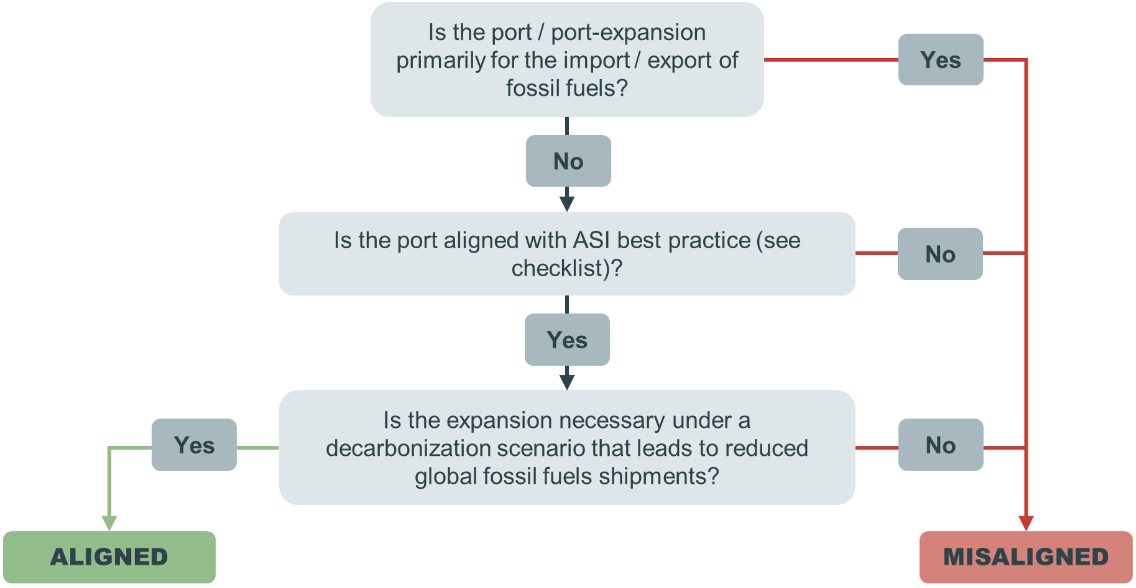

Figure 8: Decision tree for port construction / expansion

The Paris-compatibility of port expansion for the transport of other goods can be assessed in comparison to a best practice port, similar to the road sector approach. The characteristics of such a best practice port include provisions around the extent to which the operation of the port itself is electrified, offers onshore power[17], has policies for green allocation for berths, considers the emissions of the ships in port fee structures, has speed reduction zones around the port, and the extent to which it fosters further transport via inland waterways or rail as opposed to fossil fuel-based road freight. When not built for primarily for the transport of fossil fuels, inland waterways and canals can be considered to be Paris aligned because they: 1). enable a very carbon efficient mode of freight transport and connectivity; 2). enable significant modal shift from ICE road freight transport; and 3). and short sea shipping and shipping on inland waterways is much more readily electrified / decarbonized than intercontinental shipping (Peters 2018).

[17] The OPS technology is known by a variety of names: Alternative Maritime Power (AMP), Cold Ironing, Shoreside Electricity and Onshore Power Supply. The IEC/ISO/IEEE standard uses the term High Voltage Shore Connection (HVSC) systems.

Policy	
Shift	Maximized short sea shipping to feeder ports
	Maximized inland waterway connectivity
	Maximized rail interconnectivity to hinterland
	Railways or trams of freight in the port area
Improve	GHG emissions intensity differentiated port fee
	Incentives for reducing speed in approach
	Emissions intensity considered in berthing allocation
	Availability and promotional pricing of on shore power / cold ironing
	Electric charging infrastructure for trucks
	Electric freight rail track
	Maximize container utilization
	Logistics optimization

Table 14: Best Practice Application of ASI principle in port policies.

5 Alignment with the Paris Agreement beyond direct investment lending

Key Conclusions

Building up a Paris-aligned portfolio means that not only investment finance, but all lending instruments, should become aligned, and a Paris-aligned project pipeline needs to be created.

In order to achieve Paris-alignment of financial intermediary (FI) lending and policy-based lending (PBL), climate tools used for investment finance should be updated and also applied to these instruments. To function effectively for these lending types, they should be combined with a climate impact assessment by the MDB, and be integrated into a climate management system by the FI - or in the legislative framework on climate by the client government. Climate tools should also be tailored to national circumstances.

Strengthening MDB information gathering and evaluating in the preparation phase needs to be increased. Clients also need to be accompanied during the implementation of climate tools. Climate results of the clients should be monitored, evaluated and disclosed by the MDBs.

Long-term cooperation can incentivize moves towards alignment over time. For FIs this could mean first applying exclusion and positive lists, then building up GHG accounting, ring-fencing the application of further climate tools such as shadow carbon pricing and benchmarks to MDB finance and eventually institutionalizing these climate tools. For PBLs, a gradual development towards an aligned development pathway can similarly be reached over time.

Proposed approaches to strengthen a Paris-aligned project pipeline include 1) the integration of systematic climate mitigation potential analysis in investment finance, financial intermediary lending and policy-based lending 2) the provision of technical assistance in client countries, 3) the pooling of bankable projects and 4) the integration of tools for Paris-alignment in project preparation facilities.

This chapter considers what alignment with the Paris objectives might mean for MDB operations other than direct project investments in physical assets: financial intermediary (FI) lending and policy-based lending (PBL). It also focuses on activities that would strengthen a Paris-aligned project pipeline.

What FI lending and PBLs have in common is that MBDs have considerably less information about the use of funds than they do with investment finance. When assessing potential impacts on climate change and appropriate mitigation measures, delegating responsibility to a partner creates an additional level of complexity.

Independent of the lending instrument, there will be a need to strengthen the pipeline of Paris-aligned bankable projects in which the MDBs can invest, otherwise it will be impossible for the banks to align their portfolios with the Paris objectives without substantially decreasing investment volumes. Policy support and project preparation facilities can play an important role in creating a desirable project pipeline. Chapter 5 reviews the experience with such instruments and identifies best practices.

5.1 Financial intermediary lending

In FI operations MDBs channel their support through financial intermediaries that on-lend these funds to beneficiaries for a determined purpose. Typically, the FI blends the MDB support with own finance before disbursing it to the end client. Institutions acting as financial intermediaries include commercial banks, public development banks, micro finance institutions and insurance companies. A wide range of financial instruments is used in cooperation with FI, including loans, guarantees, technical assistance and equity.

At the time a project is approved and the contract between MDB and FI signed, the projects ultimately financed are not known (except in cases of refinancing already ongoing projects). The MDB is usually not involved in the appraisal decision of individual projects, expect for very large or controversial projects which might require a "no-objection" by the MDB. There is no contractual relation between the MDB and the end-client, i.e. investment projects.

This does not mean that the FI has a carte blanche to finance anything it wants to with extended funding without accountability. The purpose and modality of the use of funds are defined in the project appraisal documents as well as in the contract. This may range from rather general objectives, such as strengthening of the capital market, to a specific and detailed end-use, such as photovoltaic investments in line with a specific national regulation.

Tools to predefine the use of funds include eligibility criteria, exclusion lists, sector/technical guidelines and sample projects. The FI will finance projects and assume the entire technical and financial responsibility for the projects within a defined scope, including assessing and managing of environmental and social impacts (risks). In its due diligence, the MDB must assess whether the FI has the capacities to make those assessments. MDBs' environmental and social safeguards contain specific provisions for FI finance. If the FI does not have an environmental and social risk management system in place satisfying MDB standards, the FI has to make respective adjustments to its system as a whole - or at least for the MDB related finance activities.

As with investment projects, the FI must submit regular reports on its performance against the agreed objectives and provisions. The amount of information the MDB receives on the end-use may vary from overarching aggregate data to parts of the project documentation such as environmental and social impact assessments or technical feasibility studies. Generally, however, it receives much less information than for directly financed investment projects.

MDBs provide a considerable share of their commitments - 20 to 50% - through FIs (MDBs 2017; IFC, n.d.; IDB 2018a; ADB 2018; AfDB 2018; EBRD 2018, n.d., n.d., n.d.). The EIB has by far the largest total FI commitments. A lack of standardized reporting means it is not possible to extract exact comparable figures on FIs. Some MDBs report on credit lines (which usually represent the largest share of FI finance), others on support to the financial sector (which might also cover TA and policy dialogue), and none of the project databases allow filtering for type of recipient/borrower or for sector split of financial instruments. The lack of data also prohibits a thorough assessment of the quantitative role of FI lending for climate finance, and vice versa, which seems to differ significantly among MDBs. For a full understanding of the importance of FI lending for climate finance activities, harmonized disclosure would be desirable.

From a climate perspective, cooperation with financial intermediaries offers opportunities for mainstreaming climate considerations across a wider range of financial institutions. FI lending could have the potential to introduce Paris-aligned environmental and social safeguard systems into local finance institutions. Engagement with FIs can potentially support the necessary financial sector reforms to "green" the financial system and, accordingly, economies in developing countries

The main risk associated with FI lending is the MDBs' lack of control. Cases in which the FI on-lends the funds to projects that are not in line with the social and environmental safeguards of the MDB have repeatedly been reported (Roasa 2017).

Table 15: Examples of typical FI projects categorized according to their Paris alignment

Compatible	Conditional	Misaligned
• Equity and debt to structured investment fund for RE technologies without emissions over their lifetime • Credit line for small hydro	• Credit line to tackle liquidity shortage in local market • Guarantee to national energy financing facility • Credit line for rehabilitation of energy infrastructure • Credit line for energy efficiency in industry • Equity share in urban transport fund	• General credit line which is likely to be used by the FI to finance coal fired power plants

5.1.1 State of play in applying climate tools to FI operations

Having been involved in, for example, Green Bonds issuance and green banking reforms MDBs have recognized the large potential of cooperating with FIs in the area of climate finance[18]. Some MDBs explicitly highlight the strategic role of FI finance for their climate finance. The IFC's Definitions and Metrics for Climate-Related Activities (IFC 2017a) state that mitigation activities through financial intermediaries can be considered indirect mitigation in the MDB's reporting. The EBRD mentions enhanced financial intermediation as one of three strategic objectives within the financial sector strategy and recognizes the need to address climate change i.e. through Green Finance as a key activity to reach this objective (EBRD 2016). The IFC also works with banks to help them identify their pipeline of climate projects and also provides a tool that helps banks to tag climate-related investments[19]. It is less evident whether MDBs screen FI operations not originally intended to be climate finance for potential mitigation opportunities.

In principle, appraisal procedures for financial intermediary finance are the same as for direct project finance, though there are usually some standards tailored to the specific nature of financial intermediary operations, most prominently around environmental and social safeguards[20]. The EIB environmental and social handbook specifically includes a section on requirements for intermediaries in applying climate-related standards (EIB 2013a).

Project-level climate tools currently used by MDBs are not consistently used for all FI operations, as their use is not explicitly mandatory for FIs (EIB, n.d.)[21], or they are deemed inapplicable in practice. For example, most MDBs include GHG accounting as a standard requirement in their environmental and social safeguards, but they do not require GHG accounting for FI finance. The uncertainty over end-use of funds and transfer of control to a third party is a common explanation for skipping this criterion[22]. At the same time, MDBs are regularly estimating, up front, emissions savings for FI operations, e.g. when applying for GCF funding. This indicates that the gross GHG of a project could similarly be estimated, although this becomes less accurate the broader the definition of the FI lending purpose[23]. Monitoring of GHG emissions during implementation is also still an exception rather than a rule. As a prerequisite,

[18] For a short assessment see (Wright, Hawkins, et al. 2018)
[19] Information from communication with IFC staff
[20] The IFC Performance Standard's interpretation note for financial intermediaries is an international reference point in this regard. It guides IFC staff as well as the FI on how meet the requirements (IFC 2017b).
[21] The EIB, for instance, when listing its climate criteria states that they are applied to investment projects (only).
[22] CPI (2017): EBRD Implementing the EBRD Green Economy Transition (EBRD, n.d.).
[23] AfDB, EBRD, EIB, IDB, WB have applied for co-financing by the GCF in order to create special financial facilities or funds – financial intermediaries for - lending to specific project types. See, e.g. (GCF, n.d., n.d.).

the FI has to be contractually obliged to report on the financed emissions, which is all too often waived with the argument of a lack of capacity. The EIB, however, encourages project promoters to provide information on expected absolute and relative GHG emissions from the projects they finance (EIB 2013a).

If GHG emissions are not calculated and monitored, there is a risk the potential negative impacts of an FI project on climate change are not thoroughly assessed, especially when the operations are not directly targeted at a climate-relevant sector but instead address capital market failures. If they don't include FI lending, the MDB's gross, portfolio-wide emissions are omitting an important aspect. Some MDBs have already addressed this loophole, such as the EIB, whose climate strategy commits to developing an approach "to provide and approximate assessment of the overall footprint of financially intermediated lending" (EIB 2015).

Table 16: Climate tools used for Paris alignment of FI-lending – State of play and entry points

Tool	State of Play	Entry point to support PA-alignment
Prerequisites		Climate impact assessment by MDB Climate management system in place at FI Build up via TA if non-existent
Positive and negative lists	Exclusion list according to MDBs fossil fuel policy generally not consistently applied to FIs.	Provide science-based positive and negative list (including development in 5-year milestones) for easy use by client Require FI to apply this exclusion list to MDB finance Exclude FIs where, based on current portfolio and investment strategy, a significant part of funds (e.g. more than 5 percent) is expected to be used for investments on the negative list OR: Require FI to apply this exclusion list to entire project pipeline (always in the case of general purpose funding)
GHG accounting	Usually not applied ex-ante because of unknown end-use	Apply based on sector specific emissions factors. If end-use of funds unknown: Apply based on realistic estimation of projects benefitting. Disclose level of uncertainty. Verify that effective GHG accounting in place at FI – have FI report on it Include emissions originating from FI lending in MDB portfolio-wide GHG accounting / reduction targets / and climate impact assessments
Benchmarks & BAT	Only applied in dedicated sectoral climate projects, benchmarks either the same as for MDB direct finance[24] or project-specific	Require FI to consistently apply benchmarks Either MDB's level or FI/country specific. If country-specific: analysis has to be conducted whether in line with PA-aligned pathways

[24] E.g. the EIB requires FIs to apply the same eligibility criteria for renewable energy and energy efficiency as it does for direct investment finance (EIB 2013b).

Shadow carbon price	Not applied	Require FI to consistently apply shadow carbon price. Either MDB's level or FI/country specific. If country-specific: analysis has to be conducted whether in line with PA-aligned pathways
Decarbonization tools (see chapter 4)	Not applied	Require FI to consistently apply decarbonization tool(s). Either MDB's or country/FI specific. If country-specific: analysis has to be conducted whether in line with PA-aligned pathways. Provide TA on pathway modeling OR: provide lists with development (5 year milestones) of aligned / conditional / misaligned categories + decision trees for conditional category for easy use by client

5.1.2 Challenges and Entry Points

Along with the individual tool-specific challenges to ensure Paris alignment as discussed in chapter 3 there is a number of FI-specific challenges hampering the use of climate tools. Some cannot be overcome completely, but there are key entry points to tackle and manage them. Table 15 summarizes the main elements. A more detailed discussion of the challenges and entry points can be found in Annex A.2.

Table 17: Challenges and entry points in applying climate tools to FI lending

<table>
<tr><th>Challenges</th><th>Entry points</th></tr>
<tr><th colspan="2">Instrument and process level</th></tr>
<tr><td>Predictability vs. flexibility:
Narrower eligibility criteria for end-clients = easier to forecast impacts
⇔ Riskier for an FI to commit to a very specific investment purpose

Maintaining delegation benefits:
Attractive due to delegated responsibility for individual investment decisions to FI
⇔ MDB has to ensure that the agreed purpose is met & standards are adhered to</td><td><u>Strengthen climate considerations in preparation phase:</u>
Adapt and apply existing climate tools consistently (see Table 16)
Climate impact assessment: i) Screening for climate impacts and risk categorization, ii) In depth climate impact analysis for high and significant risks, incl. assessment of the client's capacity to identify and manage the risk as well as a gap analysis on national legislation and decarbonization pathway/MDB criteria. Agree on steps to strengthen capacities and close the gaps.

Mitigation potential analysis: screening for (additional) climate mitigation measures
For this purpose, clients should mandatorily provide necessary information

<u>Strengthen climate considerations during implementation:</u>
Accompany client to integrate climate tools (manage technical assistance)
Monitor and evaluate climate reporting/results, e.g. reporting on GHG, review of the top exposures of the FI's portfolio; and expanded supervision to include a sample review of FI sub-clients
Report and disclose climate results</td></tr>
<tr><th colspan="2">Capacities and resources</th></tr>
<tr><td>Scarce time allocation
FI lending thought to be less time intensive than direct project investments</td><td>MDBs need additional financial resources (to be translated in additional time, expertise and funding) to apply climate tools along the project cycle
Strive for harmonization and mutual learning between IFIs inter alia via climate mainstreaming initiative</td></tr>
<tr><td>Lack of financial resources, personnel and technical expertise on client side</td><td>Need for additional TA and grants to support clients in setting up/strengthening climate impact management systems, aligning policies and procedures, monitoring and reporting on impacts.</td></tr>
<tr><th>Country ownership</th><th>Long-term cooperation</th></tr>
<tr><td>Policy coherence vs. scientific decarbonization pathway:
Questionable whether public banks legitimated to go beyond national legislation</td><td>Incentivize ambition raising in prospect of future, long-term cooperation
"Ring-fence" support in the first place (climate tools applied only for MDB project/supported policy) and gradually move to full alignment of overall portfolio i.e. legislative framework
Make use of exit option after one phase if climate results are not achieved</td></tr>
</table>

5.2 Policy-based lending

PBL[25] general budget support funds are used to provide fast assistance in the face of urgent development needs, supporting specific policy and sector reforms by disbursing funds directly into a national budget.

While the principles are the same, implementation differs among banks including in terms of sectors and conditions for disbursement of policy-based loans. Some MDBs tend to use one multi-sectoral PBL while others provide several single sector PBLs per country (IDB 2016). Most PBLs come in the form of standard financial terms or concessional loans, while grants and guarantees are also possible (WBG, n.d.; ADB 2016d; IDB, n.d.).

Policy-based lending is conditional on the implementation of (sectoral) political reform (or multiple reform steps), after which disbursement takes place. While this depends on the implementation of the reform, it is independent of whether the reform achieved its intended result. Reforms may include legislative, organizational as well as investment measures, developed and approved in a detailed dialogue between the MDB and the country.

PBLs include a policy dialogue, technical support for designing and implementing the reform, as well as concessional finance for its broad implementation. They are frequently implemented as joint programs with several donors or banks. PBLs are often used in combination with other instruments such as technical assistance (TA) or investment loans. PBLs mostly have what is termed a programmatic character, meaning several phases are approved individually, allowing the bank to readjust – or exit - its commitment.

The policy matrix contains prior actions, triggers and results. The World Bank defines prior action as "policy and institutional actions deemed critical to achieving the objectives of a program supported by the development policy operation. These present the legal terms defined in the loan agreement that have to be met for each operation before disbursement" (WBG, n.d.).

Due diligence covers the content of the policy reform and the capacity of national structures and appropriateness of procedures to successfully implement the reform (including public financial management and environmental and social safeguards). Progress is then measured and monitored, based on the implementation of the reform and not on individual projects. Individual spending is not reported and documented.

PBLs are most suited for developing countries with an advanced public management system.

The World Bank, IDB, ADB and AfDB engage in PBL, however the level of publicly available information on the their PBL activities varies substantially. While the World Bank has maintained a database of prior actions for all its PBLs since 1980, it is not possible to filter for this type of operation in other banks' public project databases.

PBLs are dominantly applied to support public sector management, but are increasingly becoming popular in fostering sector reforms. For example the ADB has provided half of its PBL between 2011 and 2015 for public sector management, followed by energy with 20% and the financial sector with 17% (ADB 2016a).

PBLs rank very high when it comes to implementing the principles of aid effectiveness (ownership, alignment, harmonization, managing for results, mutual accountability) (OECD, n.d., 2005a, 2005b). They may, however, benefit sectors and activities that are not aligned with the temperature goal of the Paris Agreement. Unintended effects of policy reforms, such as the introduction of new fossil fuel

[25] Also called development policy finance (DPLs)

subsidies and an increase of deforestation risks (Mainhardt 2017) have been reported. A lack of incentives for renewable energy and adequate climate change risk assessment may jeopardize the potential of PBL to create an enabling environment for climate resilient low-carbon pathways.

Table 18: Examples of typical PBL projects categorized according to their Paris alignment

Compatible	Conditional	Misaligned
• PBL for renewable energy reform including e.g. [26] • legal frameworks to accommodate renewable energy sources • grid and operation policies to prioritize the dispatch of renewable energy or other advanced RE promotion policies • effective feed-in tariffs • economic incentives for geothermal exploration	• Private sector development PBL • PBL for PPP-Framework	• PBL for energy policy reform favoring fossil fuels • PBL for PPP-Framework benefitting coal transport railways or coal port terminals

5.2.1 State of play in applying climate tools

Since the modalities for **PBLs** differ substantially from investment finance, banks generally have separate operational policies and sometimes particular environmental and social standards for PBL. The World Bank has explicitly excluded PBLs from its safeguards, and continues to do so in its new environmental and social framework, effective in October 2018 (Bank Information Center and Global Witness 2013). However, the World Bank's policy for PBLs requires - in general terms - assessing a country's policies and institutional framework and capacity to identify risks and respective mitigation measures. Climate change is not specifically mentioned (WBG 2017b). The ADB applies its safeguards to PBLs, specifying that its strategic environmental assessments (SEA) might be useful (ADB 2016c). An SEA is a tool used in development cooperation that assesses potential impacts of a country or sector-wide policy, putting a strong emphasis on stakeholder engagement (WBG 2012). Only the AfDB has a separate section on climate change in its policy on PBLs, requiring an SEA to assess the impact on climate change as well as the country's capacity to mitigate respective impacts. A systematic analysis of the use of climate tools in practice was not possible given the lack of comprehensive data.

[26] Examples from recommendations in (Mainhardt 2017)

Table 19: Climate tools used for Paris alignment of PBL – State of play and entry points

Tool	State of Play	Entry point to support PA-alignment
Prerequisite for comprehensive application of tools below		Have client country report on all measures and incentives included in the reform as well as all projects potentially benefitting Climate impact assessment, e.g. within Strategic Environmental Assessment (SEA) by MDB Overall national climate regulatory framework in place in client country; build up via TA if non-existent
Positive and negative lists	Not applied	Verify that non of the reforms and corresponding measures benefit misaligned sectors Assess also reforms that are not part of PBL, conducted by client country in recent year(s) and/or in targeted sectors Exempt misaligned activities from subsidies or PPPs Prioritize non-emitting options within PBL reforms
GHG accounting	Not consistently applied	Include GHG accounting in climate impact assessment (e.g. in SEA) by MDB based on sectors likely benefitting from the reform Have country do GHG accounting Move from disclosing estimated emissions that will be avoided to accounting for and disclosing gross emissions
Benchmarks & BAT	Might be integrated in an energy, industry or transport sector policy	Integrate country specific Paris-aligned benchmarks into reforms
Shadow carbon price	Not applied	Could be applied by MDB based on GHG assessment resulting from climate impact assessment/SEA. Added value to be assessed on case by case basis.
Decarbonization tools (see chapter 4)	Not applied	Build up capacities to have countries do the modeling for Paris-aligned pathways themselves. Ensure that reform does only support technologies that are aligned according to pathways OR: provide lists of aligned / conditional / misaligned categories (5 year milestones) + decision trees for conditional category for easy use by client

5.2.2 Challenges and Entry Points

A number of challenges arise when trying to apply climate tools ensuring Paris-alignment to PBL. These are summarized together with entry points to address these challenges. For a more detailed discussion see Annex A.3.

Table 20: Challenges and entry points in applying climate tools to Policy Based Lending

Challenges	Entry points
Instruments/Modalities/Tools	
Scope of a policy reform: Direct climate impacts can be clearly identified if the policy reform includes public investment measures ⇔ impact of a policy on numerous private investment decisions more difficult **Maintaining the benefits of policy-based disbursement logic**: Requiring the government to seek approval for individual investments would strongly undermine the principles of aid effectiveness & delegated responsibility	***Strengthen climate considerations in preparation phase:*** Adapt and **apply existing climate tools consistently** (see Table 19) **Climate impact assessment**: i) Screening for climate impacts and risk categorization, ii) In depth climate impact analysis for high and significant risks though mandatory Strategic Environmental Assessment (SEA) assessing indirect impacts such as counteracting existing incentive structures, undermining political signals. Include gap analysis between national legislation and decarbonization pathway/MDB climate criteria. Agree on steps to strengthen capacities and close the gaps. **Mitigation potential analysis:** For PBL in high mitigation relevant sectors (energy, transport, infrastructure), at least one prior action on climate mitigation. For this purpose, **client should report** on all measures and incentives of the reform, on other reforms in the targeted sector as well as all projects potentially benefitting from the reform with potential climate impacts ***Strengthen climate considerations during implementation:*** **Accompany client** to integrate climate tools, such as benchmarks into reforms (manage technical assistance) **Monitor and evaluate** climate impact reporting/results **Report and disclose** climate results
Capacities and resources	
Scarce time allocation Myths: PBL = big and fast **Lack of financial resources, personnel and technical expertise** on client side	MDBs need **additional financial resources** (to be translated in additional time, expertise and funding) to apply climate tools along the project cycle Strive for **harmonization** and mutual learning between IFIs inter alia via climate mainstreaming initiative Need for **additional TA and grants to support clients** in setting up/strengthening climate impact management systems, aligning policies/regulations, monitoring and reporting on impacts
Country ownership	**Long-term cooperation**
Policy coherence: Introducing climate tools in a single area could harm national policy coherence of PBL, if inconsistent with overall national climate regulatory framework	**Incentivize ambition raising** in prospect of future, long-term cooperation “Ring-fence” support in the first place (climate tool applied only for MDB supported policy) and **gradually move to full alignment** of legislative framework Make use of **exit option** after one phase if climate results are not achieved

5.3 Building a Paris-aligned project pipeline

There is an undeniable necessity for a strong, Paris-aligned, pipeline of bankable projects the MDBs or local entities can support. On the one hand, MDBs' portfolios are demand-driven as a matter of country ownership. On the other hand, project pipelines are co-developed in practice. MDBs have the know-how and mandate to take environmental and sustainability concerns into account and may prioritize projects. This policy support or support instruments for project pipeline development, such as project preparation facilities, can play an important role in enabling the emergence of prioritized projects. This section outlines some of the emerging entry points to build a Paris-aligned project pipeline.

5.3.1 Mitigation potential analysis

A mitigation potential analysis provides technology guidance and/or capacity building to reduce a project's carbon footprint. Investigating the feasibility and economic viability of substitutes that are less carbon and/or energy-intensive generates additional climate benefits. While this is not a tool to assess Paris-alignment, it can help align individual projects.

For example, the IDB has developed a screening tool that, early in the project cycle (at the programming stage), identifies whether a project has the potential to incorporate climate change-related elements. Once a project is "flagged" during the scanning exercise, the climate change division contacts the responsible sector and offers both technical or financial support to their specialists to mainstream climate change into the operation. IDB-Invest also holds a monthly business committee meeting to look at leads and transactions in the project pipeline. Its Advisory Service preliminarily identifies potential adaptation or mitigation components so Critical Roles and Division Chiefs can instruct staff to raise the issue with clients – a voluntary action[27]. The EBRD promotes the use of energy audits, which can disclose energy saving potentials. They can also generate economic savings, which makes this tool attractive to the borrower (EBRD 2013).

When used complementarily, mitigation potential analysis can contribute to aligning project proposals with 1.5°C trajectories. For example, if a project proposal does not reach the Paris-informed emissions standard nor proves to be an economically viable solution when applying a Paris-informed carbon price, a mitigation potential analysis can help to discover applicable elements to a project that will make the project compatible with the emissions standard or the shadow carbon price. This could include verifying the feasibility of alternative sources of process energy, use of alternative materials, or applying more energy efficient processes.

When applied together with an emissions standard or a carbon price, this tool will also help reduce portfolio emissions even further, supporting, for example, an ambitious portfolio emissions reduction target. While emissions standards can be connected to <2°C-1.5°C pathways, mitigation potential analysis can reduce emissions even further than the required threshold without significant additional cost.

Conducting a mitigation potential analysis appears to be useful for all MDBs. Energy audits are easy to implement and could be required by more MDBs. Additional tools disclosing the sector-specific mitigation potential of projects would require additional financial resources and expertise. Sharing of approaches, such as those developed by the IDB, can help to limit these costs.

---

[27] Information from communication with IDB and IDB-Invest.

5.3.2 Further entry points

An important incentive for client countries to integrate Paris-alignment considerations into project proposals is when climate related elements can be combined with business opportunities. MDBs have started to emphasize business opportunities in line with NDCs. For example, through the platform NDC Invest the IADB is financing technical and financial studies to facilitate the visualization of the gains of all the stakeholders and of the options of regulatory changes, if needed. As part of the platform, the *NDC Pipeline Accelerator* provides non-reimbursable financial support to carry out pre-feasibility studies of specific NDC-aligned investment projects. *NDC Market Buster* offers additional reimbursable and non-reimbursable resources so that innovative financial instruments and business models can overcome market barriers and other non-financial barriers (IDBG, n.d.). Similar efforts could be undertaken to help client countries understand the business opportunities in Paris-aligned projects.

Because project costs could increase due to consideration of Paris-alignment, the availability of concessional funding from international funds, and leveraging more capital from other financial institutions or from the private sector, are important tools to encourage the client's decision to integrate climate considerations into projects. MDBs can help client governments understand how concrete Paris-aligned projects proposals could help the country access climate funding from MDBs and other multi- and bilateral institutions.

Technical Assistance (TA) can influence country policy and capacity and thereby support the development of a Paris-aligned project pipeline. The ADB operations manual on TA describes several types ranging from identifying, developing and preparing projects over enhancing capacities of executing entities and implementation support, and formulating and coordinating development strategies to undertaking sector, policy or issues-oriented studies for countries, regions or sub-regions (ADB 2016c). As it is the countries seeking assistance or finance for assistance, all of the described assistance activities leave room for Paris-alignment assessments (e.g. energy/emissions modelling, trainings on technology options, financial instruments for renewables) that would benefit both MDB and country aims. By employing agents trained in environmental sciences in the TA departments there would also be less likelihood of negative environmental impacts[28].

Opening up the national strategy engagement process to stakeholders in client countries leads to a greater variety of options and is a potential strategy to open up longstanding institutional structures. While the outcome of such a stakeholder process is open, this is also likely to raise options of enhanced climate commitments and Paris-aligned development pathways. Integrating a bottom-up green country strategy into institutional frameworks could help to mainstream Paris-alignment in the project pipeline development (Green Climate Fund 2014).

Given the high costs of finding and developing bankable sustainable projects, MDBs with overlapping investment regions could profit from banking or pooling project pipelines. Combining efforts would provide two benefits: sharing due-diligence costs and joining MDB forces to attract private finance (Lee 2017). The Global Infrastructure Hub (GIH), a cloud-based sharing facility to provide a global infrastructure project pipeline established exactly for these reasons, could serve as an example for such a combined effort (Global Infrastructure Hub, n.d.).

---

[28] (Nielson, Tierny 2003: S. 264)

All MDBs operate Project Preparation Facilities with similar objectives: to prepare projects that are technically and economically sound and "bankable", and attract private finance by adopting a consistent and high-quality approach to project preparation and transaction advice, especially for public-private partnership (PPP) projects (IDB, n.d.). There is a vast landscape of such facilities, run by MDBs, by countries, localities or regions. Most recently, MDBs have joined efforts with support by the G20 to scale up project preparation for infrastructure projects to close the investment gap, simplify and speed-up preparation processes to leverage private investments (AIIB et al. 2017). Infrastructure Project Preparation Facilities (IPPFs)[29] carry great potential for providing finance for well-prepared, Paris-aligned, bankable projects if they contain appropriate safeguarding measures. Therefore, tools to assess Paris alignment should also be used in Project Preparation Facilities.

There is a considerable need to enhance transparency in the preparation processes. Whether a PPF is involved in project preparation or also responsible for strengthening domestic institutional capacity, Paris-alignment needs to be underlined at every level.

[29] InfraFund (IDB), NEPAD (AfDB), Joint Assistance to Support Projects in European Regions (EIB), Arab Financing Facility Technical Assistance Fund (AFFI-TAF) co-managed (IFC), Infrastructure Project Preparation Facility (EBRD) and Asia Pacific Project Preparation Facility (AP3F, ADB)

6 Transparency

6.1 Improving transparency to improve management of climate-related risks

As public financial institutions, the MDBs have a responsibility to be transparent about where they invest and the impacts of those investments. It is essential that MDBs adhere to high standards of transparency regarding their funding flows, the climate impacts of their activities and the potential risks climate change might pose to their investments. Not only is this an important aspect of basic fiduciary responsibility to shareholders and stakeholders affected by MDB investments, it also allows for more effective management of climate-related risks and opportunities.

Two types of risk need to be understood and managed: climate-related financial risk and finance-related climate risk. On the one hand, climate change and the measures taken by governments to address it might have a direct impact on MDB investments. A mismanagement of these climate-related financial risks could lead to a misallocation of capital and potentially stranded assets. On the other hand, the investments made by MDBs might also have a direct impact on the achievability of climate targets by the global community or host countries.

The tools and approaches discussed in previous chapters can help manage these two types of risk. But adequate climate risk management does not only require employing an appropriate set of tools, it also includes disclosing which risks are addressed, how they are addressed, and the way climate risk management features in an institution's overall strategy and governance. A commitment to disclosure can be a strong driver for an institution to systematically analyze and address risks. Disclosure addresses lack of awareness and information asymmetries within institutions and among shareholders and stakeholders. This makes it more likely that the relevant information will be available to those responsible to consider when making decisions.

6.2 Status quo

6.2.1 "Joint Methodology for Tracking Climate Finance"

The MDBs have been jointly reporting on climate finance since 2012. Reporting of mitigation finance is based on the *Common Principles for Climate Change Mitigation Finance Tracking* developed by the MDBs and the International Development Finance Club, and includes nine core elements (IDFCs and MDBs 2015):

1. *Additionality*. The tracking is activity-based and is not focused on the project's purpose or results, nor the origin of the financial resources (i.e. MDBs' own resources or external resources from dedicated climate finance facilities).
2. *Timeline*. Project reporting is at the time of board approval or commitment.
3. *Conservativeness*. Climate finance should be under-reported rather than over-reported.
4. *Granularity.* The tracking of mitigation activities should be disaggregated from non-mitigation activities within a project.
5. *Scope.* Mitigation activities or projects can exist at multiple scales: standalone projects, multiple standalone projects under a larger program, a component of a standalone project, or a program financed through a financial intermediary.
6. *Results.* Reporting on mitigation finance of a project or activity does not imply evidence of climate change mitigation impacts.

7. *Eligibility.* Not all activities that reduce GHGs in the short term are eligible to be counted towards MDB mitigation finance.
8. *Exclusions.* Activities should be excluded even if they are on the positive list of qualified activities if unique attributes cause them to not be supportive of climate-related efforts. Examples include hydropower or geothermal plants that release high levels of GHG emissions.
9. *Avoiding double counting.* Reporting should not account for the same funding as both mitigation and adaptation finance.

While eligibility for mitigation finance is dependent simply on whether the activity falls under a positive set of mitigation activities, qualification for adaptation finance is based on an assessment process, taking into account the climate change vulnerability context and the specific project intent to reduce climate vulnerabilities.

The strengths of the MDB mitigation finance tracking approach are the use of harmonized terms and standardized mitigation categories, as well as counting climate-relevant components or subcomponents only (Weikmans and Roberts 2017). One can also argue that the common reporting has helped to catalyze climate ambition, as the very existence of a methodology has incentivized MDBs to scale up finance. From 2016 to 2017, the MDBs' climate finance increased from $27.4 billion to 35.2 billion (AfDB et al. 2018).

Nevertheless, there is still potential for improvement of the MDB mitigation finance tracking. So far, the joint reporting has not consistently included project-level data. Four of the MDBs currently report such data, to varying degrees. The ADB discloses the amount of mitigation and adaptation finance that can be attributed to any project ("Climate Change Financing 2017" 2018).The World Bank has begun to list climate finance projects, but does not provide information on what proportion of finance is counted towards climate finance ("Climate Finance" 2018). In its 2017 Sustainability Report (as part of its annual reporting process), the EBRD disclosed project-level data on climate finance or GET finance ("EBRD Sustainability Report 2017" 2018). However, it is not explicitly stated whether these projects received mitigation or adaptation finance (or both). The EIB and EBRD, as European Union institutions, report project-level data to the OECD DAC database. Reported projects are not consistently marked for adaptation or mitigation finance and, even if they are, it is not currently clear how the OECD Rio marker system does - or does not - overlap with the MDB-IDFC Joint methodology.

More fundamentally, the Common Principles for Climate Mitigation Finance Tracking were developed in 2012 and are not explicitly aligned with the Paris Agreement. While the methodology excludes certain activities, others that reduce GHG gases are counted towards mitigation finance, regardless of whether they are informed by Paris-compatible pathways.

6.2.2 MDB reporting on their total portfolio

While the MDBs have all made climate finance commitments for 2020 (Figure 8), and have scaled up their climate finance since 2011, climate finance is only one part of the equation when thinking about the Paris-alignment of the MDBs. Climate finance targets do not paint a complete picture without the consideration of the MDBs' other finance, including finance for activities that could counteract climate change mitigation or adaptation efforts.

MDB	Targets announced
ADB	Doubling climate finance to USD 6 billion annually by 2020 (own resources only), of which USD 4 billion is for mitigation and USD 2 billion is for adaptation
AfDB	Triple climate financing to reach 40 percent of investments by 2020
EBRD	40 percent of EBRD annual business investment by 2020 in green finance[a]
EIB	Global target of greater than 25 percent of all lending. Increased target of 35 percent of lending in developing countries by 2020.
IDBG	Goal to double climate finance to 30 percent of operational approvals by 2020 to an average USD 4 billion per annum, and to improve evaluation of climate risks and identify opportunities for resilience and adaptation measures.
WBG	A one-third increase in climate financing, from 21 percent to 28 percent of annual commitments by 2020. If current financing levels are maintained, this would mean an increase to USD 16 billion in 2020. The WBG intends to continue current levels of leveraging co-financing for climate-related projects, that could mean up to another USD 13 billion a year in 2020. The direct financing and leveraged co-financing together represent potentially an estimated USD 29 billion in 2020.

Figure 9:. MDB 2020 commitments for climate finance action (AfDB et al. 2017)

It has therefore been suggested to also consider MDBs' net climate finance, defined as the value of climate finance flows minus financial flows to high-emissions and maladaptive activities (Bodnar et al. 2017), or the ratio of energy-related climate finance to fossil fuel finance (Wright, Hawkins, et al. 2018).

In order to enable such assessments of progress in the overall alignment of the portfolio, it would be beneficial for MDBs to harmonize the way they disclose information on the composition of their total portfolio. All the MDBs considered in this paper publicly disclose approved projects, although the level of project detail varies somewhat. Unlike with climate finance, the MDBs do not have a joint methodology for reporting investments that are not specifically tagged as climate finance. As a result, comparing investment levels in different sectors can be difficult.

6.2.3 Accounting and reporting of projects' climate-related performance

Climate finance reporting covers the financial inputs, not the outcomes or impacts. In order to enable a comprehensive understanding of the climate impact of MDB investments, accounting and reporting of emissions needs to be improved. As discussed in section 3.1.2, MDBs should account their gross emissions across their entire portfolio, covering Scopes 1 and 2 as well as Scope 3 where significant. These emissions should also be reported publicly.

However, disclosure of current and past emissions alone is generally not sufficient for risk management, since it is a backward-looking metric, focused on the current portfolio, resulting from past investment decisions. It needs to be supplemented by forward-looking reporting on the steps taken to decarbonize investment project pipelines. Setting and disclosing science-based emissions targets (see section 3.2) would be an important first step. Going further, MDBs could adopt a comprehensive, forward-looking framework, as outlined in the next section. Climate finance and emissions reporting would both feed into this framework.

6.3 Comprehensive reporting framework for climate-related financial risks and finance-related climate risks

6.3.1 Reporting on climate-related financial risk, based on TCFD recommendations

An important step towards the comprehensive integration of climate aspects in investment decisions is comprehensive, forward-looking climate risk and opportunities disclosures and management, as laid out in the Task Force for Climate-related Financial Disclosure (TCFD, see Box 6) recommendations. This section will therefore consider how the TCFD recommendations might be relevant for the MDBs, particularly regarding disclosure of risks arising from the global transition to a low-carbon economy and forward-looking disclosure of transition strategies.

The TCFD divided climate-related risks into two major categories: transition risk (the financial risks which could result from the process of adjustment towards a lower-carbon economy, i.e. policy risks, legal risks, technology risks, market risks, and reputational risks) and physical risk (the impact on insurance liabilities and the value of financial assets that may arise from climate and weather-related events, differentiated by acute risks and chronic risks) (Financial Stability Board 2015). In this working paper, we focus on transition risks, while physical risks will be addressed in other components of the overall research project and the final report.

The TCFD recommendations on the disclosure of portfolio risks introduce a new global emphasis on reporting not only positive investments in climate-related activities, but also the risks that investments face from the changing climate, informed by forward-looking climate-related scenarios. In March 2018, the EBRD became the first MDB to commit to the TCFD recommendations and has agreed to launch climate-related financial disclosure during 2018 (see Box 7).

The TCFD recommendations promote a very important paradigm shift: from GHG accounting and disclosure to forward-looking assessments of how future physical and transition risks and opportunities might impact actors' financial and business performance.

Box 6: The Task Force on Climate-related Financial Disclosures (TCFD)

Climate-related financial risks are currently under-reported. To address this gap, G20 finance ministers and central bank governors called upon the Financial Stability Board (FSB) and its chair Mark Carney, the Governor of the Bank of England, to develop guidelines for the disclosure of climate-related risks. Consequently, the FSB created an industry-led task force, the "Task Force on Climate-related Financial Disclosures" (TCFD), in early 2016 to develop recommendations on climate-related disclosures that could promote more informed investment, credit, and insurance underwriting decisions. The aim was to help identify the information needed by stakeholders to appropriately assess climate-related risks and opportunities.

Chaired by Michael R. Bloomberg, the TCFD's 32 members combine the expertise of users and preparers of disclosures. In developing its final report (published in June 2017, (TCFD 2017b)), the TCFD also drew extensively on external resources (e.g. through public consultations). As of August 2018, more than 300 organisations (from Allianz SE and KPMG International to PwC and the UK Government) have expressed their support for the resulting recommendations (TCFD 2018).

The recommendations form a 'voluntary and consistent' disclosure framework that comprises four key dimensions: governance, strategy, risk management, and metrics and targets. The framework is supposed to be implemented by all organizations with public debt, and also by asset managers and asset owners. The framework provides supplemental guidance for the financial sector and for those non-financial sectors likely to be especially affected by climate change.

As these suggestions are meant to complement existing national disclosure practices, the TCFD recommends disclosing climate-related risks in organizations' mandatory annual filings.

The TCFD aims for a widespread use of its proposals. To this end, the TCFD knowledge hub was recently launched (TCFD, n.d.). This hub serves as a platform to share knowledge, best practice, and experiences with regards to the TCFD recommendations, and aims to help organizations to make use of the recommendations in the first place.

Core Elements of Recommended Climate-Related Financial Disclosures

Governance
The organization's governance around climate-related risks and opportunities

Strategy
The actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning

Risk Management
The processes used by the organization to identify, assess, and manage climate-related risks

Metrics and Targets
The metrics and targets used to assess and manage relevant climate-related risks and opportunities

Box 7: The EBRD's commitment to TCFD-compliant disclosure

In March 2018, the EBRD announced its support of the TCFD recommendations and that it would start climate-related financial disclosure in 2018 (EBRD 2018b). This is a very important first step, showing that not only are private sector actors moving ahead, but that MDBs are also beginning to apply TCFD recommendations.

To date, the EBRD seems to be focusing on disclosure of climate-related finance (e.g. its portfolio's share of renewable energy assets), and also on the physical risks climate change poses for assets.

With regards to climate-related physical risks, the EBRD already engages in the development of common metrics for disclosing the physical risks and opportunities of climate change. To this end, the EBRD has hosted industry-led working groups (with representatives from Allianz, Bloomberg, Moody's, Shell, Siemens, and the OECD, among others) since late 2017. Recently, it organized a conference collecting their insights (31 May 2018), which resulted in recommendations on physical climate impacts in financial reporting (EBRD 2018b, 2018a).

The EBRD also seeks to support corporations and partner financial institutions in adopting the TCFD guidelines.

Building on these initiatives, the EBRD should broaden its focus to disclose all of the most important information for risk assessment, i.e. expanding its disclosure provision to cover carbon-related, Paris-aligned investments and transition risks. Taking the next step, the EBRD should advance comprehensive disclosure, as spelled out by the TCFD or, ideally, the present working paper's TCFD+ framework (see below).

6.3.2 Reporting on finance-related climate risk

MDBs are not only financial institutions, they are also public institutions, set up to further global policy goals. While the TCFD recommendations focus on material financial risks posed by climate change for a given institution and its investments, MDBs can also be expected to report on the risks their investments might pose for the achievability of global or client-country climate objectives. Disclosure of finance-related climate risk and the forward-looking strategies to minimize such risk or, put differently, reporting on the efforts towards Paris-alignment, is necessary. Most MDBs have published climate change strategies, which increasingly include commitments to overall portfolio alignment, investment and/or investment targets and similar elements. These strategies could be the first steps towards comprehensive reporting on Paris-alignment.

MDBs should increase transparency on the impacts their investments might have on the achievability of global and national climate targets and the steps they are taking to minimize these risks. This includes transparency on:

- The definition of Paris-alignment used by the MDB and the underlying climate scenarios informing this definition;
- Risks assessments regarding the impact that an MDB's investments and other activities have on global, and, where applicable, recipient countries' climate targets, Informed by scenario analysis;
- Overall and sector-specific strategies to align with the Paris goals, including the extent to which different climate tools (see Chapter 3.4) are used by the MDB to manage climate risks and promote alignment;

- Support to develop enhanced, Paris-aligned NDCs and long-term low greenhouse gas development strategies to create reliable investment frameworks (which, in turn, would reduce transition risks for investments in the respective country);
- Aligning MDBs' respective country strategies with client countries' NDCs and long-term strategies.

Some of this reporting would be similar and potentially overlapping with the disclosures recommended by the TCFD, for example information on the scenarios - and aspects of a climate strategy are likely to be similar. It may therefore be most efficient to simultaneously report on both climate-related financial risk, and efforts to align with the Paris agreement.

6.3.3 The TCFD+ guidelines for MDBs

In line with the considerations outlined above, in this working paper, we have developed a TCFD-based disclosure concept that takes both climate-related financial risks and finance-related climate risks into consideration. This concept will be referred to as "TCFD+ concept".

The specific TCFD+ guidelines for MDBs are found in the Annex A.3. These new guidelines build explicitly on the TCFD guidance for implementing the recommendations (TCFD 2017a). We have copied sections that were directly applicable directly into these TCFD+ guidelines. For some sections, we have undertaken minor amendments or added MDB-specific guidance. However, in total, these TCFD+ guidelines are very much in line with the overall TCFD-guidance and therefore other market actors would easily understand them.

Applying the TCFD+ guidelines could significantly enhance MDBs' decision-making and accountability. In the TCFD+ guidelines we have added the following dimensions to the TCFD recommendations:

- Transparency on risk assessments regarding the impact of MDB activities on global, and – where applicable – recipient countries' climate targets;
- Transparency on risk mitigation strategies related to MDB support activities for the development of enhanced Paris-aligned NDCs;
- More comprehensive consideration of financial intermediaries (the TCFD's specific guidance for banks already considers financial intermediaries to some extent);
- Transparency recommendations targeted to portfolio-wide and/or project-related aspects, with reference to investment strategies and project assessment cycles.

6.3.4 Encouraging comprehensive disclosure in partner institutions

It would also be in the interest of MDBs to request their partners to apply the TCFD recommendations or, ideally, the enhanced, TCFD+ guidelines as outlined in the Annex. This holds especially for financial intermediary lending. Investments in the financial sector constitute an important share of overall MDB investments. In order to invest wisely, MDBs need to know whether their financial partners adequately address financial climate risks and opportunities. Physical, transition and liability risks affect the probability of default of final borrowers and, thus, potentially also of financial intermediaries. To make an unbiased investment decision, these risks need to be taken into account in the MDBs' project approval decision as well as for the risk premium applied.

6.3.5 Recommendations

It is key that MDBs move towards comprehensive, Paris-aligned and forward-looking climate-related disclosures with regards to all their investments. This can build on existing climate finance reporting and greenhouse gas emissions accounting.

Effective disclosure principles require information to be accurate, up to date and comparable across actors. The TCFD+ framework provides a structure and guidance for climate-related disclosures. Building on the industry-led TCFD recommendations, applying the TCFD+ framework would ensure that disclosed information is not only understood by governments and stakeholders, but is also compatible, useful and replicable with regards to further financial market initiatives and recent developments.

Disclosed information needs to be up to date and readily-available. As recommended by the TCFD, it should feature in annual financial filings. MDBs should also set up a joint database that contains all information, readily available for stakeholders and the interested public (Nettersheim and Köhler 2018). They should update this information annually at the very least, and should provide information in a disaggregated manner, comparable across MDBs.

7 Conclusion: Guiding Principles for Aligning MDB Investments with the Paris Temperature Goal

MDBs already use a number of tools and approaches to assess climate mitigation-related aspects of their investments, and they are developing them further. This working paper has identified opportunities to refine and expand these tools, so they can support alignment with the Paris temperature goal. The following guiding principles can guide the MDBs' approach to the topic:

1) Under the Paris Agreement, governments committed to pursue efforts to limit global temperature increase to 1.5°C. "Pursuing efforts" should be understood as including an obligation for governments to deploy the public money channeled through banks with a policy mandate, such as MDBs, in a way that is consistent with the 1.5° goal. Paris-alignment of MDB investments should therefore ensure compatibility of all investments with 1.5°C scenarios.
2) Paris-alignment should guide all MDB operations, including direct project investment lending, investments through financial intermediaries, policy-based lending and technical. As such, Paris-alignment concerns all investments (including in greenhouse gas-emitting technologies), not only "climate finance".
3) Alignment of investments with the Paris temperature goal should be guided by the best available science, in particular pathways that show how greenhouse gas concentrations in the atmosphere can be limited to levels compatible with that goal.
4) Paris-alignment needs to take a long-term perspective informed by scenarios compatible with the Paris temperature goal. Compatibility with national plans, such as the NDCs, is a necessary - but not a sufficient - condition for alignment.
5) According to Paris-compatible scenarios, CO_2 emissions need to reach net zero around 2050. Therefore, all MDB investments in energy supply and demand sectors, as well as in industry, need to support carbon neutrality by 2050.
6) Some investment areas are unambiguously misaligned with the Paris Agreement and all MDBs should exclude them.
7) Some investment areas are unambiguously aligned with the Paris Agreement and should be prioritized through the use of positive lists and setting of investment targets.
8) Classification of investment areas as "aligned" and "misaligned" should become a recurrent exercise. Where possible, classification should also indicate from today at which point in the future an investment area might move from the "conditional" to the "misaligned" category.
9) Investment areas that are neither unambiguously aligned nor misaligned should be considered "conditionally aligned" and need to be assessed through the use of decision-making tools that are informed by the best available science and country decarbonization pathways.
10) Greenhouse gas accounting for all relevant investments is a necessary prerequisite for assessing Paris-alignment. MDBs should conduct GHG accounting for projects in all sectors, covering Scopes 1, 2 and 3, where relevant, and disclose this information.
11) Where a shadow carbon price is used, it needs to reflect levels compatible with the Paris temperature goal.
12) Portfolio-wide targets of gross emissions should be introduced to monitor the desired development of a bank's entire portfolio.
13) MDBs should increase their efforts to build a project pipeline of Paris-aligned projects, through dedicated technical assistance and project preparation support, the country strategy process and internal incentives.
14) Shareholders and stakeholders should be able to assess to what extent MDBs are making progress in aligning their investments with the Paris temperature goal. Transparency on the current status of alignment and forward-looking disclosure of climate-related risks and opportunities should be introduced.

References

ADB. 2009a. “Energy Policy.”

———. 2009b. “Safeguard Policy Statement. June 2009.”

———. 2010. “Reducing Carbon Emissions for Transport Projects”

———. 2016a. “Enhancing Flexibility of Policy-Based Lending Operations.”

———. 2016b. “Guidelines for Estimating Greenhouse Gas Emissions of Asian Development Bank Projects: Additional Guidance for Transport Projects,” 28.

———. 2016c. “Operational Manual.”

———. 2016d. “Operations Manual: Bank Policies.”

———. 2017a. “Climate Change Operational Framework 2017 – 2030”

———. 2017b. “Guidelines for Estimating Greenhouse Gas Emissions of Asian Development Bank Projects: Additional Guidance for Clean Energy Projects.”

———. 2017c. “Guidelines for the Economic Analysis of Projects.”

———. 2018. “Climate Change Financing 2017.” 2018.

AfDB. 2012. “Energy Sector Policy of the AfDB Group.”

———. 2016. “The African Development Bank Group's second climate change action plan (2016-2020).”

AfDB, ADB, EBRD, EIB, IDB, IsDB, and WBG. 2018. “Joint Report on Multilateral Development Banks’ Climate Finance.”

AfDB, ADB, EBRD, EIB, IDB, and WBG. 2015. “Joint Statement by the Multilateral Development Banks at Paris, COP21. Delivering Climate Change Action at Scale: Our Commitment to Implementation.”

———. 2017. “Joint Report on Multilateral Development Banks’ Climate Finance (2016).”

Agora Verkehrswende. 2017. “Transforming Transport to Ensure Tomorrow’s Mobility 12 Insights into the Verkehrswende.”

AIIB. 2016. “Environmental and Social Framework.”

———. 2018. “Energy Sector Strategy: Sustainable Energy for Asia. 15 June 2017, Amended 11 April 2018.”

AIIB, AfDB, ADB, EBRD, EIB, IADB, IsDB, NDB, and WBG. 2017. “Joint MDB Statement of Ambitions for Crowding in Private Finance.”

Anex, Robert, and Reid Lifset. 2014. “Life Cycle Assessment.” Journal of Industrial Ecology 18 (3). Wiley/Blackwell (10.1111): 321–23. doi:10.1111/jiec.12157.

Assessing Measures of Energy Efficiency Performance and Their Application in Industry. 2009. OECD.

Baerwaeld, JE (Institute of Traffic Engineers). 1976. Traffic Engineering Handbook. Prentice Hall Inc.

Bank Information Center, and Global Witness. 2013. “World Bank Safeguards & Development Policy Lending: A Primer on Why DPLs Should Be Part of the Safeguard Review.”

Bathiany, Sebastian, Vasilis Dakos, Marten Scheffer, and Timothy M. Lenton. 2018. “Climate Models Predict Increasing Temperature Variability in Poor Countries.” Science Advances 4 (5). doi:10.1126/sciadv.aar5809.

Bingler, Julia Anna, Gerrit Hansen, Victoria von Rosenberg, and Lutz Weischer. 2017. “Greening Investments: Make Multilateral Development Banks Work for the Paris Agreement.” Germanwatch.

Blanco, Herib, and André Faaij. 2018. “A Review at the Role of Storage in Energy Systems with a Focus on Power to Gas and Long-Term Storage.” Renewable and Sustainable Energy Reviews 81 (August 2017). Elsevier Ltd: 1049–86. doi:10.1016/j.rser.2017.07.062.

Bloomberg NEF. 2018. “Electric Vehicle Outlook 2018.” https://about.bnef.com/electric-vehicle-outlook/.

BNEF. 2017. “New Energy Outlook 2017. Executive Summary.” https://www.actu-environnement.com/media/pdf/news-29215-ENR-outlook-bloomberg.pdf.

———. 2018a. “Global LNG Outlook 2018 | Bloomberg New Energy Finance | Bloomberg Finance LP.” https://about.bnef.com/lng-outlook/.

———. 2018b. “New Energy Outlook 2018.” Bloomberg NEF.

Bodnar, Paul, Carloine Ott, Joe Thwaites, Laetitia de Marez, and Blanka Kretschmer. 2017. “Net Climate Finance: Reconciling the Clean and Dirty Sides of the Financial Ledger.” Rocky Mountain Institute.

Boettcher, Miranda, Stefan Schäfer, Matthias Honegger, Sean Low, and Mark G. Lawrence. 2017. “Carbon Dioxide Removal.” IASS Fact Sheet October 2017 1. doi:10.2312/iass.2017.017.

Carbon Tracker, and UN PRI. 2017. “2 Degrees of Separation: Transition Risk for Oil and Gas in a Low Carbon World.” Carbon Tracker. http://2degreeseparation.com/.

Cervero, Robert, and Jin Murakami. 2010. “Effects of Built Environments on Vehicle Miles Traveled: Evidence from 370 US Urbanized Areas.” Environment and Planning A 42 (2). SAGE PublicationsSage UK: London, England: 400–418. doi:10.1068/a4236.

Chapman, Lee. 2006. “Transport and Climate Change: A Review.” Journal of Transport Geography 15: 354–67. doi:10.1016/j.jtrangeo.2006.11.008.

Climate Action Tracker. 2018a. “Highway to Paris: Safeguarding the Climate by Decarbonising Freight Transport.” In CAT Decarbonisation Series. https://climateactiontracker.org/documents/353/CAT_20180522_DecarbSeries_FreightTransport.pdf.

———. 2018b. “What’s on the Table? Mitigating Agricultural Emissions While Achieving Food Security.” Climate Action Tracker (Climate Analytics, Ecofys, NewClimate Institute).

Climate Action Tracker - Country Assessments. 2018.

Climate Investment Fund, 2016. “Greenhouse Gas Analysis and Harmonization of Methodology.” CTF/TFC.18/Inf.4/ November 23, 2016

———. 2017. “Greenhouse Gas Analysis and Harmonization of Methodology.” CTF/TFC.18/Inf.4/Rev.1 April 10, 2017.

Cohen, Simon, Zoi Christoforou, and Régine Seidowsky. 2014. “Assessing the Impact of Speed Limit Changes on Urban Motorways: A Simulation Study in Lille, France.” doi:10.1016/j.trpro.2014.10.071.

Coplon-Newfield, Gina, and Alexandra Dobell. 2017. “Lyft Will Provide 1 Billion Automated Electric Car Rides Per Year By 2025 - VICE Impact.” Vice Impact.

Cozzi, Laura, Timur Gül, and Andrew Prag. 2017. “Commentary: A New Approach to Energy and Sustainable Development - the Sustainable Development Scenario.” Iea.Org.

Cronin, Casey, Surabi Menon, Seth Monteith, Dan Plechaty, Markus Hagemann, Niklas Höhne, Sebastian Sterl, et al. 2015. “Faster and Cleaner - Decarbonisation in the Power and Transport Sectors Is Surpassing Predictions and Offering Hope for Limiting Warming to 2°C.” San Francisco, USA. https://newclimateinstitute.files.wordpress.com/2015/12/faster-cleaner-decarbonization-in-the-power-transport-sectors.pdf.

Cuéllar-Franca, Rosa M., and Adisa Azapagic. 2015. “Carbon Capture, Storage and Utilisation Technologies: A Critical Analysis and Comparison of Their Life Cycle Environmental Impacts.” Journal of CO2 Utilization 9 (March). Elsevier: 82–102. doi:10.1016/J.JCOU.2014.12.001.

Darby, Megan. 2017. “Port of Amsterdam Set to Be Coal-Free by 2030.” Climate HOme.

Dodds, Paul E., and Will McDowall. 2013. “The Future of the UK Gas Network.” Energy Policy 60 (September). Elsevier: 305–16. doi:10.1016/J.ENPOL.2013.05.030.

EASAC. 2018. “Science Advice for the Benefit of Europe Negative Emission Technologies: What Role in Meeting Paris Agreement Targets?” https://easac.eu/fileadmin/PDF_s/reports_statements/Negative_Carbon/EASAC_Report_on_Negative_Emission_Technologies.pdf.

EBRD. n.d. “EBRD Green Economy Transition Knowledge Hub.”

———. n.d. “EBRD Protocol for Assessment of Greenhouse Gas Emissions.”

———. n.d. “Environmental and Social Risk Management Manual.”

———. 2013. “Energy Sector Strategy.”

———. 2014. “Methodology for the assessment of coal fired generation projects 25 September 2014.”

———. 2016. “Financial Sector Strategy 2016-2020.”

———. 2017. “EBRD Sustainability Report 2017.”

———. 2018a. “Advancing TCFD Guidance on Physical Climate Risks and Opportunities. Report Prepared by Four Twenty Seven and Acclimatise for the European Bank for Reconstruction and Development (EBRD) as a Contribution to Collaboration between the EBRD and the Global Ce.” https://www.physicalclimaterisk.com.

———. 2018b. “EBRD, GCECA Publish Recommendations on Physical Climate Impacts in Financial Reporting. Press Release by Svitlana Pyrkalo.” https://www.ebrd.com/cs/Satellite?c=Content&cid=1395274521158&d=Mobile&pagename=EBRD%2FContent%2FContentLayout;).

Edenhofer, O., R. Pichs Madruga, and Y. Sokona. 2012. Renewable Energy Sources and Climate Change Mitigation (Special Report of the Intergovernmental Panel on Climate Change). Clim. Policy. Vol. 6. doi:10.5860/CHOICE.49-6309.

EIB. n.d. “Continued Mainstreaming: Climate Action and Our Investment Projects.”

———. n.d. “European Investment Bank: Energy Lending Criteria.”

———. 2013a. “Environmental and Social Handbook.”

———. 2013b. “Environmental and Social Handbook.” http://www.eib.org/attachments/strategies/environmental_and_social_practices_handbook_en.pdf.

———. 2013c. “The Economic Appraisal of Investment Projects at the EIB,” 224.

———. 2014. “Methodologies for the Assessment of Project GHG Emissions and Emission Variations.”

———. 2015. “EIB Climate Strategy: Mobilising Finance for the Transition to a Low-Carbon and Climate-Resilient Economy.”

Eklof, J. 2011. “Success Story or Cautionary Tale? Swedish Ethanol in Co-Existing Science-Policy Frameworks.” Science and Public Policy 38 (10). Oxford University Press: 795–806. doi:10.1093/spp/38.10.795.

“Environmental and Social Framework.” 2016.

European Commission. n.d. “Climate Change and Major Projects.”

European Environment Agency. 2011. “Do Lower Speed Limits on Motorways Reduce Fuel Consumption and Pollutant Emissions? — European Environment Agency.” Copenhagen: European Environment Agency. https://www.eea.europa.eu/themes/transport/speed-limits.

European Parliament and Council. 2010. 2010/31/EU.

———. European Parliament and Council. 2018. Vol. (EU) 2018/.

Ewing, Jackson J. 2011. “Cancun and Climate Security: New Approaches, Mixed Results.” NTS Alert. http://www.rsis.edu.sg/nts/HTML-Newsletter/Alert/pdf/NTS_Alert_jan_1101.pdf.

FHA, US Department of Transportation. 1968. National Highway Functional Classification Study Manual. U.S. National Government Printing Office.

“Financing for Aviation Infrastructure.” 2016. Financing for Aviation Infrastructure, Issue Brief Series, .

Fricko, Oliver, Simon C Parkinson, Nils Johnson, Manfred Strubegger, Michelle TH van Vliet, and Keywan Riahi. 2016. “Energy Sector Water Use Implications of a 2 °C Climate Policy.” Environmental Research Letters 11 (3): 034011. doi:10.1088/1748-9326/11/3/034011.

Fridriksson, Thráinn, Almudena Mateos, Pierre Audinet, and Yasemin Orucu. 2016. “Greenhouse Gases From Geothermal Power Production.” http://documents.worldbank.org/curated/en/550871468184785413/pdf/106570-ESM-P130625-PUBLIC.pdf.

Fridriksson, Thráinn, Almudena Mateos Merino, A Yasemin Orucu, and Pierre Audinet. 2017. “Greenhouse Gas Emissions from Geothermal Power Production.” In PROCEEDINGS Geothermal Reservoir Engineering, 1–12. https://pangea.stanford.edu/ERE/db/GeoConf/papers/SGW/2017/Fridriksson.pdf.

Fuss, Sabine, William F Lamb, Max W Callaghan, Jérôme Hilaire, Felix Creutzig, Thorben Amann, Tim Beringer, et al. 2018. “Negative Emissions—Part 2: Costs, Potentials and Side Effects.” Environmental Research Letters 13 (6): 063002. doi:10.1088/1748-9326/aabf9f.

Fyhri, Aslak, and Nils Fearnley. 2015. “Effects of E-Bikes on Bicycle Use and Mode Share.” Transportation Research Part D: Transport and Environment 36 (May). Pergamon: 45–52. doi:10.1016/J.TRD.2015.02.005.

Gaventa, Jonathan, M A N O N Dufour, and Luca Bergamaschi. 2016. "More Security , Lower Cost a Smarter Approach To Gas Infrastructure in Europe," no. March: 1–32.

GCF. n.d. "FP006 Energy Efficiency Green Bonds in Latin America and the Caribbean - Project." Green Climate Fund. https://www.greenclimate.fund/-/energy-efficiency-green-bonds-in-latin-america-and-the-caribbean.

———. n.d. "FP025 GCF-EBRD Sustainable Energy Financing Facilities - Project." Green Climate Fund. https://www.greenclimate.fund/-/gcf-ebrd-sustainable-energy-financing-facilities.

GFEI. 2018. "Ukraine Exempts EVs from VAT."

Global Infrastructure Hub. n.d. "Global Infrastructure Hub."

Goodwin, Phil, and Kurt Van Dender. 2013. "'Peak Car' — Themes and Issues." Transport Reviews 33 (3). Routledge: 243–54. doi:10.1080/01441647.2013.804133.

Gota, Sudhir, Cornie Huizenga, and Karl Peet. 2016. "Implications of 2DS and 1.5DS for Land Transport Carbon Emissions in 2050." Paris Process on Mobility and Climate. http://www.ppmc-transport.org/wp-content/uploads/2016/11/SLoCaT-1.5DS-2050-Report-2016-11-07.pdf.

Green Climate Fund. 2014. "Decisions of the Board – Eighth Meeting of the Board, 14 - 17 October 2014. GCF/B.08/45. Annex XIV."

Greenhouse Gas Protocol, World Resources Institute, and wbcsd. 2011. "Corporate Value Chain (Scope 3) Accounting and Reporting Standard: Supplement to the GHG Protocol Corporate Accounting and Reporting Standard."

"Guidelines for Estimating Greenhouse Gas Emissions of Asian Development Bank Projects: Additional Guidance for Clean Energy Projects." 2009.

Guidelines for the Economic Analysis of Projects. 2017. Mandaluyong City, Metro Manila, Philippines: Asian Development Bank.

Haas, Peter, Gajus Miknaitis, Harley Cooper, Linda Young, and Albert Benedict. 2010. "Transit Oriented Development and The Potential for VMT-Related Greenhouse Gas Emissions Growth Reduction By Center for Neighborhood Technology." Center for Transit Oriented Development. http://www.climatechange.ca.gov/inventory/index.html.

Hall, Dale, and Nic Lutsey. 2018. "Effects of Battery Manufacturing on Electric Vehicle Life-Cycle Greenhouse Gas Emissions," 12.

Handl, Gunther. 1998. "The Legal Mandate of Multilateral Development Banks as Agents for Change Toward Sustainable Development." The American Journal of International Law 92 (4): 642–65. doi:10.2307/2998127.

Handy, Susan L, Marlon G Boarnet, Reid Ewing, and Richard E Killingsworth. 2002. "How the Built Environment Affects Physical Activity: Views from Urban Planning." American Journal of Preventive Medicine 23 (2). Elsevier: 64–73. doi:10.1016/S0749-3797(02)00475-0.

Hansen, Gerrit, Jörg Haas, and Peter Erickson. 2017. "Aligning Infrastructure Investments with the Long-Term Climate Goals – The Case for a Transition Test."

Harper, Anna B., Tom Powell, Peter M. Cox, Joanna House, Chris Huntingford, Timothy M. Lenton, Stephen Sitch, et al. 2018. "Land-Use Emissions Play a Critical Role in Land-Based Mitigation for Paris Climate Targets." Nature Communications 9 (1). doi:10.1038/s41467-018-05340-z.

Hawkins, Andrew. 2018. “Uber Will Start Paying Some Drivers to Switch to Electric Cars - The Verge.” The Verge.

Headicar, Peter. 2013. “The Changing Spatial Distribution of the Population in England: Its Nature and Significance for ‘Peak Car.’” Transport Reviews 33 (3). Routledge : 310–24. doi:10.1080/01441647.2013.802751.

Hellenic Shipping News Worldwide. 2017. “Ship Financing Drops by $42.5 Billion as Traditional Bankers Exit the Market |.” Hellenic Shipping News Worldwide, October 7. https://www.hellenicshippingnews.com/ship-financing-drops-by-42-5-billion-as-traditional-bankers-exit-the-market/.

Höhne, Niklas, Christoph Bals, Frauke Röser, Lutz Weischer, Markus Hagemann, Alexander El Alaoui, David Eckstein, Jakob Thomä, and Morten Rossé. 2015. “Developing Criteria to Align Investments with 2 ° C Compatible Pathways.”

Holz, Christian, Lori Siegel, Eleanor B Johnston, Andrew D. Jones, and John Sterman. 2017. “Ratcheting Ambition to Limit Warming to 1.5°C –Trade-Offs Between Emission Reductions and Carbon Dioxide Removal.” https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3063337.

House, Kurt Zenz, Antonio C. Baclig, Manya Ranjan, Ernst A. van Nierop, Jennifer Wilcox, and Howard J. Herzog. 2011. “Economic and Energetic Analysis of Capturing CO2 from Ambient Air.” Proceedings of the National Academy of Sciences 108 (51): 20428–33. doi:10.1073/pnas.1012253108.

IDB. n.d. “Annex IV: Key Objectives of MDB-Led Infrastructure Project Preparation Facilities (IPPFs).”

———. n.d. “Policy-Based Lending Category - Website.”

———. 2011. “Environmental Impact Assessments for Cement Plants. VPS/ESG. TECHNICAL NOTE No. IDB-TN-301.”

———. 2013. “Chemical Plant GHG Emissions. Reconciling the Financing of Chemical Plants with Climate Change Objectives. Environmental Safeguards Unit. TECHNICAL NOTE No. IDB-TN-618.”

———. 2016. “Technical Note: Design and Use of Policy-Based Loans at the IDB.”

———. 2016b. “Corporate Results Framework 2016-19”

IDBG. n.d. “NDC-Invest Website. Components.”

IDFCs, and MDBs. 2015. “Common Principles for Climate Mitigation Finance Tracking.”

———. 2017. “Joint IDFC-MDB Statement at One Planet Summit.”

IEA. 2017a. “Energy Technology Perspectives 2017. Catalysing Energy Technology Transformations.” Paris, France: International Energy Agency. http://www.iea.org/etp2017/.

———. 2017b. “World Energy Outlook 2017.” Paris, France: International Energy Agency. https://www.iea.org/weo2017/.

———. 2018. “World Energy Investments 2018.” Paris. https://www.iea.org/wei2018/.

IEC MSB. 2012. “Grid Integration of Large-Capacity Renewable Energy Sources and Use of Large-Capacity Electrical Energy Storage.” Iec, no. 3: 102. doi:10.1002/yd.282.

IEEFA. 2017. “Overpaid and Underutilized: How Capacity Payments to Coal-Fired Power Plants Could Lock Indonesia into a High-Cost Electricity Future.” http://ieefa.org/wp-content/uploads/2017/08/Overpaid-and-Underutilized_How-Capacity-Payments-to-Coal-Fired-Power-Plants-Could-Lock-Indonesia-into-a-High-Cost-Electricity-Future-_August2017.pdf.

IFC. 2011. “Update of IFC’s Policy and Performance Standards on Environmental and Social Sustainability, and Access to Information Policy IFC IFIs, 2015. International Financial Institution Framework for a Harminsed Approach to Greenhouse Gas Accounting.”

———. 2015. “Update on IFC’s Management of E&S Risks in Its FI Business.”

———. 2016. “Climate Investment Opportunities in Emerging Markets.” 2016.

———. 2016b. “IFC Climate Implementation Plan.”

———. 2017a. “IFC’s Definitions and Metrics for Climate-Related Activities.”

———. 2017b. “Interpretation Note on Financial Intermediaries.”

———. 2017c. “Annual Report 2017. Creating Markets”

IFIs. 2015. “International Financial Institution Framework for a Harmonised Approach to Greenhouse Gas Accounting.”

IPCC. 2014a. Climate Change 2014: Mitigation of Climate Change. Vol. 3. Cambridge University Press.

———. 2014b. “Working Group 3 Chapter 10: Industry.”

IRENA. 2017. Electricity Storage and Renewables: Costs and Markets to 2030. www.irena.org.

Jung, Jiyeon, and Yoonmo Koo. 2018. “Analyzing the Effects of Car Sharing Services on the Reduction of Greenhouse Gas (GHG) Emissions.” Sustainability 10 (2): 539. http://www.mdpi.com/2071-1050/10/2/539/pdf.

Keen, P, and R Phillpotts. 2010. “Low Cost Electrification for Branch Lines.” Derby: DeltaRail.

Kempener, Ruud, Paul Komor, and Anderson Hoke. 2013. “Smart Grids and Renewables - A Guide for Effective Deployment.” International Renewable Energy Agency, no. November: 47. http://www.irena.org/publications/2013/Nov/Smart-Grids-and-Renewables-A-Guide-for-Effective-Deployment.

Kennedy, Christopher, Julia Steinberger, Barrie Gasson, Yvonne Hansen, Timothy Hillman, Miroslav Havránek, Diane Pataki, Aumnad Phdungsilp, Anu Ramaswami, and Gara Villalba Mendez. 2009. “Greenhouse Gas Emissions from Global Cities.” Environ. Sci. Technol. 43: 7297–7302. doi:10.1021/es900213p.

Kittner, Noah, Felix Lill, and Daniel M Kammen. 2017. “Energy Storage Deployment and Innovation for the Clean Energy Transition.” doi:10.1038/nenergy.2017.125.

Krause, Andreas, Thomas A. M. Pugh, Anita D. Bayer, Wei Li, Felix Leung, Alberte Bondeau, Jonathan C. Doelman, et al. 2018. “Large Uncertainty in Carbon Uptake Potential of Land-Based Climate-Change Mitigation Efforts.” Global Change Biology, April. Wiley. doi:10.1111/gcb.14144.

Kriegler, Elmar, Gunnar Luderer, Nico Bauer, Lavinia Baumstark, Shinichiro Fujimori, Alexander Popp, Joeri Rogelj, Jessica Strefler, and Detlef P van Vuuren. 2018. “Pathways Limiting Warming to 1.5°C: A Tale of Turning around in No Time?” Philosophical Transactions. Series A, Mathematical, Physical, and Engineering Sciences 376 (2119). The Royal Society: 20160457. doi:10.1098/rsta.2016.0457.

Kuramochi, Takeshi, Niklas Höhne, Michiel Schaeffer, Jasmin Cantzler, Bill Hare, Yvonne Deng, Sebastian Sterl, et al. 2018. “Ten Key Short-Term Sectoral Benchmarks to Limit Warming to 1.5°C.” Climate Policy 18 (3): 287–305. doi:10.1080/14693062.2017.1397495.

Lackner, Klaus S., Sarah Brennan, Jürg M. Matter, A.-H. Alissa Park, Allen Wright, and Bob van der Zwaan. 2012. “The Urgency of the Development of CO2 Capture from Ambient Air.” Proceedings of the National Academy of Sciences 109 (33): 13156–62. doi:10.1073/pnas.1108765109.

Lauwers, Dirk. 2008. “Functional Road Categorization: New Concepts and Challenges Related to Traffic Safety, Traffic Management, and Urban Desing - Reflections Based on Practices in Belgium Confronted with Some Easter European Cases.” Transportation and Land Use Interaction . https://core.ac.uk/download/pdf/55820505.pdf.

Lazarevic, David, and Michael Martin. 2016. “Life Cycle Assessments, Carbon Footprints and Carbon Visions: Analysing Environmental Systems Analyses of Transportation Biofuels in Sweden.” Journal of Cleaner Production 137 (November). Elsevier: 249–57. doi:10.1016/J.JCLEPRO.2016.07.075.

Lee, Nancy. 2017. “Billions to Trillions? Issues on the Role of Development Banks in Mobilizing Private Finance,” 34.

Li, Richard, and Garrett Fizgerald. 2018. “Ride-Hailing Drivers Are Ideal Candidates for Electric Vehicles - Rocky Mountain Institute.” Rocky Mountain Institute Blog.

Litman, Todd. 2017. “Understanding Transport Demands and Activities: How Prices and Other Factors Affect Travel Behavior.” http://www.vtpi.org/elasticities.pdf.

Mainhardt, Heike. 2017. “World Bank Development Policy Finance Props Up Fossil Fuels and Exacerbates Climate Change: Findings from Peru, Indonesia, Egypt and Mozambique.” Bank Information Center.

McCollum, David L., Wenji Zhou, Christoph Bertram, Harmen-Sytze de Boer, Valentina Bosetti, Sebastian Busch, Jacques Després, et al. 2018a. “Energy Investment Needs for Fulfilling the Paris Agreement and Achieving the Sustainable Development Goals.” Nature Energy 3 (7): 589–99. doi:10.1038/s41560-018-0179-z.

———. 2018b. “Energy Investment Needs for Fulfilling the Paris Agreement and Achieving the Sustainable Development Goals.” Nature Energy 3 (7): 589–99. doi:10.1038/s41560-018-0179-z.

MDBs. 2016. “Statement by Multilateral Development Banks: Delivering on the 2030 Agenda.” Text/HTML. World Bank.

Metayer, Matthieu, Christian Breyer, and Hans-Josef Fell. 2015. “The Projections for the Future and Quality in the Past of the World Energy Outlook for Solar PV and Other Renewable Energy Technologies.” 31st European Photovoltaic Solar Energy Conference, September 14 - 18, 2015, no. SEPTEMBER. Hamburg, Germany. doi:10.4229/31stEUPVSEC2015-7DV.4.61.

Moeckel, Rolf (Technical University of Munich). 2017. “Working from Home: Modeling the Impact of Telework on Transportation and Land Use.” In Transportation Research Procedia 26, 207–14. Elsevier. https://ac.els-cdn.com/S2352146517308803/1-s2.0-S2352146517308803-main.pdf?_tid=2403669d-f034-44c7-8a24-7699c6923571&acdnat=1531218792_e796f4eb6ad33c5ce75885d94e3ad2d5.

Muradov, N.Z., and T.N. Veziroğlu. 2005. “From Hydrocarbon to Hydrogen–carbon to Hydrogen Economy.” International Journal of Hydrogen Energy 30 (3). Pergamon: 225–37. doi:10.1016/J.IJHYDENE.2004.03.033.

Muttitt, Greg, Adam Scott, Tim Buckley, and Colin Rees. 2018. “Off Track,” no. April. http://priceofoil.org/content/uploads/2018/04/OFF-TRACK-the-IEA-Climate-Change.pdf.

Nahlik, Matthew J., and Mikhail V. Chester. 2014. “Transit-Oriented Smart Growth Can Reduce Life-Cycle Environmental Impacts and Household Costs in Los Angeles.” Transport Policy 35 (September). Pergamon: 21–30. doi:10.1016/J.TRANPOL.2014.05.004.

Nettersheim, Christine, and Michel Köhler. 2018. “Internal Working Document by the Greenwerk.”

NetworkRail. 2018. “Great Western Electrification Project Frequently Asked Questions.” NetworkRail. Accessed July 10. https://www.rctcbc.gov.uk/EN/Resident/ParkingRoadsandTravel/Travel/Relateddocuments/GreatWesternelectrificationprojectFAQ.pdf.

Newman, Peter, and Jeff Kenworthy. 2011. “‘Peak Car Use’: Understanding the Demise of Automobile Dependence.” World Transport Policy and Practice 17 (2). https://espace.curtin.edu.au/bitstream/handle/20.500.11937/23589/183183_183183.pdf?sequence=2.

O. Edenhofer, R Pichs-Madruga Y Sokona K Seyboth P Matschoss S Kadner T Zwickel P Eickemeier G Hansen S Schlömer C von Stechow (eds). n.d. “IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation: Prepared by Working Group III of the Intergovernmental Panel on Climate Change.”

OECD; IEA. 2007. “Hydrogen Production and Distribution.” In IEA Energy Technology Essentials. Paris: OECD/IEA.

OECD/IEA, and IRENA. 2017. “Perspectives for the Energy Transition: Investment Needs for a Low-Carbon Energy System.” International Energy Agency. International Energy Agency, International Renewable Energy Agency. http://www.irena.org/DocumentDownloads/Publications/Perspectives_for_the_Energy_Transition_2017.pdf.

OECD/ITF. 2018. “Reducing Shipping Greenhouse Gas Emissions Lessons From Port-Based Incentives.” Paris: OECD/ITF. https://www.itf-oecd.org/sites/default/files/docs/reducing-shipping-greenhouse-gas-emissions.pdf.

OECD. n.d. “Paris Declaration and Accra Agenda for Action - Website.”

———. 2005a. “Paris Declaration on Aid Effectiveness.”

———. 2005b. “The Paris Declaration on Aid Effectiveness and the Accra Agenda for Action.” Paris. http://www.oecd.org/development/effectiveness/34428351.pdf.

———. 2017a. “Technical Note on Estimates of Infrastructure Investment Needs: Background Note to the Report Investing in Climate, Investing in Growth.” https://www.oecd.org/env/cc/g20-climate/Technical-note-estimates-of-infrastructure-investment-needs.pdf.

———. 2017b. Investing in Climate, Investing in Growth. Paris: OECD Publishing. doi:10.1787/9789264273528-en.

Olmer, Naya, Bryan Comer, Biswajoy Roy, Xiaoli Mao, and Dan Rutherford. 2017. “GREENHOUSE GAS EMISSIONS FROM GLOBAL SHIPPING, 2013–2015.” Washington DC: The International Council on Clean Transportation. https://www.theicct.org/sites/default/files/publications/Global-shipping-GHG-emissions-2013-2015_ICCT-Report_17102017_vF.pdf.

Olsson, Lennart, Maggie Opondo, Petra Tschakert, Arun Agrawal, and Siri EH Eriksen. 2014. “Livelihoods and Poverty.”

Oommen, Biju Ninan. 2018. “ROLE OF INTERNATIONAL ORGANIZATIONS IN PORT INFRASTRUCTURE DEVELOPMENT.” UNESCAP. Accessed July 11. https://www.unescap.org/sites/default/files/(Session 4 World Bank_Role of International Organizations in Developing Infrastructure.pdf.

Oxford Economics. 2017. “Global Infrastructure Outlook.” Global Infrastructure Hub.

Papaefthymiou, Georgios, Katharina Grave, and Ken Dragoon. 2014. “Flexibility Options in Electricity Systems.” Ecofys, European Copper Institute, no. March: 51. doi:Project number: POWDE14426.

Peters, Adele. 2018. “These Electric Barges Are A Cleaner Cargo Solution Than Trucks.” Fast Company. February.

Ranganathan, Janet. 2004. “The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition),” 116.

REN21. 2017. “Renewables 2017 Global Status Report.” Paris. doi:ISBN 978-3-9818107-6-9.

Rickwood, Peter, Garry Glazebrook, and Glen Searle. 2008. “Urban Structure and Energy—A Review.” Urban Policy and Research 26 (1). TF: 57–81. doi:10.1080/08111140701629886.

Roasa, Dustin. 2017. “Time to Come Clean: How the World Bank Group and International Investors Can Stop the World’s Most Dangerous Coal Plant.” Inclusive Development International; Bank Information Center Europe; Center for Financial Accountability.

Rogelj, Joeri, Gunnar Luderer, Robert C. Pietzcker, Michiel Schaeffer, Volker Krey, and Keywan Riahi. 2015a. “Energy System Transformations for Limiting End-of-Century Warming to below 1.5°C.” Nature Climate Change 5: 519–27. doi:10.1038/NCLIMATE2572.

———. 2015b. “Energy System Transformations for Limiting End-of-Century Warming to below 1.5°C.” Nature Climate Change 5: 519–27. doi:10.1038/NCLIMATE2572.

Rogelj, Joeri, Alexander Popp, Katherine V. Calvin, Gunnar Luderer, Johannes Emmerling, David Gernaat, Shinichiro Fujimori, et al. 2018. “Scenarios towards Limiting Global Mean Temperature Increase below 1.5 °C.” Nature Climate Change, 1. doi:10.1038/s41558-018-0091-3.

Rosenberg, Martin. 2018. “Batteries Out-Distance Gas-Burning Generators.” The Energy Times. February.

Rubin, Edward S., John E. Davison, and Howard J. Herzog. 2015. “The Cost of CO2 Capture and Storage.” International Journal of Greenhouse Gas Control 40 (September): 378–400. doi:10.1016/j.ijggc.2015.05.018.

Samadi, Sascha, Stefan Lechtenböhmer, Clemens Schneider, Karin Arnold, Manfred Fischedick, Dietmar Schüwer, and Andreas Pastowski. 2016. “Decarbonization Pathways for the Industrial Cluster of the Port of Rotterdam.” Wuppertal: Wuppertal Institute. www.wupperinst.org.

Scherer, Laura, and Stephan Pfister. 2016. “Hydropower’s Biogenic Carbon Footprint.” Edited by Juergen P. Kropp. PLOS ONE 11 (9). Public Library of Science: e0161947. doi:10.1371/journal.pone.0161947.

Schleussner, C.-F., T. K. Lissner, E. M. Fischer, J. Wohland, M. Perrette, A. Golly, J. Rogelj, et al. 2016. “Differential Climate Impacts for Policy-Relevant Limits to Global Warming: The Case of 1.5\,$^\circ$C and 2\,$^\circ$C.” Earth System Dynamics 7 (2): 327–351. doi:10.5194/esd-7-327-2016.

Schleussner, Carl-Friedrich, Joeri Rogelj, Michiel Schaeffer, Tabea Lissner, Rachel Licker, Erich M. Fischer, Reto Knutti, Anders Levermann, Katja Frieler, and William Hare. 2016. “Science and Policy

Characteristics of the Paris Agreement Temperature Goal.” Nature Climate Change Online Pub. doi:10.1038/NCLIMATE3096.

Schlomer, S., Thomas Bruckner, Lew Fulton, Edgar Hertwich, Alan McKinnon, Daniel Perczyk, Joyashree Roy, et al. 2014. “Annex III: Technology-Specific Cost and Performance Parameters.” Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. doi:http://report.mitigation2014.org/report/ipcc_wg3_ar5_annex-ii.pdf.

Schuiling, R. D., and P. Krijgsman. 2006. “Enhanced Weathering: An Effective and Cheap Tool to Sequester Co<Subscript>2</Subscript>.” Climatic Change 74 (1–3): 349–54. doi:10.1007/s10584-005-3485-y.

Science Based Targets. 2018. “Transport | Science Based Targets.” https://sciencebasedtargets.org/transport-2/.

Searchinger, Tim, and Ralph Heimlich. 2015. “Avoiding Bioenergy Competition for Food Crops and Land.” 9. WRI.

Shankleman, Jess. 2016. “Two Charts That Show How Renewable Energy Has Blown Away Expectations - Bloomberg.” Bloomberg.

Sims, R., R. Schaeffer, F. Creutzig, X. Cruz-Núñez, M. D’Agosto, D. Dimitriu, M. J. Figueroa Meza, et al. 2014. “Transport.” Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovern- Mental Panel on Climate Change [Edenhofer,. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.

Sims, Ralph, Roberto Schaeffer, Felix Creutzig, Xochitl Cruz-Núñez, Marcio D’Agosto, Delia Dimitriu, Maria Josefina Figueroa Meza, et al. 2014. “IPCC Fifth Assessment Report (AR5) - Chapter 8: Transport.” https://www.ipcc.ch/report/ar5/.

Smith, Pete, Steven J. Davis, Felix Creutzig, Sabine Fuss, Jan Minx, Benoit Gabrielle, Etsushi Kato, et al. 2016. “Biophysical and Economic Limits to Negative CO2 Emissions.” Nature Climate Change 6 (1): 42–50. doi:10.1038/nclimate2870.

Smith, T. W. P., J. P. Jalkanen, B. A. Anderson, J. J. Corbett, J. Faber, S. Hanayama, E. O’Keeffe, et al. 2014. “Third IMO Greenhouse Gas Study 2014.” International Maritime Organization (IMO). doi:10.1007/s10584-013-0912-3.

Steffen, Will, Johan Rockström, Katherine Richardson, Timothy M. Lenton, Carl Folke, Diana Liverman, Colin P. Summerhayes, et al. 2018. “Trajectories of the Earth System in the Anthropocene.” Proceedings of the National Academy of Sciences, August. doi:10.1073/pnas.1810141115.

Sterl, Sebastian, Claire Fyson, Jasmin Cantzler, Hanna Fekete, Sofia Gonzales-Zuñiga, Ursula Fuentes, Matt Beer, Yvonne Deng, Lindee Wong, and Daan Peters. 2018. “What’s on the Table? Mitigating Agricultural Emissions While Achieving Food Security.” Climate Action Tracker (Climate Analytics, Ecofys, NewClimate Institute).

Sterl, Sebastian, Markus Hagemann, Hanna Fekete, Niklas Höhne, Jasmin Cantzler, Andrzej Ancygier, Matt Beer, et al. 2017. “Faster and Cleaner 2. KICK-STARTING GLOBAL DECARBONIZATION: IT ONLY TAKES A FEW ACTORS TO GET THE BALL ROLLING.” https://newclimateinstitute.files.wordpress.com/2017/04/faster-cleaner-fulldoc_041817.pdf.

Strefler, Jessica, Nico Bauer, Thorben Amann, Elmar Kriegler, and Jens Hartmann. 2015. “Integrated Assessment of Enhanced Weathering.” https://irena.org/EventDocs/Session 4_Jessica Strefler_WEB.pdf.

Sustainable Infrastructure Foundation. 2017. “AfDB Loans & Grants over USD 30 Billion in Africa during Past 50 Years - Sustainable Infrastructure Foundation.” Sustainable Infrastructure Foundation. https://public.sif-source.org/mdbs-infra-news/afdb-loans-grants-usd-30-billion-africa-past-50-years/.

Talvitie, A. 1996. “Functional Classification of Roads.” In Meeting of the Transportation Research Board. Washington DC. http://siteresources.worldbank.org/INTROADSHIGHWAYS/Resources/338993-1115316483571/1-roads_classification.pdf.

Tanaka, Katsumasa, and Brian C. O’Neill. 2018. “The Paris Agreement Zero-Emissions Goal Is Not Always Consistent with the 1.5 °c and 2 °c Temperature Targets.” Nature Climate Change 8 (4): 319–24. doi:10.1038/s41558-018-0097-x.

TCFD. n.d. “TCFD Knowledge Hub. On: Website.” https://www.fsb-tcfd.org/tcfd-supporters/.

———. 2017a. “Annex: Implementing the Recommendations of the TCFD.”

———. 2017b. “Final Report: Recommendations of the Task Force on Climate-Related Financial Disclosures.” https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-TCFD-Report-062817.pdf.

———. 2018. “TCFD Supporters as of the One Planet Summit September 2018. On: Website.” https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-TCFD-Report-062817.pdf.

Telaretti, E., and L. Dusonchet. 2016. “Battery Storage Systems for Peak Load Shaving Applications: Part 2: Economic Feasibility and Sensitivity Analysis.” In 2016 IEEE 16th International Conference on Environment and Electrical Engineering (EEEIC), 1–6. doi:10.1109/EEEIC.2016.7555795.

Teske, Sven, Steve Sawyer, and Oliver Schäfer. 2015. “Energy [R]Evolution. A Sustainable World Energy Outlook 2015.” Energy [R]Evolution. Greenpeace; SolarPower Europe; GWEC. http://www.greenpeace.org/international/Global/international/publications/climate/2015/Energy-Revolution-2015-Full.pdf [accessed on 5 December 2016].

U.S. Department of Energy. 2018. “Hydrogen Production and Distribution.” Alternative Fuels Data Center.

UNEP. 2017. “The Emissions Gap Report 2017.” Nairobi. doi:ISBN 978-92-9253-062-4.

Vaughan, Naomi E, Clair Gough, Sarah Mander, Emma W Littleton, Andrew Welfle, and E David. 2018. “Evaluating the Use of Biomass Energy with Carbon Capture and Storage in Low Emission Scenarios.” Environmental Research Letters 13. http://iopscience.iop.org/article/10.1088/1748-9326/aaaa02/meta.

Vuuren, Detlef P. van, Elke Stehfest, David E. H. J. Gernaat, Maarten van den Berg, David L. Bijl, Harmen Sytze de Boer, Vassilis Daioglou, et al. 2018. “Alternative Pathways to the 1.5 °C Target Reduce the Need for Negative Emission Technologies.” Nature Climate Change, 1. doi:10.1038/s41558-018-0119-8.

WBG. n.d. “Products and Services - Website.” Text/HTML. World Bank.

———. 2012. “Strategic Environmental Assessment in the World Bank.” Edited by Fernando Loayza.

———. 2016. “World Bank Group Climate Change Action Plan.”

———. 2017a. Announcement at One Planet Summit 2017.

———. 2017b. “Development Policy Financing.”

———. 2017c. “Guidance Note on Shadow Price of Carbon in Economic Analysis.”

———. 2017d. “Report of the High-Level Commission on Carbon Prices.”

———. 2018. “State and Trends of Carbon Pricing 2018.”

———. 2018. “Climate Finance.” 2018. August.

Weikmans, Romain, and J Timmons Roberts. 2017. “Climate and Development The International Climate Finance Accounting Muddle: Is There Hope on the Horizon?” Climate and Development, December. doi:10.1080/17565529.2017.1410087.

While, G. 2017. “Upstream Carbon Emissions : LNG vs Pipeline Gas,” no. April: 2–5.

Wilkerson, Jordan T., Benjamin D. Leibowicz, Delavane D. Turner, and John P. Weyant. 2015. “Comparison of Integrated Assessment Models: Carbon Price Impacts on U.S. Energy.” Energy Policy 76 (January): 18–31. doi:10.1016/j.enpol.2014.10.011.

Williams-Derry, Clark. 2007. “Increases in Greenhouse-Gas Emissions from Highway-Widening Projects.”

Williamson, Phil. 2016. “Emissions Reduction: Scrutinize CO2 Removal Methods.” Nature 530 (7589): 153–55. doi:10.1038/530153a.

Woetzel, Jonathan, Nicklas Garemo, Jan Mischke, Martin Hjerpe, and Robert Palter. 2016. “Bridging Global Infrastructure Gaps.” McKinsey & Company.

World Bank Group. 2012. “Turn Down the Heat: Why a 4°C Warmer World Must Be Avoided.”

Wright, Helena, Taylor Dimsdale, C L Aire Healy, Sonny Williamson, and Nick Mabey. 2018. “Sustainable Infrastructure and the Multilateral Development Banks Changing the Narrative.” https://www.e3g.org/library/sustainable-infrastructure-and-the-multilateral-development-banks-changing.

Wright, Helena, James Hawkins, Dileimy Orozco, and Nick Mabey. 2018. “Banking on Reform: Aligning the Development Banks with the Paris Climate Agreement | E3G.” e3g. https://www.e3g.org/docs/E3G_-_Banking_on_Reform_Report_-_Final.pdf.

WWF. 2011. “The Energy Report: 100% Renewable Energy by 2050.” 100% Renewable Energy by 2050. Gland; Switzerland. http://assets.panda.org/downloads/the_energy_report_lowres_111110.pdf.

Annex

A.1 Financial Intermediary lending - discussion of challenges and entry points for Paris alignment

A.1.1 Challenges

A.1.1.1 Instrument inherent challenges

Predictability vs. flexibility in FI operations: There is a clear trade-off between predictability and flexibility. The narrower the eligibility criteria in terms of technology or appliance, the better one can forecast the expected results and impacts. However, in view of uncertain end-client demand, which is particularly relevant for new technologies and immature markets, it is risky for an FI to commit to a very specific investment purpose.

Maintaining delegation benefits of FI operations: From an operational point of view, FI is attractive due to delegated responsibility for individual investment decisions to the intermediary. A no-objection for each transaction would pose a costly extra effort on both sides which rules out the efficiency gains of working with FIs. However, the MDB must ensure the agreed purpose is met, standards are adhered to and information is available on request.

A.1.1.2 Capacity and resource constraints

MDBs' scarce allocation of capacity and resource for FI lending: FI projects are often thought to be less intensive in terms of human resources because the ultimate investments are appraised by the FI instead of the MDB. Conducting in depth climate analysis and monitoring results is often not feasible with the given number of personnel and their respective technical expertise.

Clients not prioritizing climate in allocation of resources: For an FI with resource constraints, with clients and potentially (public) shareholders prioritizing other topics than climate, it is not surprising that a management rewarded for short-term results is not supportive of investing in the implementation of climate tools, adjust IT accordingly, provide trainings etc.

A.1.1.3 Country ownership vs. scientific evidence

If the scientific pathway deviates from the country's NDC and an MDB's climate tools are more restrictive than national regulation, it is a matter of country ownership of the development cooperation to seek a country-specific compromise. In the case of public banks, it is especially questionable whether it is legitimate for them to go beyond national legislation and exclude activities that would be eligible under national policy.

A.1.2 Key entry points

Most of the challenges in applying climate tools to FI operations cannot be eradicated completely, but there are a number of potential key entry points to tackle and manage them. The following sub-section outlines the main elements (see Table 17 and Table 18 for a summary).

A.1.2.1 Integrate climate tools in project preparation

Strengthening climate considerations in the preparation phase is crucial to improve the climate performance of FI operations. Gathering and evaluating information upfront to increase predictability of results and tailoring climate tools to country circumstances are key conditions for the following steps:

a) Adapt and apply existing climate tools consistently:

In order to align all financial flows with the global temperature goal, climate tools for investment projects should be applied consistently for FIs as well. This includes making GHG accounting of gross estimates mandatory for all instruments.

Ideally, a joint methodology would be developed, potentially under the IFI Framework for a Harmonized Approach to Greenhouse Gas Accounting (IFIs 2015), disclosing all assumptions and uncertainties. In case of unknown end-use of funds, the MDB should do its best to make a realistic assumption based on the FI's track record, market demand and sector-specific emissions factors. Given the extent of FI-lending, accounting for and reporting on these GHG emissions is necessary to reflect the correct number of the MDBs “financed emissions”. The information would also be valuable to feed into reduction targets for MDBs gross portfolio emissions or into avoided emission targets.

Paris-aligned positive and negative lists should be applied to FI-lending either through ring-fencing their application for MDB finance only, or by having the client institutionalize these lists. Science-based lists providing five-year milestones until 2050 should be provided for easy use by the client.

Climate tools like benchmarks and carbon pricing could only be applied effectively in FI operations if the client would be required to apply a country specific climate tool and to have a respective climate management system in place (similar to an environmental and social management systems of MDBs). In order to ensure FI compliance with the tool, lessons can be drawn inter alia from IFC’s Action Plan to improve environmental and social performance among FI clients (IFC 2015).

b) Introduce additional climate tools at MDB level:

Climate impact assessment:

- Screening for climate impacts and risk categorization:

  Each MDB should conduct a mandatory screening for potential negative impacts on the climate, leading to a risk categorization in early concept phase (not to be confused with the climate related financial risks). An instrument-specific methodology (e.g. decision tree) could be developed to guide project managers. The potential impacts assessed should include induced emissions (Greenhouse Gas Protocol, World Resources Institute, and wbcsd 2011). In the case of an unknown end-use of funds, the MDB should do its best to make a realistic assumption based on the FI's track record and market demand.

- In depth climate impact analysis for high and significant risks:

  The analysis should entail an assessment of the client’s capacity to identify and manage the risk. Climate tools used by the FI should be compared with the MDB’s climate tools based on a decarbonization pathway and possible gaps be closed.

Mitigation potential analysis:

- A screening for potential (additional) climate mitigation measures in each FI operation should be introduced. This could be done jointly with the climate impact assessment.

c) Improve the climate reporting:

MDBs should introduce mandatory client reporting on climate impacts using standardized indicators.

d) Harmonization and mutual learning:

IFIs should strive for mutual learning and harmonization, for example, via the climate mainstreaming initiative. MDBs and international networks could jointly develop a standardized toolbox applicable to different national legislations, as they exist for environmental and social considerations, e.g. at the EBRD (EBRD, n.d.). Harmonization reduces transaction costs and facilitates joint projects.

A.1.2.2 Integrate climate tools in project implementation

Fully-fleshed climate criteria applied in the project design need to be implemented thoroughly in the next step. This starts with accompanying the client's integration of climate criteria. Performance during implementation needs to be monitored and evaluated against climate criteria with clear indicators. The IFC's Action Plan to improve environmental and social performance among FI clients includes useful orientation, such as increased annual supervision requirements to cover high and medium-risk clients, a review of the top exposures of the FI's portfolio; and expanded supervision to include a sample review of FI sub-clients. Results should be disclosed publicly.

A.1.2.3 Additional resources and capacities

On the MDB side, the additional time and expertise required to apply the climate tools along the project cycle will require scaling-up financial resources.

For clients it will, in most cases, not be possible to apply the additional climate tools and build up respective capacities without financial and technical support by the MDB. Consequently, grant funding needs to be made available for this purpose.

A.1.2.4 Long-term cooperation

Not only are there significant resource and capacity constraints in raising the ambition of FIs or governments with respect to climate change, implementing robust IT and raising internal awareness also take time. However, the prospect of long-term cooperation and support can be a powerful incentive to include climate tools and adjust them over time.

A gradual development towards full Paris alignment could be agreed starting with ring-fencing MDB support in the first phase and striving for alignment of the entire portfolio i.e. legislative framework over time to mainstream climate change and increase the climate finance share of portfolios.

Non-compliance with climate tools should be treated as a breach of contract. If the agreed climate results are not met the exit option should be actively used.

A.2 Policy Based Lending - discussion of challenges and entry points for Paris alignment

A.2.1 Challenges

A.2.1.1 Instrument inherent challenges

***Scope of a policy reform**:* Direct climate impacts can be clearly identified if the policy reform includes public investment measures. However, when it comes to the impact of a policy on numerous private investment decisions, it becomes more difficult to measure climate impacts. It is not possible to remove this level of uncertainty in the expected impact of a policy.

***Maintaining the benefits of policy-based disbursement logic**:* Even if some PBL include public investment measures as part of a policy reform it would be counterproductive to revert to an investment project logic. While appealing from an oversight and control perspective, requiring the government to seek approval for individual investments would heavily undermine the principles of aid effectiveness and delegated responsibility.

A.2.1.2 Capacity and resource constraints

MDBs' scarce allocation of capacity and resource for PBL: PBLs are generally larger in volume than investment projects and, as the IDB states, "PBLs are faster and cheaper to prepare and to implement, and they generate more income per dollar approved" (IDB 2016). Applying climate tools will necessarily consume additional resources that are currently not reserved for these instruments.

From a country perspective the lack of financial resources and skilled personnel might be hampering the mainstreaming of climate objectives into feasible policy interventions. This is especially the case if the PBL is not directly targeting climate change or the line ministry for climate change is not involved, there might be limited knowledge and incentives to allocate scarce resources accordingly.

A.2.1.3 Country ownership vs. scientific evidence

Climate tools of an MDB that are based on scientific decarbonization pathways and may be more restrictive than national regulation raise questions of country ownership. Introducing climate tools unilaterally in a single area could easily harm the national policy coherence of a PBL, if inconsistent with the overall national climate regulatory framework.

A.2.2 Key entry points

A.2.2.1 Integrate climate tools in project preparation

Increasing efforts and resources in the project preparation phase are of great importance in order to enable the use of climate tools in PBL and to thereby ensure that this part of an MDBs portfolio is also aligned with the Paris Agreement.

a) Adapt and apply existing climate tools consistently:

In order to align all financial flows with the global temperature goal, climate tools for investment projects should be applied consistently for PBL as well. Table 17 suggest entry points for PBL.

b) Introduce additional climate tools at MDB level:

Each MDB should conduct a mandatory

- climate impact assessment and risk categorization as well as an
- in-depth climate impact analysis for high and significant risks based on projections of economic development through and sector benefitting from the reform.

This could be integrated in a Strategic Environmental Assessment. Impact of climate regulation used by the client government should be compared with impacts of the MDB's climate tools based on a decarbonization pathway, and possible gaps closed.

Mitigation potential analysis: A screening for potential (additional) climate mitigation measures in each PBL should be introduced. For PBL in high mitigation relevant sectors (energy, transport, infrastructure), there should be at least one prior action on climate mitigation.

c) Improve climate reporting:

The client should report on all measures and incentives included in the reform, as well as all projects potentially benefitting from the reform with potential climate impacts (Mainhardt 2017).

d) Harmonization and mutual learning:

To reduce transaction cost and facilitate joint projects, experiences should be exchanged and methodologies harmonized, for example via the climate mainstreaming initiative.

A.2.2.2 Integrate climate tools in project implementation

Performance and impact of (prior action) reforms after their implementation should be monitored and evaluated against climate criteria with clear indicators. Results should be disclosed publicly.

A.2.2.3 Additional resources and capacities

As for FI-lending, MDBs will also require additional financial resources for PBL. These could be invested into time and expertise to apply the climate tools to PBL.

For clients integrating Paris-aligned climate safeguards and tools into legislation and reforms will in most cases not be possible without financial and technical support by the MDB. Consequently, grant funding needs to be made available for this purpose.

A.2.2.4 Long-term cooperation

Building up the necessary capacities in client countries to create a comprehensive climate policy framework, raising the ambition of governments with respect to climate change, implementing robust IT and raising internal awareness take time. Long-term cooperation and support can incentivize the introduction of climate standards, which can become more ambitious over time.

Use of agreed climate tools and (prior) actions should be a binding part of the lending contract. In cases of non-compliance or failure to reach the agreed climate results the MDB should make use of its exit-option.

A.3 Suggested TCFD+ guidelines

The TCFD has developed specific guidance for a variety of sectors to implement the TCFD recommendations. Based on the structure and content as developed by the TCFD, the following TCFD+ guidelines lay out most important climate-related information that should be disclosed by MDBs.

All information provided should be **updated at least annually** and be published in the **annual financial filings**. Furthermore, MDBs should feed the TCFD+ guidelines information into the MDB database on MDBs climate finance, GHG emissions and climate risk and opportunity management, as described in chapter 6.3.5.

TCFD+ guidelines

Like the TCFD recommendations, the TCFD+ guidelines address four key dimensions: Metrics and Targets, Risk Management, Strategy, and Governance.

Metrics and Targets: Governments, stakeholders and financial partner institutions in capital markets need to understand how MDBs measure and monitor their climate-related risks (financial aspect), and progress towards their goals and towards achieving Art. 2.1c of the Paris Agreement (impact aspect).

Risk Management: Governments, stakeholders and financial partner institutions in capital markets need to understand how MDBs identify, assess and manage climate-related risks (financial aspect), risks to achieving their goals and achieving Art. 2.1c of the Paris Agreement (impact aspect), and how those climate risk management processes are integrated into existing risk management processes and MDBs' project assessment cycle.

Strategy: Governments, stakeholders and financial partner institutions in capital markets need to understand how climate risks may affect MDBs' business strategy, financial planning (financial aspect) and investment policy including climate goals and targets (impact aspect) over the short, medium and long term. Governments and stakeholders need to further understand MDBs' strategies to ensure climate and other development objectives are pursued in a synergetic manner, for which disclosure of these strategies is essential.

Governance: Governments, stakeholders and financial partner institutions in capital markets need to understand whether climate-related risks and opportunities (financial aspect and impact aspect) receive appropriate board and management attention.

Table 21: Suggested TCFD+ Guidelines

Suggested TCFD+ Guidelines	
The following guidelines were developed by Germanwatch and NewClimate Institute. They closely follow the detailed structure of the original TCFD guidelines developed by industry experts, as laid out in *Implementing the Recommendations of the Task Force on Climate-related Financial disclosures* (TCFD 2017a, p. 14 ff.). Sections that we added to the TCFD recommendations appear in *italic font*. Sections that we considered as obsolete, were deleted and put into brackets in the footnote.	
Metrics and Targets Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material *with regards to financial and/or impact aspects.*	
Recommended Disclosure a)	**Guidance for all sectors**

Disclose the **metrics** the organization uses to assess climate-related risks and opportunities in line with its strategy and risk management process.	• Organizations should provide the key **metrics** used to measure and manage climate-related risks and opportunities (as described in Tables A1 and A2 in the TCFD report, see (TCFD 2017a)). Organizations should consider including metrics on climate-related risks associated with water, energy, land use, and waste management where relevant and applicable. *This applies to metrics used to measure and manage:* *a) financial climate risks (financial aspect)* *b) impact on global, and – where applicable –recipient countries' climate targets (impact aspect)* • Where climate-related issues are material *(either in terms of financial or impact aspects)*, organizations should consider describing whether and how related performance metrics are incorporated into **remuneration policies**. • Organizations[30] should provide their **internal carbon prices** (*level, projected increase over time, scenarios/tools employed and key assumptions to determine the carbon price*) as well as, *where relevant,* climate-related opportunity metrics such as revenue from products and services designed for a lower-carbon economy. • Metrics should be provided for historical periods to allow for trend analysis. • In addition[31], organizations should provide a description of the **methodologies** used *and* ***key assumptions*** to calculate or estimate climate-related metrics. **Supplemental Guidance for Banks** • Banks should provide the metrics used to assess the impact of (transition and physical) climate-related risks on **their lending** and **other financial intermediary** business activities in the short, medium, and long term. Metrics provided may relate to credit exposure, equity and debt holdings, or trading positions, broken down by: o Industry (based on Global Industry Classification Standard) o Geography o Credit quality (e.g. investment grade or non-investment grade, internal rating system) o Average tenor • Banks should also provide the amount and percentage **of carbon-related assets relative to total assets** as well as the amount of lending and other financing connected with **climate-related opportunities**
Recommended Disclosure b) Disclose Scope 1, Scope 2, and, if appropriate, Scope 3	**Guidance for All Sectors** • Organizations should provide **their** *and their **financial intermediaries'*** Scope 1 and Scope 2 *own **and financed*** **GHG emissions** and, if appropriate, Scope 3 GHG *own and financed* emissions and the **related risks**. *Where data from financial intermediaries is not available, the banks should ask them to apply the TCFD+ recommendations and consider making this a prerequisite for further business relations.*

30 [Where relevant],

31 [where not apparent,]

<table>
<tr><td>greenhouse gas (GHG) emissions, and the related risks.</td><td>

GHG emissions should be calculated in line with the GHG Protocol methodology to allow for aggregation and comparability across organizations and jurisdictions.
As appropriate, organizations should consider providing related, generally accepted, industry-specific GHG efficiency ratios.
GHG emissions and associated metrics should be provided for historical periods to allow for trend analysis.
In addition[32], organizations should provide a description of the methodologies used and key assumptions to calculate or estimate the metrics
</td></tr>
<tr><td>Recommended Disclosure c)

Describe the targets the organization uses to manage climate-related risks and opportunities and performance against targets.</td><td>
Guidance for All Sectors

Organizations should describe their key climate-related targets such as those related to GHG emissions, water usage, energy usage, etc, in line with the goals set out in the Paris Agreement (i.e. in line with science-based pathways to limit temperature increase to 1.5°C/<2°C), enhanced Paris-aligned NDCs and respective country strategies; and anticipated regulatory requirements or market constraints or other goals. Other goals may include efficiency or financial goals, financial loss tolerances, avoided GHG emissions through the entire product life cycle, or net revenue goals for products and services designed for a lower-carbon economy.
In describing their targets, organizations should[33] include the following:

progress towards a decarbonized project pipeline and a decarbonized portfolio by 2050;
whether the target is absolute or intensity based and the year when the intensity target will be transformed into an absolute target,
timeframes over which the target applies;
base year from which progress is measured;
key performance indicators used to assess progress against targets,
how the target aligns with the goals as set out in the Paris Agreement and contributes to its implementation, based on scenario assessments where applicable;
the methodologies used to calculate targets and key performance indicators, including key assumptions for scenario analyses.

Organizations should disclose targets and engagement processes related to partner organizations, most notably financial intermediaries, to implement Paris-aligned business models and/or investment strategies
MDBs should disclose the amount of historic, actual, projected and targeted Paris-aligned climate finance, in absolute amounts and relative to carbon-related finance, differentiated by own financial resources (including climate-earmarked finance provided to financial intermediaries) and finance mobilized.
</td></tr>
<tr><td colspan="2">Risk Management</td></tr>
</table>

32 [where not apparent,]
33 [consider including]

Disclose how the organization identifies, assesses, and manages climate-related risks *with regards to financial and impact-related aspects*.	

Recommended Disclosure a)
 	
Describe the organization's processes for **identifying** and **assessing** *financial and impact-related* climate-related risks.
	Guidance for all sectors
	
	• Organizations should describe their *and their financial intermediaries'* risk management processes for **identifying and assessing** *financial and impact aspects of* climate-related risks. An important aspect of this description is how organizations determine the relative significance of climate-related risks in relation to other risks *and at which stage and how various risks are addressed in MDBs' project assessment cycles. Where relevant information from financial intermediaries is not available, the banks should ask financial intermediaries to apply the TCFD+ recommendations and consider making this a prerequisite for further business relations.*
	• Organizations should *anchor their risk assessment in scientific 1.5°/<2° scenarios and* describe whether they consider existing and emerging regulatory requirements related to climate change (e.g., limits on emissions), *climate-related market dynamics, enhanced Paris-aligned NDCs and respective country strategies,* as well as other relevant factors considered.
	• Organizations should also[34] *disclose* the following:
	  o processes for assessing the potential size and scope of identified climate-related risks and
	  o definitions of risk terminology used or references to existing risk classification frameworks used.
	
	Supplemental Guidance for Banks
	
	• Banks should[35] *characterize* their climate-related risks in the context of traditional banking industry risk categories such as credit risk, market risk, liquidity risk, and operational risk.
	• Banks should also consider describing any risk classification frameworks used (e.g., the Enhanced Disclosure Task Force's framework for defining "Top and Emerging Risks")[36].

Recommended Disclosure b) Describe the organization's	**Guidance for All Sectors** • Organizations should describe their processes for **managing** *financial and impact aspects of* climate-related risks, *with regard to own financing operations (projects), the entire portfolio, and to financial intermediaries'*

[34] [consider disclosing]

[35] [consider characterizing]

[36] The Enhanced Disclosure Task Force was established by the FSB to make recommendations on financial risk disclosures for banks. It defined a top risk as "a current, emerged risk which has, across a risk category, business area or geographical area, the potential to have a material impact on the financial results, reputation or sustainability or the business and which may crystallise within a short, perhaps one year, time horizon." An emerging risk was defined as "one which has large uncertain outcomes which may become certain in the longer term (perhaps beyond one year) and which could have a material effect on the business strategy if it were to occur." (TCFD 2017a)

processes for **managing** climate-related risks.	*operations*, including how they make decisions to mitigate, transfer, accept, or control those risks. • In addition, organizations should describe their processes for **prioritizing** climate-related risks, including how **materiality determinations** *with regards to financial and impact aspects* are made within their organizations. • *Describe how MDB contributes to/enables/promotes Paris-aligned, reliable long-term* ***regulatory frameworks*** *in partner countries to achieve climate targets and to minimize financial climate risks (minimize physical risks and transition risks).*
Recommended Disclosure c) Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organization's **overall risk management**.	**Guidance for All Sectors** • Organizations should describe how their *and financial intermediaries'* processes for identifying, assessing, and managing climate-related risks are **integrated into their overall risk management**, *differentiated by project climate risk management (financial aspects and impact aspects) and portfolio climate risk management (financial aspects and impact aspects)*.
Strategy Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material *with regards to financial and impact-related aspects*.	

Recommended Disclosure a)
 	
Describe the climate-related **risks and opportunities** the organization has identified over the short, medium, and long term.
	Guidance for all sectors
	
	• Organizations should provide the following information:
	  ○ a description of what they consider to be the relevant short, medium, and long-term **time horizons**, taking into consideration the useful life of the organization's assets or infrastructure and the fact that climate-related issues often manifest themselves over the medium and longer terms,
	  ○ a description of the specific **climate-related issues** potentially arising in each time horizon (short, medium, and long term) that could have a material financial impact on the organization and distinguish whether the climate-related risks are transition, *litigation* or physical risks, and
	  ○ a description of the **process(es)** used to determine which risks and opportunities could have a material financial impact on the organization; as well as
	  ○ *a description of the specific risks and opportunities of the MDBs' and financial intermediaries' investment strategy and projects related to achieving the* ***climate goals*** *as set out in the Paris Agreement, in enhanced Paris-aligned NDCs and respective country strategies.*

	• Organizations should[37] *provide* a description of their *financial and impact-related* risks and opportunities **by sector and/or geography**[38]. In describing climate-related issues, organizations should refer to Tables A1 and A2 (TCFD 2017a). **Supplemental Guidance for Banks** Banks should describe[39] **concentrations of credit exposure** to carbon-related assets[40]. Additionally, banks should consider disclosing their climate-related risks (transition, *litigation* and physical) in their **lending** and other **financial intermediary business activities**.
Recommended Disclosure b) Describe the impact of climate-related risks and opportunities on the organization's **businesses, strategy, and financial planning**.	**Guidance for All Sectors** • Building on recommended disclosure (a), organizations should discuss how identified climate-related issues have affected *and will affect* their businesses, strategy *(including overall policy, sector strategies and country strategies)*, and financial **planning**. • Organizations should consider including the impact on their businesses and strategy in the following areas: o Products and services o Supply chain and/or value chain o Adaptation and mitigation activities o Investment in research and development o Operations (including types of operations and location of facilities) • Organizations should describe how climate-related issues serve as an input to their **financial planning process**, the time period(s) used, and how these risks and opportunities are **prioritized**. Organizations' disclosures should reflect a holistic picture of the **interdependencies** among the factors that affect their ability to create value over time. Organizations should also consider including in their disclosures the impact on financial planning in the following areas: o Operating costs and revenues o Capital expenditures and capital allocation

[37] [consider providing]
[38] [, as appropriate.]
[39] [significant]
[40] Recognizing that the term carbon-related assets is not well defined, the Task Force encourages banks to use a consistent definition to support comparability. For the purposes of disclosing information on significant concentrations of credit exposure to carbon-related assets under this framework, the Task Force suggests banks define carbon-related assets as those assets tied to the energy and utilities sectors under the Global Industry Classification Standard, excluding water utilities and independent power and renewable electricity producer industries.

	○ Acquisitions or divestments ○ Access to capital • *Since*[41] climate-related scenarios *should*[42] *be* used to inform the organization's strategy and financial planning,[43] *the applied* scenarios *and key assumptions* should be described. *MDBs' should furthermore disclose their strategies to ensure climate and other development objectives are pursued in a synergetic manner.*
Recommended Disclosure c) Describe the **resilience** of the organization's strategy, taking into consideration different climate related scenarios, including a *1.5°C/*<2°C or lower scenario.	**Guidance for All Sectors** • Organizations should describe how **resilient their *and their financial intermediaries'* strategies** *(including business strategies, country strategies, sectoral programs etc.)* are to climate-related risks and opportunities, taking into consideration a transition to a lower-carbon economy consistent with a *1.5°/*<2°C or lower scenario and[44] scenarios consistent with increased physical climate-related risks. • Organizations should consider discussing: ○ where they believe their *and their financial intermediaries'* strategies may be **affected** by climate-related risks and opportunities; ○ how their strategies might **change** to address such potential risks and opportunities; and ○ the climate-related **scenarios** and associated time horizon(s) considered. Refer to Section D in the Task Force's *final* report for information on applying scenarios to forward-looking analysis.
Governance Disclose the organization's governance around climate-related risks and opportunities*, with regards to financial and impact-related aspects*.	
Recommended Disclosure a) Describe the **board's oversight** of climate-related risks and opportunities *with regards to financial and impact-related aspects*.	**Guidance for all sectors** • In describing the board's oversight of climate-related issues, organizations should consider including a discussion of the following: ○ processes and **frequency** by which the board and/or board committees (e.g., audit, risk, or other committees) are **informed** about climate-related issues *with regards to financial and impact-related aspects*; ○ whether the board and/or board committees **consider** climate-related issues when **reviewing and guiding** strategy, major plans of action, risk management policies, annual budgets, and business plans as well as setting the organization's performance

[41] [If]
[42] [were]
[43] [such]
[44] [where relevant to the organization,]

	objectives, monitoring implementation and performance, and overseeing major capital expenditures, acquisitions, and divestitures, and o how the board monitors and oversees **progress against goals** and targets for addressing climate-related issues *with regards to financial and impact-related aspects.*
Recommended Disclosure b) Describe **management's role** in assessing and managing climate-related risks and opportunities.	**Guidance for All Sectors** • In describing **management's role** related to the assessment and management of climate-related issues, organizations should consider including the following information: o whether the organization has **assigned climate-related responsibilities** to management-level positions or committees and, if so, whether such management positions or committees **report** to the board or a committee of the board and whether those responsibilities include assessing and/or managing climate-related issues, o a description of the associated organizational structure(s), *provide a) an overview/organigram and b) a schematic overview over the role of climate-related considerations in project assessment cycle* o processes by which management is informed about climate-related issues, and o how management (through specific positions and/or management committees) monitors climate-related issues.