INVEST4CLIMATE
KNOWLEDGE SERIES

ENABLING INSTITUTIONAL INVESTMENT IN

CLIMATE SMART INFRASTRUCTURE

WORLD BANK GROUP

Global Infrastructure Facility
A G20 INITIATIVE

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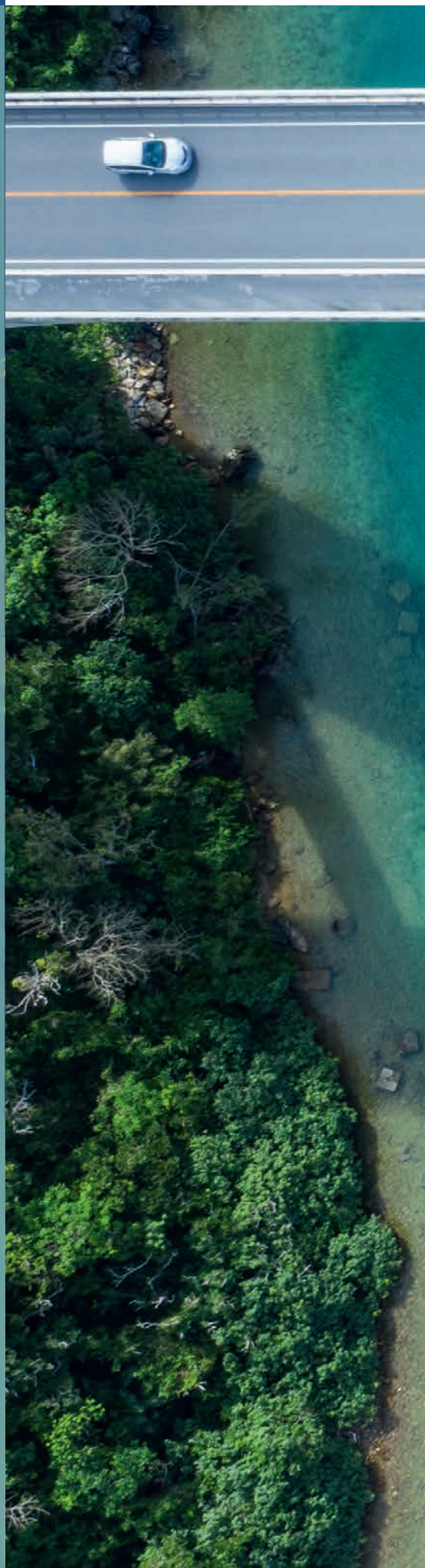

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Abbreviations

AIF Alternative Investment Fund

CFF Climate Finance Facility

CFLI Climate Finance Leadership Initiative

CLO Collateralized Loan Obligation

CSP Concentrated Solar Power

DFI Development Finance Institution

IPCC Intergovernmental Panel on Climate Change

IREDA Indian Renewable Energy Development Agency

IFI International Financial Institution

LCOE Levelized Cost of Energy

MDB Multilateral Development Bank

MIGA Multilateral Investment Guarantee Agency

NADB North American Development Bank

OECD Organization for Economic Cooperation and Development

SDG Sustainable Development Goal

UNDP United Nations Development Programme

Note: All dollar ($) amounts are U.S. dollars unless otherwise indicated.

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01

EXECUTIVE SUMMARY

01 | Executive Summary

The world is not on track to address climate change. As countries move toward developing stimulus packages to stem the economic impact of COVID-19, it will be vitally important to build the foundation for a more resilient, sustainable and prosperous future (Stephen Hammer, Stéphane Hallegatte & Ferzina Banaji 2020). The challenge of the low carbon transition starts with tackling the chronic lack of financing and the need to find new sources or leverage existing ones, especially in emerging markets and developing countries. This will involve spending public budgets better and smarter, making international public climate finance more transformative[1] and leveraging the private sector (World Bank 2019d; World Bank Group 2020; IFC 2016). While infrastructure investment gap estimates are complex to measure and vary depending on the scenario and assumptions used, the need for significant investment in climate-smart infrastructure and the existence of a climate investment gap is clear, ranging from 2 to 8 percent of GDP annually by 2030 (World Bank 2019d). To close the financing gap, private capital is necessary in all scenarios (World Bank 2015b).

The objective of this report is to explore innovative financing approaches and case studies for enabling institutional investment in "climate-smart" infrastructure projects in emerging markets that can help close the climate investment gap. The successful implementation of such approaches requires addressing policy, regulatory, and other barriers and could coincide with work that is already ongoing. This report is intended not only for audiences at DFIs already familiar with infrastructure investment in emerging markets, but also as a resource for those institutional investors who are interested in, but less familiar with, investing in emerging market infrastructure. The interactions and frameworks involved are complex and cannot be discussed in their entirety in a single report; as such, the report highlights many key concepts and provides additional resources for further review.

Decarbonization of the global economy is key to achieving the goal of limiting global warming (World Bank 2015b) and leads to a net benefit to society exceeding $26 trillion (GCEC 2018). Decarbonization requires the reversal of deforestation, the adoption of sustainable agricultural practices and the elimination of fossil fuels from the world's electricity generation, industrial and transportation systems (World Bank 2019c). Shifting energy infrastructure away from fossil fuels and toward climate-smart solutions can go a long way to solving the problem, as the burning of fossil fuels for energy is responsible for 73 percent of anthropogenic greenhouse gas emissions (ClimateWatch n.d.a.). Decarbonization of energy also will lead to significant energy efficiency gains, reduced total energy requirements, reduced total infrastructure investment requirements, increased employment, lower total energy expenditures, and lower social and climate costs (IMF 2019; GCEC 2018; Jacobson et al. 2019; GSPP 2020). While the focus of this report is on mitigation investments, climate adaptation and resilience investments are also briefly discussed as an important area for further in-depth research. Regardless, increased levels of climate-smart infrastructure investment are needed to reap these rewards and close the climate investment gap (World Bank 2019d).

Climate finance is at record levels, but still short of what is needed. From $1.6 trillion to $3.8 trillion of annual investment is needed between 2016 and 2050 for supply-side energy system investments to keep global warming to less than 1.5°C (IPCC 2018). The level of investment required to address the climate crisis outstrips public budgets and the capacity of DFIs to address. OECD pension funds alone hold more

1 The Transformational Climate Finance report (World Bank Group. 2020) identifies eight sets of levers to make international public climate finance more transformative: project-based investments; financial sector reform; fiscal policy; sectoral policies; trade policy; innovation and technology transfer; carbon markets; and climate intelligence.

than $27.6 trillion in assets under management but are often constrained in the types of investments they can make (OECD 2019). OECD institutional investors more broadly hold more than $100 trillion in assets under management (World Bank 2015), more than enough to close the gap.

Recent years have seen a rapid increase in institutional investment in infrastructure and a growing concern with responsible investing, but institutional investors can face significant barriers to infrastructure investment, particularly in emerging markets. Governance structures are critical to enabling the necessary levels of infrastructure investment and are determined by governments (OECD 2017b). DFIs also have a critical role to play in providing technical assistance to help governments create bankable transaction structures and participating in blended finance structures to enable institutional investment.

Deploying institutional capital in climate-smart infrastructure requires addressing the dearth of bankable projects and not only leveraging traditional approaches to infrastructure finance, but also enabling further use of green bonds and securitization. The bond markets could provide an additional $1-$1.5 trillion annually in private sector capital for climate-smart infrastructure through wider use of securitization (White & Case 2018). The refinancing of debt and the securitization of debt and equity in infrastructure projects creates opportunities for institutional investors to invest in climate-smart infrastructure even if they may not be able to invest directly in greenfield[2] projects due to regulatory barriers, minimum diversification and credit rating investment restrictions, a preference for brownfield projects, or a lack of budget or capacity to understand each underlying asset and market. The focus of this report is on refinance and securitization models of debt. Models to recycle equity, such as YieldCos and Clean Energy Investment Trusts are also mentioned, and resources are provided for further reference. Refinance and securitization models also enable DFIs and commercial banks, which are critical at the project level to ensure bankability, to recycle capital so they can lend to new projects at the levels needed. Assuming the policy and regulatory barriers that limit project pipelines are addressed, lenders are increasingly likely to face capital constraints. Basel III implementation may also limit the ability of lenders to offer the long-term loans that are critical to infrastructure investment.[3] As work to address policy and regulatory barriers to infrastructure investment in emerging markets proceeds, designing the enabling environment to facilitate later securitization will enable future capital recycling and institutional investment. As the use of green bonds and securities expands, methods to prevent greenwashing and ensure funds are directed toward climate-smart infrastructure also grow in importance.

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2 The term "greenfield" refers to projects that are newly constructed as opposed to "brownfield" projects which are already in operation.

3 Basel III is a 2009 international regulatory accord that introduced a set of reforms designed to mitigate risk within the international banking sector, by requiring banks to maintain proper leverage ratios and keep certain levels of reserve capital on hand. See: https://www.investopedia.com/articles/economics/10/understanding-basel-3-regulations.asp

The first chapter of the report introduces key concepts related to the need for increased levels of climate-smart investment and the potential of refinance and securitization as a tool to facilitate further institutional investor involvement. The second chapter discusses the challenges and opportunities to close the climate investment gap, highlights the different roles of government, DFIs, and institutional investors, and the opportunity to use green bonds and green securitization and other methods to attract institutional capital. The third chapter reviews and provides a framework to examine the interconnected layers of investment barriers specific to institutional investment in climate-smart infrastructure. Considering these barriers together allows investors and other stakeholders to better understand the complex web of challenges to expanding investment in climate projects and identify opportunities to address each barrier.

Eight innovative case studies and topic boxes are interspersed throughout the report to give examples of ways these barriers can be addressed and the financial structures that can be used to attract institutional investment to help achieve the goals of the Paris Climate Agreement. In many of the case studies, there is an intermediary that absorbs higher risks; identification and structuring of such an intermediary, with a strong balance sheet, is critical to implementing many innovative financing solutions. The case studies are outlined in table 1 and feature the following approaches:

1. Widescale green securitization approaches through bankable governance frameworks and policies, standardization of terms for the underlying projects, and innovative platforms such as shown by *case study 1 - Clifford Capital CLO Infrastructure Take-Out Facility*.

2. Technical assistance and public-private partnership concession programs to address long-term planning, policy and regulatory, and project pipeline barriers to enable both domestic and international institutional investment as demonstrated by case study 2 – *Colombia's Fourth Generation (4G) Roads Concession Programme*.

3. Green bond issuance and refinancing approaches to provide local financing and address currency exchange rate and inflation risk as demonstrated by *case study 3 - Refinancing with Green Bonds: North American Development Bank (NADB)*.

4. Concessional capital and alternative investment funds to address financing barriers such as limited local financial market capacity as presented in *case study 4 - Take-Out Financing Using AIF - Indian Renewable Energy Development Agency*.

5. Innovative solar revenue puts or insurance and credit enhancement approaches to address commercial barriers as shown in *case study 5- Innovative Financial Tools to Refinance on Better Terms–kWh Analytics*.

6. The creation of a domestic green bond market to address transaction costs, green technology, financing, and credit risk barriers to help finance environmentally friendly development including Kenya's first bond issuance to support affordable and environmentally friendly student housing as shown in *case study 6 – Green Bond Programme Kenya*.

7. Green asset backed securities to bundle projects and help reduce transaction and due diligence costs for smaller project and achieve a transaction size attractive to institutional investors as presented in *case study 7 – FlexiGroup*.

8. Software tools for planning long term, complex and multisector investment considerations in cities that enable the use of the best technologies and approaches for decarbonization, such as the *EPIC software tool in case study 8*.

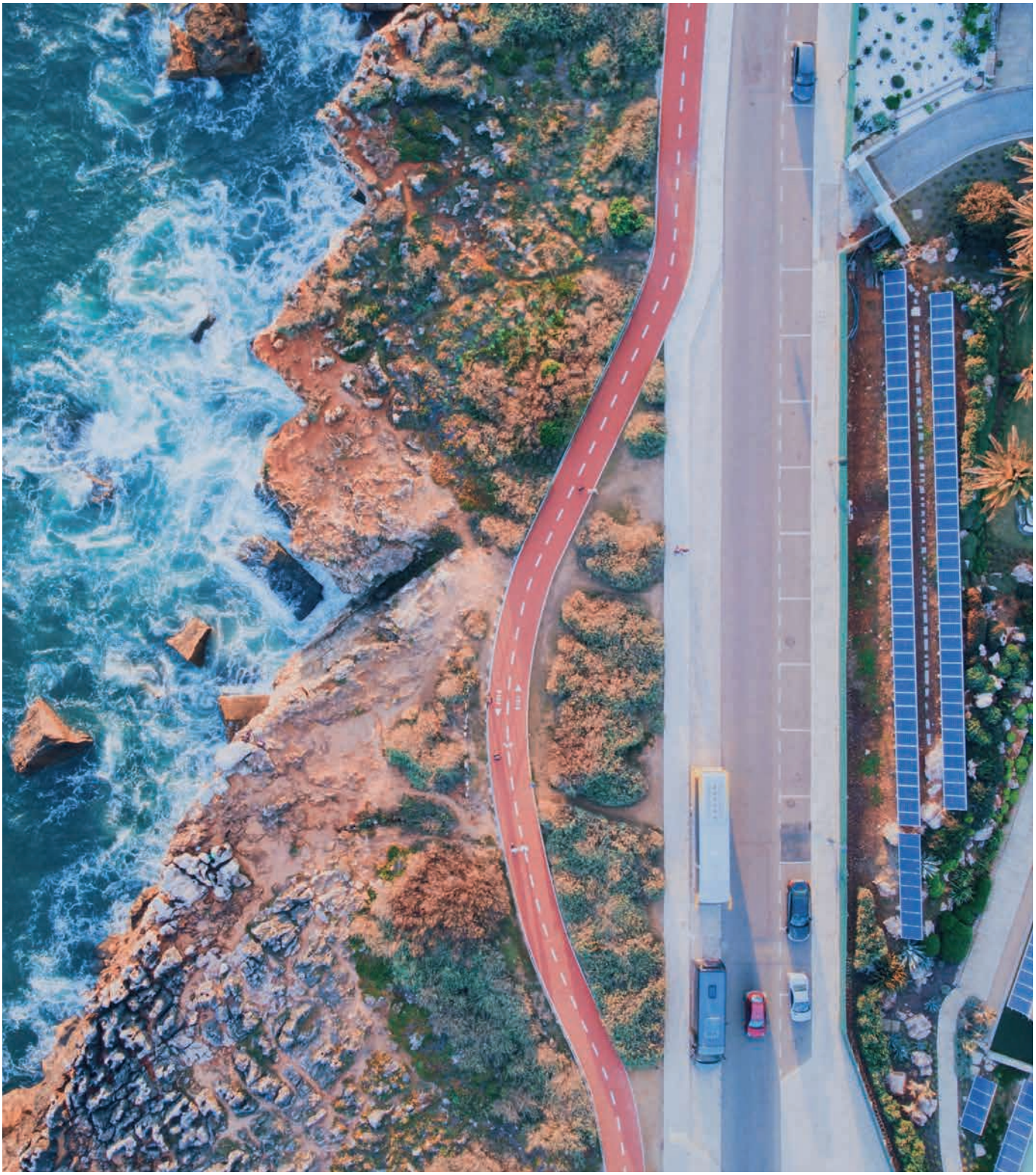

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Table 1 Summary of Case Studies

#	Case Study	Structure	Barriers Addressed	Implementer	Project Location	Size (USD million)
1	Clifford Capital CLO Infrastructure Take-Out Facility	Collateralized loan obligation issaunce	Policy and regulatory, financing, transaction and due diligence costs	Bayfront Infrastructure Capital	16 Countries	$458,00
2	Colombia's Fourth Generation (4G) Roads Concession Programme	Technical assistance and public-private partnership concession program	Project pipeline, long-term planning, policy and regulatory, financing, cost structure	World Bank Group	Colombia	$14.800,00
3	Refinancing with Green Bonds: North American Development Bank (NADB 2018)	Green bond issuance and refinance	Macroeconomic, Financing, transaction and due diligence costs	North American Development Bank (NADB)	Mexico	$126,40
4	Take-Out Financing Using AIF - Indian Renewable Energy Development Agency (Singh et al 2019)	Alternative investment funds, green Masala bond issuance	Financing, policy and regulatory, transaction and due diligence costs	Indian Renewable Energy Development Agency (IREDA)	India	$300,00

Table 1 Summary of Case Studies

#	Case Study	Structure	Barriers Addressed	Implementer	Project Location	Size (USD million)
5	Using Innovative Financial Tools to Refinance on Better Terms– kWh Analytics	Solar revenue puts	Commercial, financing, green technology	Invenergy LLC, kWh Analytics	USA	N/A (196MW)
6	Green Bond Programme Kenya	Domestic green bond issuance	Financing, green technology, transaction and due diligence costs, credit risk	Acorn Holdings (issuer) Guarantco, Kenya Banker's Association, Climate Bonds Initiative, Nairobi Securities Exchange, FMO, and Financial Sector Deepening Africa	Kenya	$42,50
7	Green Asset-Backed Securities – FlexiGroup	Green asset backed security	Transaction and due diligence costs, financing, green technology	FlexiGroup, National Australian Bank	Australia	$203,70
8	Environment Positive Innovations for Cities (EPIC) Investment Planning Tool	Planning software tool	Long-term planning	International Finance Corporation (IFC)	Cities (global)	N/A

The private sector has an important and increasing role to play in climate-smart infrastructure. Addressing barriers, both traditional and specific to green technologies, can help enable institutional investment. Domestic and international institutional investors both face barriers; some obstacles are regulatory while others are those typically encountered in infrastructure investment such as a limited pipeline of bankable projects, concerns over the macroeconomic environment such as foreign exchange risks, concerns over country risk and local policy support, access to appropriate financing, and commercial and credit barriers. Climate-smart infrastructure projects can also face additional barriers such as the need for business models that enable stakeholders to benefit from the lower life cycle costs associated with green technologies, structures that enable bundling of smaller projects to achieve cost reductions and the scale needed to attract institutional investment, access to support (from governments, DFIs, and the private sector) to help increase the diffusion of new technologies, and clear policy signals from governments to address long-term planning barriers. The report presents several approaches and tools that can help address barriers to institutional investment; however, these tools are not prescriptive and must be tailored to each situation.

There is significantly more to be done in achieving low carbon resilient development pathways to help achieve national climate ambitions under the Paris Agreement. There is no single solution to overcoming the complex, multifaceted barriers associated with financing climate change projects particularly given the need for large, complex, investments and the rapidly changing pace of green technologies. Turning the climate crisis into an opportunity for green growth requires international collaboration among governments, DFIs, and private-sector entities. Governments that prioritize climate-smart infrastructure and create enabling environments to facilitate the rapid deployment of innovative green technologies and financing models stand to reap significant benefits (OECD 2017). The scale and complexity of bridging the climate investment gap also requires participation, capability, and capacity in local markets from both governments and the private sector. This report outlines several approaches and instruments that can all contribute to increasing critical climate investment and upholding our global commitment to keep global warming to less than 1.5°C.

02

KEY CONCEPTS

02 | Key Concepts

Objective

The Invest4Climate platform, a World Bank Group–United Nations Development Programme (UNDP) partnership, was designed to mobilize[4], coordinate, and deliver the financing needed to close the climate financing gap and help countries transition to a low carbon resilient future that supports jobs and growth. For more information, see appendix 1 and https://www.worldbank.org/invest4climate. The Invest4Climate Knowledge Series provides targeted reports on expanding private investment in climate action through financial innovation and collaborative partnerships. The objective of this report is to explore innovative financing instruments and approaches for **enabling institutional investment in "*climate-smart*" infrastructure projects in emerging markets.** This report reviews the existing literature, provides an overview of key concepts related to climate-smart infrastructure, highlights key barriers in scaling-up private investment in climate-smart infrastructure, and showcases innovative refinancing, securitization, and other financial instruments that can be used to de-risk projects, recycle lender capital, and create opportunities for institutional investors to support low carbon resilient, climate-smart infrastructure projects.

Climate-Smart Infrastructure

While definitions of climate-smart infrastructure may vary, this report defines climate-smart infrastructure as infrastructure that is resilient and can withstand damage caused by extreme weather, extreme temperatures, and climate change and that reduces greenhouse gas emissions (e.g., carbon dioxide, methane, black carbon, nitrous oxide) to the maximum extent possible.[5] Climate-smart infrastructure is not only built to withstand the future effects of climate change that are already locked in at current emission levels (i.e. resilience and adaptation) but also to reduce existing, or prevent further, greenhouse gas emissions and resulting climate change from happening to the extent possible (i.e. mitigation). "*Principles for climate-smart infrastructure include:*

1. *Applying rigorous science*
2. *Prioritizing equitable outcomes*
3. *Spending limited resources wisely*
4. *Planning proactively, holistically, and transparently* (UCS 2017)."

Examples of climate-smart infrastructure projects globally range from large solar, wind, geothermal and hydroelectric generation projects such as the $3 billion Noor-Ouarzazate concentrated solar power (CSP) complex in Morroco, which received funding from the African Development Bank, Climate Investment Funds, the World Bank, and European financing institutions, to low-carbon transportation such as light rail and electric vehicle charging networks, water and waste management, and energy efficiency, among others. This report is targeted at climate-smart infrastructure projects specifically. However, quotes from the literature review refer variously to sustainable, green, clean, and climate-smart projects with some overlap in meanings. Where needed, the original language in the quotes has been retained as the findings apply similarly to climate-smart projects.

Figure 1 shows that total global climate finance flows are generally trending upward. However, while climate finance has reached record levels, action still falls far short of what is needed under a 1.5˚C scenario. Estimates of the investment required to achieve the low-carbon transition for supply-side energy systems alone range from $1.6 trillion to $3.8 trillion annually

4 See annex 4 for definition on private sector mobilization as per MDB harmonized definition.

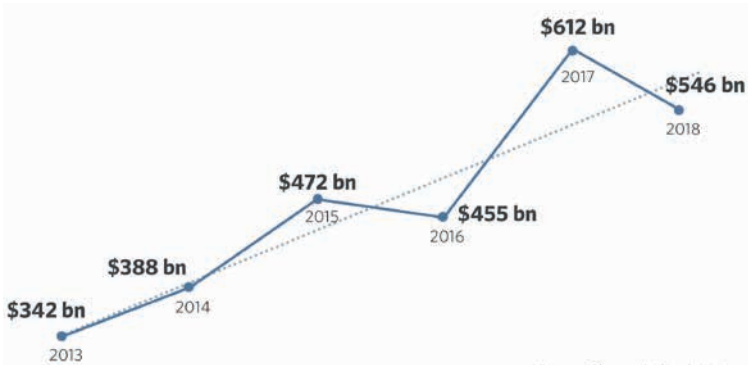
5 See https://www.ucsusa.org/sites/default/files/attach/gw-smart-infrastructure-pricncipals.pdf

between 2016 and 2050 (IPCC 2018), while the Global Commission on Adaptation (GCA 2019) estimates adaptation costs of $180 billion annually from 2020 to 2030 (CPI 2019). Estimates of the amounts needed vary according to the scenarios used.

Ensuring that infrastructure investment is truly climate-smart is critical to achieving the goals of the Paris Agreement. A variety of sustainability-related principles and standards governing infrastructure project development were implemented over the last decade along with certification schemes for green bonds and carbon credits. However, certification standards targeting infrastructure projects specifically have only just begun to be piloted. The IFC Performance Standards (IFC n.d.a.) offer a set of guiding principles for sustainable project development and form the basis of the Equator Principles (Equator Principles n.d.a), which govern member bank advisory and lending practices related to project finance transactions. The Climate Bonds Initiative offers certification of green bonds (CBI n.d.a.), and a variety of independent assessments and indices that rely on the Green Bond Principles (ICMA 2020) as a basis are available for green bond issuances both internationally and nationally (BIS 2017). Carbon credit verification is available under schemes such as the "Clean Development Mechanism (CDM) or the Gold Standard" (Gold Standard n.d.a.).[6] However, certification specific to infrastructure projects was not available until just recently. The Global Infrastructure Basel Foundation is now working on the first pilots for certification under the SuRe Standard[7] (SuRe n.d.a), which is specifically focused on certifying infrastructure projects that are sustainable and resilient.

It is important that entities issuing green bonds or other green securities adhere to certification schemes such as those above to avoid the potential for funds to be misused or to enable "greenwashing." Even with such certification schemes, cash is fungible, and the issuance of green bonds and other green securities may free up capital which is then invested in fossil fuel infrastructure. Certification standards could be strengthened to address the potential for greenwashing by requiring issuers of green securities to agree not to further invest in fossil fuel infrastructure, particularly greenfield projects, beyond what is needed to safely decommission facilities or directly reduce their emissions.

Figure 1 Total global climate finance flows, 2013-2018



Source: Climate Policy Initiative 2019, "Global landscapes of Climate Finance".

Much of the infrastructure investment needed under a 1.5˚C scenario is needed in the emerging markets, creating a significant opportunity for private sector investors. The IFC identified nearly $23 trillion of climate investment opportunities in six sectors and three regions by 2030 stemming from the Paris Agreement (IFC 2016). However, even with certification schemes becoming available to help assure institutional investors that a given infrastructure project is developed sustainably, regulatory frameworks and other barriers often make it challenging for institutional investors to invest in emerging markets.

6 See: https://www.climatebonds.net/certification/approved-verifiers

7 The SuRe Standard integrates 14 themes and 61 criteria across environmental, social, and governance to ensure infrastructure projects with SuRe certification are developed meet these sustainability and resilience criteria. As such, the standard can be applied to many climate-smart infrastructure projects.

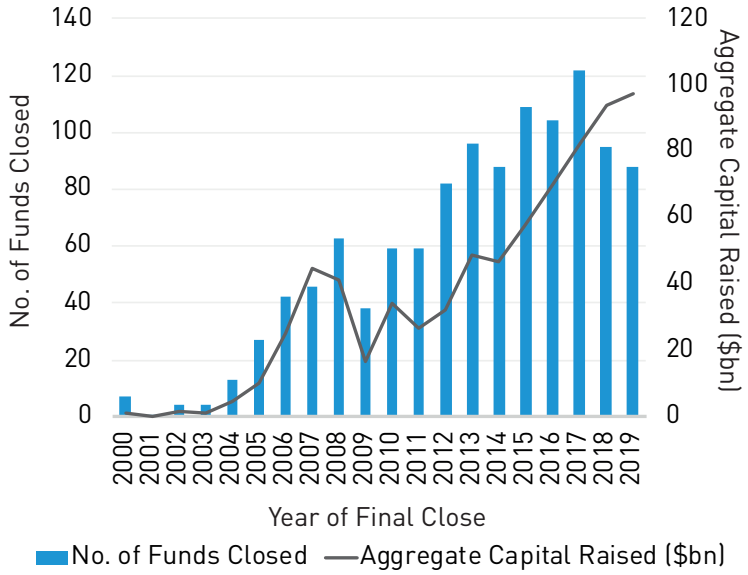
Institutional Investors

The private sector is an important source of financing for climate-smart infrastructure, and levels of investment are increasing. "*Private climate finance reached a record high of $330 billion in 2017, representing an increase of $99 billion from 2016, or 43% year-on-year growth* (CPI 2019)." This includes institutional investors, who have long been hailed as a potential source of capital to support climate-smart infrastructure investment. Institutional investors consist of sovereign wealth funds, pension funds, insurance companies, investment advisors, endowments, and mutual funds, as well as banks, credit unions, hedge funds, REITs, and other types of financial firms and asset managers. This report focuses largely on pension funds and sovereign wealth funds given their significant capital base and long-term investment needs, which matches well with infrastructure as an asset class (OECD 2013).

As shown in Figure 2, institutional investors are increasingly investing in infrastructure, with $98 billion raised globally in unlisted infrastructure funds in 2019 (Preqin 2020). This included investments into two funds targeting $20 billion each, Brookfield Infrastructure Fund IV and Global Infrastructure Partners IV. In addition to investing in unlisted infrastructure funds, several of the largest pension funds and sovereign wealth funds with the capacity to do so have created teams that specialize in investing directly in infrastructure and renewable energy projects. However, many pension funds and other institutional investors lack the capacity to support dedicated teams that understand the complexities of directly investing in infrastructure projects in each potential market.

The report aims to review the literature on institutional investors and climate investments, highlight barriers that make it difficult for institutional investors to support climate-smart infrastructure in emerging markets, and showcase innovative financing approaches that can help to address barriers to investment. Securitization and refinance are two approaches being used to create opportunities for institutional investors to support climate-smart infrastructure investments.

Figure 2 Global unlisted infrastructure fundraising, 2000-2019



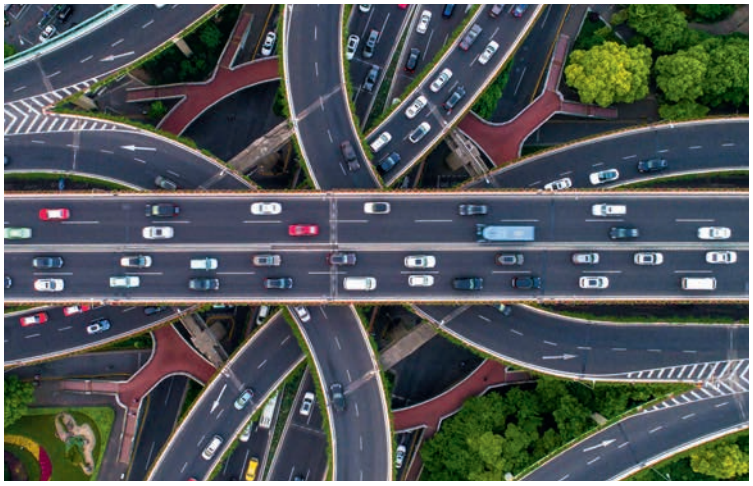
Source: Preqin. 2020.

Refinance and Securitization

Refinancing and securitization can create opportunities not only for lenders to free up capital so that they can finance additional greenfield projects, but also to create ways for institutional investors who may lack the capacity or ability to invest directly in projects that support climate-smart infrastructure. Refinancing and securitization of green assets can be accomplished through the issuance of green bonds for the purpose of refinancing or through the issuance of green asset-backed securities (CBI 2018). New financial products can help further unlock value when used to refinance climate-smart infrastructure (kWh Analytics 2019). Green bonds generally are issued to provide capital for future green projects or for the purpose of refinancing existing projects. Green asset-backed securities are generally

issued to free up capital from existing projects and to create opportunities for institutional investors to support climate-smart projects.

"*A green CLO market has large growth potential… [and the S&P] hypothetical green CLO analysis showed that green loans may have different fundamental characteristics to corporate loans such as lower asset yields, higher credit quality, and higher recovery rates* (S&P 2018)." Reasons for the low issuance of green CLOs to date include the limited number of green loans outstanding, challenges for green bonds or loans issued in emerging markets to receive ratings above the sovereign, and the short history of the green finance market compared to corporate loans (S&P 2018).



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Despite the challenges facing green asset-backed securities "*providing the banking sector with recyclable liquidity will become increasingly important as demand for sustainable investments accelerates* (White & Case 2018)." Additionally, "*by aggregating the funding into a common structure, securitisations enable institutional investors to finance small scale assets and small- and medium-size businesses* (CBI 2018)."

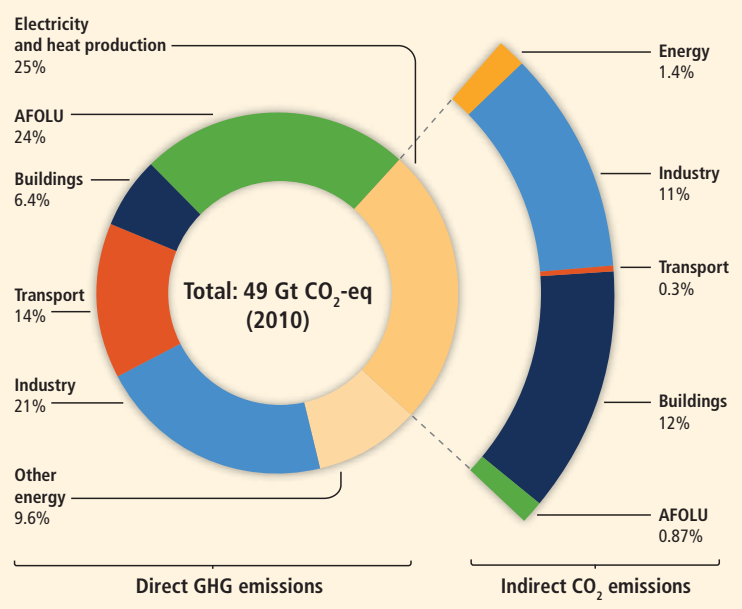
Securitization, refinance, and the other approaches highlighted in this report are being used to address barriers to investment, attract institutional investor capital, and free up lender and developer capital so it can be reinvested in new projects to accelerate the shift toward decarbonization. DFIs have a critical role to play in enabling broader use of refinance and securitization, not only by providing technical assistance to ensure the underlying assets are bankable and can later be securitized, but also in providing concessional finance, blended finance, and political risk insurance or partial credit guarantees to address risks other stakeholders cannot. Although this report contains solutions that can be replicated, these solutions are not prescriptive but are intended to demonstrate what is possible. Most solutions would need to be tailored to local legal, regulatory, and market conditions with the help of qualified and experienced experts. The approaches presented also hinge upon host governments erecting sound project governance structures. These solutions can be used to help provide the capital needed to limit the increase in global average temperatures to less than 1.5°C above pre-industrial levels in accordance with the goals of the Paris Agreement.

Report Focus and Alignment with the Paris Agreement

This report is written in the context of the Paris Agreement,[8] which commits parties to pursuing efforts to limit the increase in global average temperatures to less than 1.5°C above pre-industrial levels. The Intergovernmental Panel on Climate Change (IPCC) Special Report, *Global Warming of 1.5°C*, indicates that ***"global warming is likely to reach 1.5°C between 2030 and 2052****. . . [In] pathways with no or limited overshoot of 1.5°C, global net anthropogenic CO2 [carbon dioxide] emissions decline by about 45 percent from 2010 levels by 2030, reaching net zero around 2050 (IPCC 2018)."* The IPCC Special Report was issued before the release of a study by researchers at 10 universities and the U.S.

8 See http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf

Figure 3 Greenhouse gas emissions by economic sectors



Source: IPCC. 2014.

National Oceanic and Atmospheric Administration that found **methane emissions have been underestimated by 25 percent to 40 percent** (Hmiel et al 2020). This finding gives humanity a shorter timeline and requires further emissions reductions than those indicated in the IPCC Special Report.

Figure 3 shows the source of the emissions causing the global temperature increase. Greenhouse gas emissions can be attributed to electricity and heat production (25 percent); agriculture, forestry, and land use ("AFOLU") (24 percent); industry (21 percent); transport (14 percent); other energy (10 percent); and buildings (6 percent) (IPCC 2014). The IPCC, the U.S. Environmental Protection Agency (EPA 2019), and the World Resources Institute agree that the source of most of these emissions from all sectors other than agriculture is the burning of fossil fuels for energy. While spread across several economic sectors, **seventy-three percent of human-caused greenhouse gas emissions is the result of burning fossil fuels for energy** (ClimateWatch n.d.a.).

Unfortunately, policies, regulations, governance structures, integrated resource plans, and markets often fail to capture the full cost of carbon emissions and the full value of sustainable approaches and technologies like renewable energy, clean transportation, and vertical farming. The social costs of greenhouse gas emissions are not being fully accounted for as "*only 20 percent of global GHG emissions are covered by a carbon price and less than 5 percent of those are currently priced at levels consistent with reaching the temperature goals of the Paris Agreement* (World Bank 2019)." Renewable energy can provide a reliable power supply even for large countries like the U.S. (RMI 2018). Clean transportation solutions can meet transportation needs, and climate-smart infrastructure more broadly can provide essential services, all at low life cycle cost and with significant savings to society. Attracting institutional investment to climate-smart infrastructure is therefore critical in achieving the goals of the Paris Agreement and the focus of this report.

The first section of this report details the challenges and opportunities society faces in seeking to close the climate investment gap related to infrastructure. The second section focuses on the barriers institutional investors face in relation to infrastructure investment in emerging markets generally and climate-smart infrastructure specifically. Case studies and topic boxes are interspersed throughout the report to give examples of ways these barriers can be addressed and tools that can be used to attract institutional investment to help achieve the goals of the Paris Agreement. Given that 73 percent of the problem is related to the use of fossil fuels for energy, many of the case studies focus on large-scale energy. However, the tools and opportunities presented can often be adapted to other types of climate-smart infrastructure projects. Additionally, many of the technology solutions available to help keep global warming below 1.5°C can also provide climate benefits across multiple sectors as shown in box 1 below.

Box 1 Vertical farming

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Vertical farming uses hydroponics, aquaponics, and aeroponics to raise crops in vertically stacked layers housed in climate and environmentally controlled buildings that protect against weather and pests. Vertical farming offers not only significantly greater crop yields of 10 times or more per hectare, but also the potential to reduce water usage by up to 95 percent. Vertical farming can also be done organically, without the use of pesticides and chemical fertilizers.

The global vertical farming market, which includes the United States, Canada, Germany, the United Kingdom, Japan, India, China, South Korea, South Africa, Brazil, Mexico, Argentina, Netherlands, and Belgium, is estimated to have reached between $2.23 billion and $3.16 billion in 2018 and is projected to reach $12.77 billion to $22.07 billion by 2026.

Recent investments in vertical farming companies include $90 million in Bowery Farming by GV (formerly Google Ventures), with the funds coming from investors such as Singapore's Temasek; $200 million invested in Plenty by SoftBank Vision Fund, and $55 million being invested by AeroFarms in its 138,000 square foot Cane Creek Industrial Park building. AeroFarms also recently received an investment from the Abu Dhabi Investment Office, under the $272 million AgTech Incentive Programme, to build the world's largest indoor R&D vertical farm.

Box 1 Vertical farming (continued)

Transport
Because vertical farming facilities are enclosed, they are resilient from a climate perspective and can be built in any environment to raise any crop. These enclosed structures allow vertical farms to be located near customers and can therefore reduce the need for shipping, which also reduces the associated emissions. For example, agriculture is estimated to account for as much as 31 percent of all freight in the United States (USDA n.d.a).

Agriculture, Forestry, and Land Use
Vertical farms can produce food year-round rather than just seasonally, and they require significantly less land to provide the same crop yield. As a result, they can free land for potential use in renewable power generation, buildings, or reforestation and afforestation. Humanity is responsible for removing an estimated 2.6 trillion trees, or 46 percent of the pre-industrial total (Crowther et al. 2015), with most of this previously forested land being cleared for agricultural purposes. Vertical farming has the potential to help reverse the trend in deforestation if adopted on a wider scale and combined with reforestation and afforestation programs.

Energy
Vertical farming has the potential to reduce fossil fuel energy use in both the long-distance transport that is required for agriculture and in the running of farming equipment usually needed to grow crops. As the use of both long-distance transport and farming equipment declines, the emissions from the fossil fuels used to provide energy to both also declines. However, vertical farming energy needs are still significant, as vertical farms need constant lighting, with electricity representing one of vertical farming's greatest costs. Enabling vertical farms to source renewable electricity at utility-scale prices would not only help reduce costs for vertical farms, but also help reduce the overall greenhouse gas emissions associated with energy use for agriculture.

03

CHALLENGES AND OPPORTUNITIES TO CLOSE THE CLIMATE INVESTMENT GAP

03 | Challenges and Opportunities to Close the Climate Investment Gap

> The current scope and scale of global climate finance are grossly insufficient to limit the worst effects of climate change – there is a need for a tectonic shift beyond 'climate finance as usual' toward truly transformative policies and investments. The IPCC (2018) warns that a breach of the 1.5 °C threshold in global warming between 2030 and 2052 will result in irreversible damage to the environment and welfare losses. Keeping warming below this level necessitates rapid, large-scale emissions reductions, and a corresponding transition away from high-carbon production and consumption, across all sectors. While there is no single estimate of the investment required to meet these goals, indicative, regional, and sectoral estimates show that the gap between existing investment and what is needed represents an order of magnitude. This means that incremental increases in climate finance flows will not deliver on these objectives.
>
> *Climate Policy Initiative. "Global Landscape of Climate Finance 2019."*

Multiple estimates exist of the gap between current levels of investment and what is needed to keep global warming below 1.5°C with estimates varying according to the underlying assumptions of the technologies and approaches used to achieve this goal. What is clear throughout is that investment needs to shift rapidly away from fossil fuels toward climate-smart alternatives, and that this reallocation toward climate-smart infrastructure will lead to significant long-term savings and benefits for society (IMF 2019; GCEC 2018; Jacobson et al. 2019).

It is also clear that the investment required outweighs the existing sources of public finance from government and domestic, bilateral, and multilateral DFIs (CPI 2019). Institutional investors have a critical role to play in bridging the climate investment gap, as they hold enough capital to meet the remaining investment requirement and are increasingly viewing infrastructure as a way to diversify their investment portfolios while achieving their long-term investment objectives. Unlocking institutional investor capital will require not only increasing the investible climate-smart project pipeline but also the use of approaches that will enable a broader range of institutional investors to participate in the low-carbon transition.

This section quantifies the climate investment gap and the benefits in closing it, covers the roles of governments and development finance institutions in developing climate-smart infrastructure projects, discusses the potential for institutional investors to help close the climate investment gap, gives a brief introduction to traditional infrastructure finance options, delves into the use of green bonds and green asset-backed securities to finance climate-smart infrastructure projects, and concludes with the need to address barriers in order to attract institutional investment to climate-smart infrastructure.

The Climate Investment Gap

The ability to reach the Paris Climate Agreement goals depends on bridging the climate investment gap by reallocating large capital flows toward climate-smart infrastructure and away from fossil fuel investments to help shift to a green, just, low-carbon global economy.

Society faces three distinct investment gaps related to infrastructure. The first gap is a general *infrastructure investment gap* between current investment trends (i.e., "*business-as-usual*"), estimated at $3.1 trillion annually on average over the period 2016 to 2040, and the investment needed to provide developed country-level infrastructure globally, estimated at $3.7 trillion annually over the same period. This results in a general *infrastructure investment gap* of $0.6 trillion on average annually without consideration for concerns over climate change or sustainable development goals (Global Infrastructure Outlook 2019).[9]

The second gap is the gap between business-as-usual investment and the investment needed to achieve the sustainable development goals (SDGs), which can be viewed as a *sustainable development investment gap*. Achieving the sustainable development goals is estimated to require investment of $3.9 trillion on average annually from 2016 to 2040. Much of the total spending required to meet the sustainable development goals can come by shifting spending away from conventional infrastructure toward sustainable infrastructure. This results in a *sustainable development investment gap* of $0.7 trillion annually (Global Infrastructure Outlook 2019) compared to business-as-usual, or $0.1 trillion compared to the *infrastructure investment gap*.[10]

The third investment gap is the *climate investment gap*, which represents the investment needed to keep global warming to less than 1.5°C degrees. Between $1.6 trillion and $3.8 trillion of investment in low-carbon solutions will be needed annually to keep warming to less than 1.5°C (IPCC 2018). However, as with the *sustainable development investment gap*, some of this investment can come from re-allocating investment away from conventional infrastructure toward climate-smart infrastructure. Applying the high-end investment requirement to keep warming to less than 1.5°C of $3.8 trillion leads to a *climate investment gap* of $.6 trillion annually compared to business-as-usual, or $0.1 trillion compared to the *infrastructure investment gap*. The $0.6 trillion *climate investment gap* is therefore approximately in-line with the $0.7 trillion *sustainable development investment gap*, and the $0.6 trillion general *infrastructure investment gap*.

Other scenarios can achieve similar outcomes for much less. The report *Beyond the Gap: How Countries Can Afford the Infrastructure They Need while Protecting the Planet* for example **shifts the analysis of investment needs away from a simple focus on spending more and toward a focus on spending better on the right objectives, using relevant metrics.** Exploring thousands of scenarios, this report finds that funding needs depend on the service goals and policy choices of low- and middle-income countries and could range anywhere from 2 percent to 8 percent of GDP per year by 2030 (World Bank 2019d). The actual amount depends on the quality and quantity of services targeted, the timing of investments, construction costs, and complementary policies. Finally, infrastructure maintenance is also key to generating substantial savings by reducing the total life cycle cost of transport and water and sanitation infrastructure by more than 50 percent. Improving the efficiency of infrastructure spending, including better

9 The general infrastructure investment gap is calculated on an annual average basis as follows: $79 trillion divided 24 years (i.e. 2016-2040) = $3.3 trillion annually; $94 trillion divided 24 years (i.e. 2016-2040) = $3.9 trillion annually; Investment Gap = 3.9-3.3 =$ 0.6 trillion annually.

10 The sustainable infrastructure investment gap is calculated on an annual average basis as follows: $97 trillion divided 24 years (i.e. 2016-2040) = $4.0 trillion annually; Investment Gap = 4.0-3.3 = $0.8 trillion annually.

maintenance, could significantly help to reduce the investment gap estimates (World Bank 2019d).

Two scenarios that demonstrate how infrastructure costs can be reduced while still meeting the goals of the Paris Agreement have also been provided under other recent studies (IRENA 2019; Jacobson et al. 2019). The first is an energy system in which electricity meets 50 percent of end use energy, up from 20 percent currently, and is supplied by 86 percent renewable energy (IRENA 2019). This would result in a payoff of between $3 to $7 for every dollar spent on the transition (IRENA 2019). The other scenario assumes the electrification of end-use energy across all sectors for 143 countries, representing 99.7 percent of man-made fossil fuel emissions, with electricity provided entirely by renewable energy (Jacobson et al 2019). This scenario reduces end-use energy by 57.1 percent, reduces annual energy costs from $17.7 trillion to $6.8 trillion, and reduces social costs by 91 percent compared to business-as-usual. The scenario also results in a net gain of 28.6 million jobs across the 143 countries studied. This scenario can be accomplished by an 80 percent transition to renewable energy by 2030 and 100 percent by 2050 for generation and using technologies such as electric vehicles rather than internal combustion engines or molten oxide electrolysis rather than traditional steelmaking processes to electrify all sectors. This also results in improved energy efficiency and the elimination of the need to extract and transport fossil fuels and the associated infrastructure costs.

Regardless of which estimate is used, it is clear that there is a large and urgent financing gap to achieve a low carbon global transition in line with the Paris Agreement goals, and this will require a number of solutions and approaches to shift the global economy toward a climate-smart energy transition. Furthermore, the savings associated with climate-smart infrastructure are even higher when factors beyond up-front investment are considered. The next section discusses the economic benefits of channeling funds toward climate-smart infrastructure and how such investment will result in substantial savings that more than offset the investment needed to close the *climate investment gap*. It then discusses the importance of the overall enabling environment and innovative financial structuring models to facilitate leveraging the large balance sheets of institutional investors.

Climate Investment Savings

Aligning investment with climate goals "*could deliver economic benefits of US$26 trillion to 2030 - and this is a conservative estimate* (GCEC 2018)."

Figure 4 shows the various benefits associated with transitioning to a low-carbon economy. The $26 trillion in climate investment savings is a net economic gain that more than offsets the cost. Aligning investment with climate goals would also avoid over 700,000 premature deaths, raise $2.8 trillion in revenues and fossil fuel savings annually, increase female employment and global gross domestic product, and generate 65 million low-carbon jobs by 2030 (GCEC 2018).

Pursuing electrification of energy across all sectors and full decarbonization leads to even greater benefits, estimated at a 57.1 percent reduction in energy needs, a 61 percent reduction in energy costs, a 91 percent reduction in social costs, and a 28.6 million net gain in jobs compared to business-as-usual (Jacobson et al. 2019). This reduces energy costs from $17.7 trillion per year to $6.8 trillion per year, resulting in an annual savings of $10.9 trillion per year, higher global gross domestic product, and a payback period of less than seven years on energy cost savings alone (Jacobson et al. 2019). **Regardless of which *climate investment gap* estimate is used, the benefits of decarbonization far outweigh the costs. The overall cost is also likely to continue to decline because of green technology price trends, but each year of delay results in greater damage and lost savings and increases the investment that will need to be made up for in subsequent years.**

The annual social costs of delay also far outweigh the costs of investment (IMF 2019; GCEC 2018; Jacobson et al. 2019).

The benefit associated with decarbonization becomes more apparent once fossil fuel subsidies are quantified. Fossil fuel subsidies were estimated to have been $5.2 trillion (6.5 percent of GDP) in 2017 alone (IMF 2019). "*By component, underpricing for local air pollution is still the largest source (48 percent in 2015), while that for global warming is similar to earlier estimates (24 percent), followed by broader environmental costs of road fuels (15 percent), undercharging for general consumption taxes (7 percent) and for supply costs (7 percent)* (IMF 2019)." The largest subsidies in 2015 were in China ($1.4 trillion), the United States ($649 billion), Russia ($551 billion), the European Union ($289 billion), and India ($209 billion). Increasing attention is being paid to reforming fossil fuel subsidies for a cleaner, fairer future (World Bank n.d.a.).

Putting policies in place to eliminate fossil fuel subsidies and redirect resources from fossil fuels toward climate-smart, sustainable growth is also starting to provide the signaling and incentives needed

Figure 4 The Global Benefits of a Decisive Shift to a Low-carbon Economy when Compared with Business-as-usual

Source: GCEC 2018.

to help recalibrate institutional investor portfolios and accelerate financial flows into climate-smart infrastructure and projects. The number of companies participating in networks such as the Institutional Investors Group on Climate Change, RE100, and the Net-Zero Asset Owner Alliance is growing rapidly and leading to pressure for companies to adopt such practices as climate-related financial disclosures and divestment from fossil fuel assets.

The Role of Governments and DFIs[11]

Governments and DFIs have a key role, but the private sector is also critical in bridging the climate investment gap.

The investment needed to strategically plan for and build new climate-smart infrastructure and to retrofit or replace old infrastructure is greater than public budgets and commitments under existing nationally determined contributions (United Nations 2020). While the cost of failing to bridge the climate investment gap will fall disproportionately on emerging economies and the most vulnerable (IPCC 2018), the recent fires in Australia, California, Siberia, Brazil and Canada demonstrate that no country will be spared the adverse effects of the climate crisis.

As governments move toward developing stimulus packages to stem the economic impact of COVID-19, it will be vitally important to build the foundation for a more resilient, sustainable and prosperous future (Stephen Hammer, Stéphane Hallegatte and Ferzina Banaji 2020). The choices that governments make to restart their economic engines, including the long-term social, economic, and environmental co-benefits they seek to achieve through their stimulus investments, will be extraordinarily consequential in ensuring that they can rebuild stronger and better and avoid locking in compounding vulnerabilities, environmental issues, high-carbon trajectories and stranded assets for decades to come.[12] "*Governments have a once-in-a-lifetime opportunity to reboot their economies and bring a wave of new employment opportunities while accelerating a shift to a more resilient, low carbon, energy future* (IEA 2020)."

The governance structure and overall enabling environment is essential to effectively implementing infrastructure projects and attracting institutional investment, and the government is responsible for creating the governing public-private partnership framework. "*Successful governance of infrastructure depends on a coherent strategic planning process, an open and transparent prioritization mechanism and decision processes based on affordability and cost efficiency, a clear regulatory and institutional framework, robust co-ordination across levels of governments and evaluation mechanisms that monitor performance throughout the life cycle of the asset* (OECD 2017b)."

Studies such as the "Decarbonizing Development: Three Steps to a Zero-Carbon Future" 2015 report; the "Getting Infrastructure Right" 2017 report; the "Lifelines for Better Development" 2019 report; the "Climate Change and Governance: Opportunities And Responsibilities" note 2019; the "Sustainability Checklist for Assessing Economic Recovery Interventions" 2020 proposal; and the "Sustainable Recovery: World Energy Outlook Special" Report 2020 offer useful frameworks and exhaustive lists relating to the role of government in promoting low carbon resilient and competitive development pathways and enabling environments for private sector investment.

11 "National and international development finance institutions (DFIs) are specialized development banks or subsidiaries set up to support private sector development in developing countries. They are usually majority-owned by national governments and source their capital from national or international development funds or benefit from government guarantees. This ensures their creditworthiness, which enables them to raise large amounts of money on international capital markets and provide financing on very competitive terms:" https://www.oecd.org/development/development-finance-institutions-private-sector-development.htm

12 For further information on the types of criteria and factors for assessing such interventions, please see the "Proposed Sustainability Checklist for Assessing Economic Recovery Interventions." April 2020. World Bank: http://pubdocs.worldbank.org/en/223671586803837686/Sustainability-Checklist-for-Assessing-Economic-Recovery-Investments-April-2020.pdf

These include supportive institutional and legal frameworks (such as supportive regulation for financing options), the provision of needed climate and disaster risk information (such as hazard maps), public sector core functions (such as land-use planning, medium-term investment planning), concessional financing terms and structures, and first mover or risk absorption functions. The OECD Framework for the Governance of Infrastructure, for example, identifies ten areas and principal policy objectives relating to the role of governments in planning and implementing infrastructure investment:

1. "*Establish a national long-term strategic vision that addresses infrastructure service needs.*
2. *Manage the integrity and corruption threats at all stages of the process, from project conception to delivery.*
3. *Establish clear criteria to guide the choice of delivery mode (PPP vs direct public provision, etc.).*
4. *Ensure good regulatory design and maintain a predictable regulatory framework for investment.*
5. *Integrate a consultation process early enough so that decisions benefit from real stakeholder engagement.*
6. *Coordinate infrastructure policy across levels of government in such a way that investment decisions by central and subnational governments are coherent.*
7. *Guard affordability and value for money by using and applying cost-benefit and other methods rigorously and consistently.*
8. *Generate, analyze and disclose useful data to increase transparency and ensure accountability.*
9. *Integrate mechanisms to evaluate the performance of assets throughout their life cycle.*
10. *Review existing infrastructure resilience in the face of evolving natural and man-made risks and develop guidelines to future proof new infrastructures* (OECD 2017b).'

Furthermore, governments must address a number of global governance challenges that climate change presents including the tragedy of the commons, differential impacts, extended time frames, uncertainty, unclear accountability and perceived tradeoffs (World Bank 2019c). For instance, addressing climate change requires long-term planning and looking well beyond the typical planning horizon and electoral cycle. "Such an extended timeframe poses a problem of credible commitment. It is uncertain that future governments will continue today's policies no matter how enlightened they may be" (World Bank 2019c). Countries are putting in place long-term plans through Nationally Determined Contributions (NDCs), 2030 climate action plans, or 2050 vision plans. But these face the risk of being changed according to political cycles or short-term public sentiment. Long-term visibility and reliability of policies and private sector signaling matters for private investment, particularly in large, long-term investments such as infrastructure. Enacting long-term, climate-related plans into legislation, such as through a "framework climate legislation," is enabling some countries to strengthen the credibility of emissions reduction targets and address the "credible commitment" problem.[13]

13 Framework climate legislation is an overarching, supra-sectoral instrument that lays down general principles and obligations for climate change policymaking and implementation. Framework climate laws often have the explicit aim of reducing greenhouse gas emissions and building resilience to climate change by establishing national long-term mitigation and adaptation objectives. Framework climate laws usually establish the institutions and processes needed to meet these objectives, with more specific policy measures defined through subsequent regulation (including sector-specific laws).

Multilateral development banks (MDBs) and DFIs also have critical roles to play in creating enabling environments and mobilizing finance for climate-smart infrastructure in emerging markets (Wharton 2018). MDBs have decades of experience operating in the countries they serve and underwriting infrastructure projects. The ability of DFIs to deploy concessionary capital, provide technical assistance, and assume risks in ways the private sector cannot, coupled with their local knowledge and arrangements with the governments they serve, is important in creating enabling environments and ensuring project structures are designed such that established financial institutions are willing to lend to a country's projects at a reasonable interest rate (i.e., the project is "*bankable*"). The ability of DFIs to support projects hinges on the governance structure and enabling environment in the country as "*no amount of blended finance will compensate for a poor enabling environment and a structurally weak economy*" (Blended Finance Task Force 2018). The climate investment gap is far beyond the capacity of DFIs alone to solve and will require that the private sector reallocate investment.

Climate-Smart Infrastructure and Institutional Investors

Institutional investors have the capital to bridge the climate-investment gap but struggle to find ways to invest in climate-smart infrastructure, particularly in emerging markets.

Institutional investors, particularly pension funds, have large pools of capital, a long-term investment horizon, and a need to generate returns sufficient to meet future obligations. This makes institutional investors a good match for infrastructure projects, given unlisted infrastructure's low volatility, predictable cashflows, and opportunities for diversification (OECD 2013).

OECD pension funds alone hold more than $27.6 trillion in assets under management but are often constrained in the types of investments they can make (OECD 2019). OECD institutional investors more broadly, including sovereign wealth funds, pension funds, insurance companies, investment advisors, endowments, and mutual funds, as well as banks, credit unions, hedge funds, REITs, and other types of financial firms and asset managers, hold more than $100 trillion in assets under management (World Bank 2015). As such, institutional investors alone have more than sufficient capital to fund the entire investment needed to keep increases in global temperatures to less than 1.5°C assuming barriers to investment, including limited investment opportunities, can be removed and successful models to enable investment replicated. The amount of investment needed to close the climate investment gap is also falling as green technology prices decline not only for renewable energy and energy storage (BNEF 2019), and clean transportation (EESI 2018), but also for new technologies and practices in industrial processes (e.g., molten oxide electrolysis in steel manufacturing (Boston Metal 2019), food production, vertical farming (USDA 2018), agriculture, plant-based protein (Maixner 2019), circular waste management, green buildings (Billimoria et al 2019), and climate-smart urban planning.

In addition, many pension funds are facing a shortfall (Vanham 2017) as they struggle to find investment opportunities that can provide sufficient returns to meet future obligations. Despite the benefits of investing in climate-smart infrastructure and availability of capital, institutional investors face significant barriers in deploying their capital to support climate-smart infrastructure. This situation is unfortunate given that properly structured climate-smart infrastructure projects, such as wind and solar projects, not only provide attractive returns but also have a low operating risk profile that could fit within an acceptable range of credit risks for many institutional investors.

Climate-smart investments also provide attractive returns ranging historically from 3 percent to 6 percent for green bonds, 5 percent to 20 percent

for "green" public equities, 6 percent to 10 percent for renewable project debt, and 12 percent to 18 percent for renewable project equity (WEF 2016). For infrastructure more broadly "*70% of institutional investors report historical performance on their overall asset allocation to infrastructure (both funds and direct equity investment) between 12% and 17%. In developing countries, the evidence is less comprehensive. However, returns appear on average to be 200-600 basis points above those in developed markets, albeit with higher variation in outcomes* (Blended Finance Task Force 2018)." These returns are above the returns that pension funds are likely to receive otherwise (WEF 2017) and provide an opportunity not only to bridge the climate investment gap, but also to shore up pension fund shortfalls.

Infrastructure Finance Options

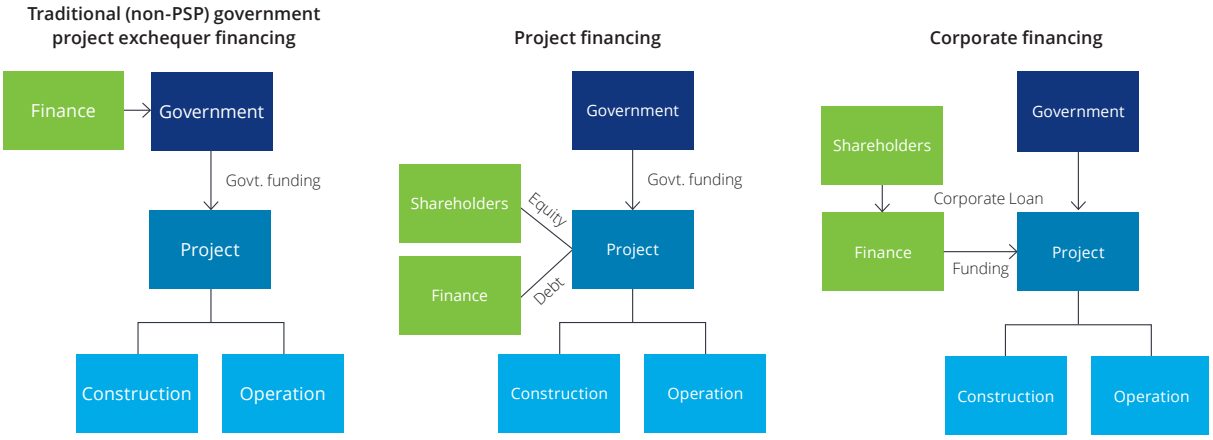
As national budgets and public sector loans from DFIs are insufficient to meet the climate investment gap on their own, public-private partnerships are increasingly being used to good result and can create assets which are attractive to institutional investors.

Institutional investors, including some of the larger pension funds, are investing directly in asset-financed infrastructure projects in more established markets in addition to purchasing green bonds. However, infrastructure projects in emerging markets often face challenges in attracting institutional investment as governance structures are often not bankable (World Bank 2017). Asset finance, including project finance, creates assets that can be securitized to create investment opportunities for institutional investors. However, securitization requires that a credit rating agency issue a rating, which can often be challenging due to the bespoke nature of emerging market infrastructure transactions. Structural challenges and market barriers also need to be resolved to create a successful securitization program (White & Case 2018).

As such, most capital for infrastructure projects still comes from non-private sector participation (non-PSP) approaches, or asset finance, including project finance. Figure 5 summarizes the traditional financing options for infrastructure at a high level, including direct government funding.

In traditional models of public finance, the government provides the resources directly to

Figure 5 Financing Options



Source: Deloitte 2018.

construct and operate the project. In corporate finance transactions, the company that is developing the project uses its own balance sheet to raise financing for the project, typically giving lenders security over the project assets and recourse to the company. In public-private partnerships, commonly referred to as PPPs or P3s, project finance is often used. The key elements of project finance are:

- The creation of a special purpose vehicle (SPV) or "project company" with no previous business or record whose sole purpose is to carry out the project.
- The use of contracts to govern construction, operation, and the revenue stream.
- Limited or no recourse to the sponsors of the project.
- The project remaining off-balance-sheet for the sponsors and for the host government (World Bank n.d.a.b).

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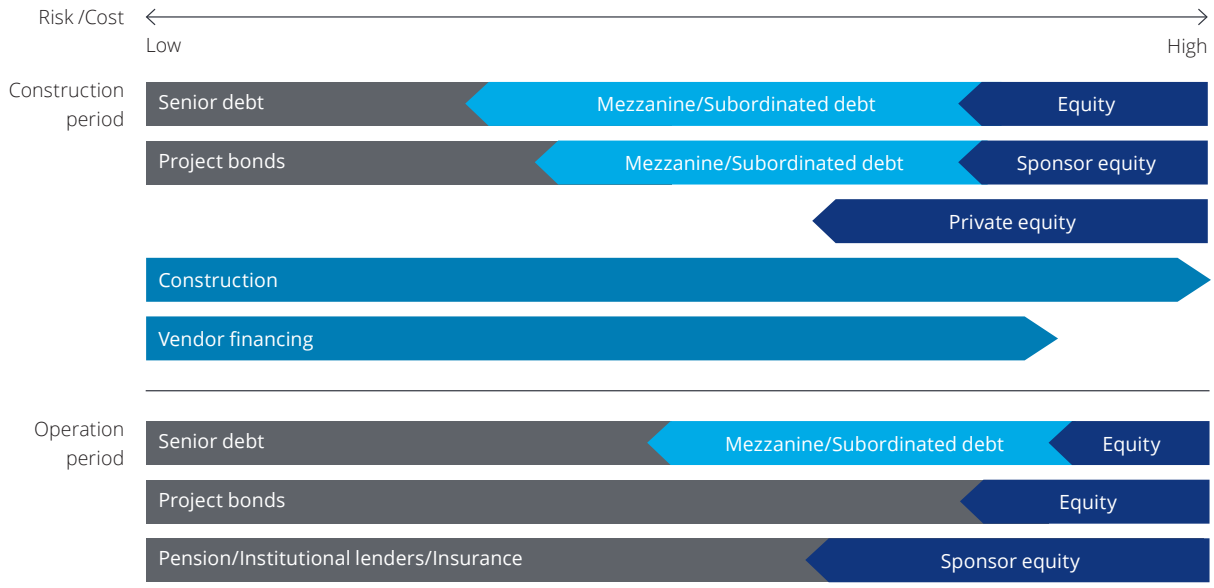
The private sector is playing an increasingly important role in meeting infrastructure needs and achieving SDGs (Deloitte 2018), particularly in financing renewable energy projects. Public-private partnerships and project finance have emerged as an effective way to attract private sector investment to infrastructure projects with good results, with the number of public-private partnerships and infrastructure projects completed on a project finance basis growing rapidly (OECD 2014; UN Environment 2019). The benefits of public-private partnerships are also becoming apparent, with the UK finding a 70 percent reduction in project budget overruns and a 65 percent reduction in schedule overruns for projects using public-private partnerships (McKinsey 2017). From 2010 to 2019, asset finance, including project finance, accounted for $2.1 trillion of the total $2.8 trillion invested in renewable energy (UN Environment 2019). In 2018, of $236 billion in projects financed on an asset finance basis, $144 billion were financed using on-balance-sheet transactions from developers and utilities, with $90 billion financed using a non-recourse project finance basis (UN Environment 2019). Leveraging private sector investment, innovation, and knowledge will be critical to delivering climate-smart infrastructure and services to reduce carbon emissions by 45 percent compared to 2010 levels as needed to limit global warming to 1.5°C (IPCC 2018) and to avoiding locking in inefficient, costly, high-carbon infrastructure for decades to come (IADB 2016).

Figure 6 summarizes the various types of capital available, for both the construction and operational periods of a typical PPP project, and the associated risk and cost for each type of capital.

Using power projects as an example, the terms of debt available prior to construction tend to be very conservative, with a high debt-service coverage ratio, shorter tenors in the case of on-balance-sheet transactions, higher interest rates, and / or lower levels of leverage achievable. The conservative terms of construction loans are due to the uncertainty over whether all parties will

Figure 6 Types of financing over construction and operation periods



Source: Deloitte 2018.

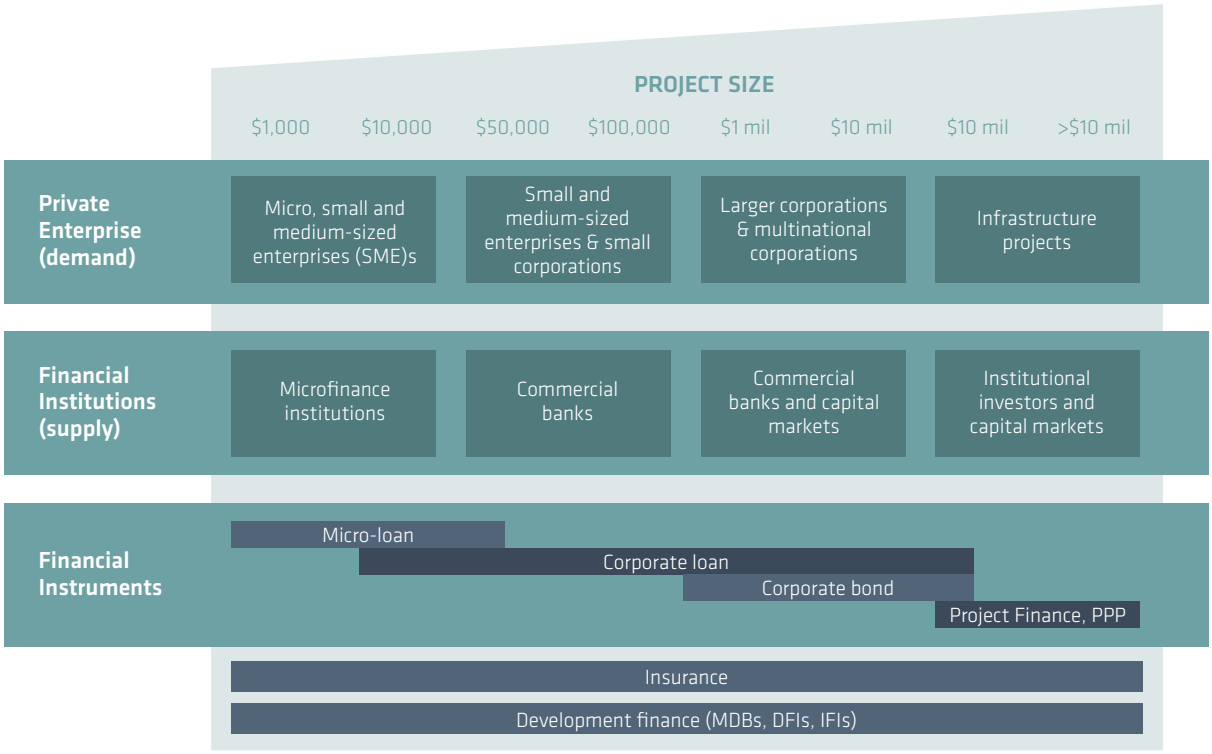
meet their obligations; sponsors will contribute their equity in a timely manner; the engineering, procurement, and construction contractor will achieve milestones on target; and the project will be fully constructed, satisfy testing requirements, and be completed on schedule. There is also uncertainty about whether the loans can be refinanced, and whether operational cash flows will be sufficient to repay debt as scheduled. Operational risks include the intermittency of renewable resources, whether the offtaker will honor its payment obligations as scheduled, and whether the facility will be operated and maintained properly.

Once the project is operational, construction risks disappear, and the operational risks can be assessed given a stable initial operating period. Refinancing at that point offers an opportunity not only to enhance the economics of the project by having more favorable debt terms and resulting returns, but also to pool assets or create securities that will enable a broader range of institutional investors to support these projects. This is critical as the challenge for project developers to raise debt may be accentuated as Basel III capital requirements continue to be implemented, with full implementation expected by January of 2022 (FSB n.d.a.).

Figure 7 details the types of financing available at various project sizes with the largest projects involving the private sector in emerging markets often being financed through blended finance involving DFIs and a syndicate of commercial banks.

Appendix 2 provides a more detailed overview courtesy of Deloitte for each type of capital and their associated characteristics (Deloitte 2018). Both project finance and on-balance sheet transactions create opportunities to issue green bonds or securitize existing assets. Even governments, such as Hong Kong, which issued a $1 billion green bond in 2019, are also able to finance some projects through green bond proceeds. In all cases, the issuance of green bonds and other green securities creates opportunities for institutional investors.

Figure 7 Debt Financing Options for Private Enterprises According to Type and Size



Source: Table adapted from UNEP 2016 report "Demystifying Adaptation Finance for Private Sector".

Green Bonds and Green Securitization

Green bond issuances create opportunities for institutional investors to support climate-smart infrastructure, and models of refinancing and securitization using green bonds and green asset-backed securities have the potential to attract capital in the amounts necessary to bridge the climate investment gap.

Green securitization takes existing financial assets and pools them into a marketable security. These securities are referred to as asset-backed securities, collateralized loan obligations (CLO), collateralized debt obligations, and receivables or "*distributed energy asset receivables*" such as those issued by BBOXX for off-grid assets in Africa in 2016 (PV 2016). Securitization creates assets which can be attractive as "*institutional investors generally have a preference for brownfield-type (e.g. operational) investments, which they see as less risky and more aligned with a long investment horizon* (OECD 2013)."

Green securitizations can offer advantages compared to green bonds issued in support of new projects, including an established payment track record, limited to no construction risk, and an operating performance history. Despite potential advantages in the securitization of existing green assets, green securitization still represents a small portion of both the overall green bond market and the overall CLO market. "*Global green bond and green loan issuance reached an adjusted USD257.7bn in 2019, marking a new global record. The total is up by 51% on the final 2018 figure of USD170.6bn. Of the total, USD10bn (4%) are green loans*" (CBI 2019). In comparison, only $32.4

billion of green asset-backed securities were issued in 2019 (CBI 2019), whereas the global CLO market reached approximately $850 billion (BOE 2019).

Unlocking the funding needed to bridge the climate investment gap and meet the 1.5°C Paris Agreement goal will require all stakeholders to increase climate-smart investment significantly, well beyond what bank and DFI balance sheets can support. As such, funding mechanisms that enable financial institutions to recycle capital to continue offering loans will be required to prevent banks, and the overall climate movement, from being constrained by rapidly running into lending limits once pipeline barriers are resolved.

"*The bond market could provide USD 1-1.5 trillion annually in additional private capital for sustainable projects… however, some structural challenges and market barriers will need to be removed and policies and incentives put in place to ensure adequate returns for investors* (White & Case 2018)." While green bond issuances are growing rapidly, the overall size of the market still falls short of what is possible and what is needed. In 2019, $257.5 billion in green bonds were issued, up from $171.1 billion in 2018 (CBI 2019) and green asset-backed securities accounted for only $32.4 billion of the total despite most utility-scale renewable projects being asset-financed (including project finance).

The slow pace of securitization is likely attributable to several factors. In addition to structural challenges and market barriers, asset-backed securities more broadly fell out of favor after the global financial crisis of 2008 as models failed to account properly for the possibility of a broader market decline in real estate and underestimated the correlation between the underlying mortgages in the event of a financial crisis (FRB 2013, CRS 2010). Given the resulting rise in defaults and the decline in market value of asset-backed securities experienced during the financial crisis, some market participants remain hesitant about asset-backed securities. This is despite revisions to the rules governing CLOs, which were made under the CLO 2.0 and CLO 3.0 frameworks (Milbank 2014) to reduce the risk associated with CLOs, and the fundamental differences between mortgage-backed securities and infrastructure-asset-backed securities.

Project finance loans are significantly different from mortgages as an asset class and "*assets like [sustainable infrastructure projects] provide the long-term income preferred by many institutional investors and CLOs can provide institutional investors access to these assets while improving the risk-adjusted returns with an optimum liability structure which works through economic cycles* (White & Case 2018)." Project finance loans, including infrastructure, demonstrate not only investment-grade levels of default but also exceptionally high levels of recovery in an event of default, which would justify an investment grade rating on a project basis in many cases. Project finance loans exhibit a 5.6 percent 10-year cumulative default rate with an average recovery rate of 77.5, and more than 58 percent of transactions resulted in 100 percent recovery (Moody's Investors Service 2019). This compares with cumulative default rates of 5.1 percent for Baa3-rated corporate bonds and 9.9 percent for Ba1-rated bonds. Project finance transactions also "*trend closer to default rates for single-A corporates by year seven* (Moody's Investors Service 2019)." Ten-year default rates were 7.8 percent in emerging markets and 8.6 percent in developing markets, higher than the 5.4 percent default rate in OECD countries but still well below the 9.9 percent default rate for Ba1-rated corporates. The global default rate was 5.2 percent for public-private partnership projects and 5.8 percent for infrastructure projects (Moody's Investors Service 2018), demonstrating that, for infrastructure project finance (including climate-smart infrastructure), risk perceptions diverge from risks observed in the bank market.

In addition, infrastructure projects are "*relatively uncorrelated with other asset classes* (JPM 2017)," this is particularly true in emerging markets where infrastructure projects are typically governed by a concession or other agreement that provides

for reliable cash flows over the life of the project. Individual projects are also typically not correlated with each other. Adverse events affecting a wind farm in Kazakhstan will have no effect on a solar farm in Panama or an electric rail project in Manila. These loans are less vulnerable to the same risks that caused the mortgage asset-backed security markets to fail during the financial crisis. As such, securitization of climate-smart infrastructure loans can create investment grade–rated securities with reasonable returns that offer exceptionally high levels of diversification and can justify the rating at a fundamental level. Aggregating loans and notes into a common structure and securitizing the assets can also enable institutional investors to finance small-scale assets and small- and medium-size businesses (CBI 2018). Case study 1 demonstrates a securitization model that has been successful in replenishing more than $458 million in bank capital and is being expanded based on this success. Using such models globally can unlock institutional investment opportunities of the size needed to address the climate crisis.

Case study 1, although not limited to renewable energy or climate-smart investments, presents an approach whereby lenders can free up capital to continue making new loans and enable a broader set of institutional investors to support climate-smart investments. Many institutional investors may be unable to invest in climate-smart infrastructure without structures like this due to barriers that can prevent them from investing directly at a project level. Some of these barriers are regulatory, and relate to investment policies that require minimum levels of diversification or prevent investment in assets below a certain credit rating, a lack of budget or capacity to understand each and every market in which a project may be located, and unfamiliarity with investing in emerging market infrastructure. Barriers and examples of other possible ways to address them are discussed in the third section of the report, "Barriers to Institutional Investment in Climate-smart Infrastructure." DFIs, institutional investors, and other capital sources each have a unique and critical role to play in bridging the climate investment gap. This model allows commercial banks and DFIs to continue to underwrite infrastructure loans to ensure that the underlying project structures mitigate and allocate risks appropriately. Institutional investors may not be able to invest directly at a project level, but most can easily purchase investment-grade rated or publicly listed securities.

The use of CLOs for infrastructure is not a new concept, but it offers a model that can leverage the capabilities of existing market participants and an established product to enable increased institutional investor participation in the amounts needed to close the climate investment gap, even in emerging markets. **Notably, despite 36 percent of the underlying loans in the case study being made to infrastructure projects in emerging markets, the securities were still able to achieve ratings as high as Aaa due to the payment track record and credit support of the underlying assets, diversification across assets and geographies, and the credit support of a highly rated entity for the issuance**. At the time of issuance, 27 percent of the loan portfolio was also still under construction but was supported by sponsor completion guarantees and sovereign guarantees. Over 30 percent of the portfolio also had credit enhancement from multilateral financial institutions or export credit agencies. The main barriers to rolling out the model presented in case study 1 are the limited pipeline of bankable, climate-smart projects, structural bottlenecks that may prevent the underlying loans from being securitized, and the willingness of lenders to "give up" loans to climate-smart infrastructure projects before they have encountered capital constraints. Otherwise, the model can be replicated or expanded globally using the architecture that is already in place: DFIs to help structure bankable projects; DFIs and commercial banks to lend to them; intermediaries to securitize, underwrite, rate, and issue the CLOs; and institutional investors to continue investing in CLOs as they already are. In emerging markets, DFIs are also well-positioned to take a first loss-tranche in a CLO structure, as Clifford Capital does in case study 1, to enhance the credit rating and marketability of the issuance.

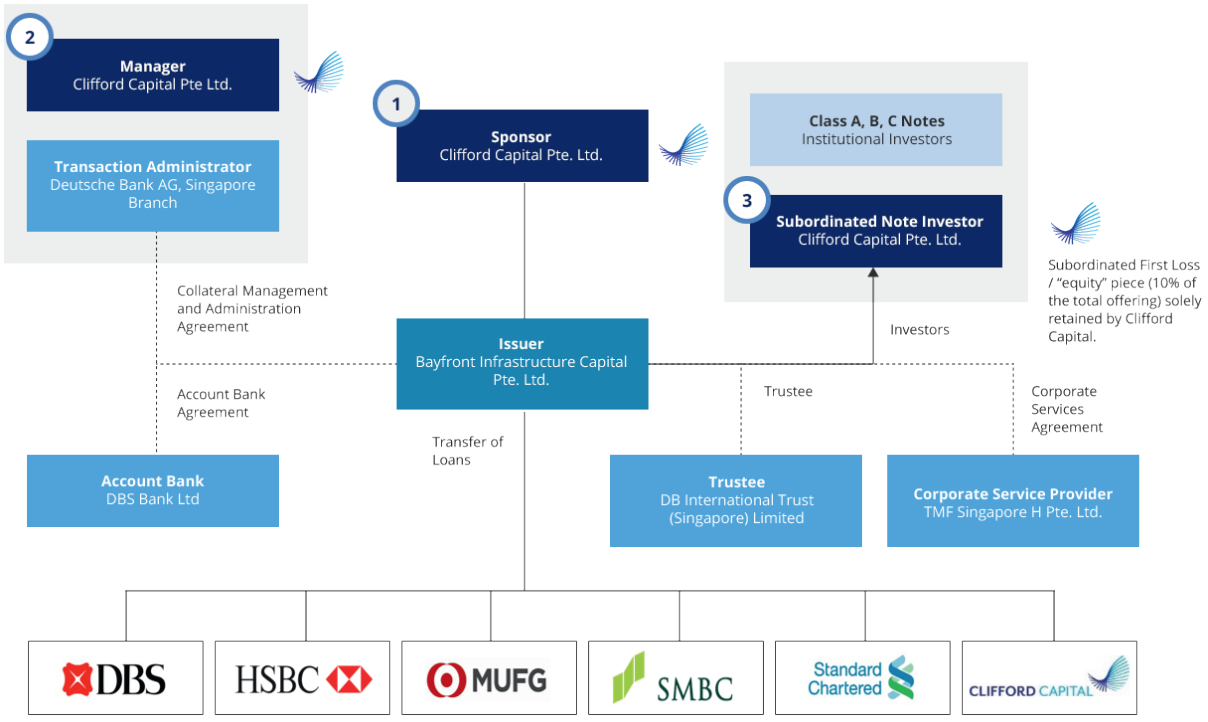
Case Study 1: Clifford Capital CLO Infrastructure Take-Out Facility (Bayfront n.d.a.)

Structure	Collateralized loan obligation issuance
Size	$458 million
Region or country	Singapore (issuance), 16 countries (underlying)
Barriers addressed	Policy and Regulatory, Financing, Transaction and Due Diligence Costs

On July 31, 2018, Bayfront Infrastructure Capital Pte. Ltd. (a special-purpose vehicle that Clifford Capital established for the purposes of the transaction) issued notes for a $458 million take-out facility, the first-ever securitization of infrastructure and project finance loans originating in the Asia-Pacific region. Figure 8 provides a visual representation of the transaction structure.

The issuance pooled 37 infrastructure asset and project finance loans from across the Asia-Pacific region and the Middle East; emerging market loans accounted for approximately 36 percent of the total. Project countries for the underlying assets include the following: Australia (20.6 percent); Indonesia

Figure 8 Bayfront Infrastructure Transaction Structure



Source: Bayfront n.d.a.

(14.4); Vietnam (14.4); Oman (10.3); Mongolia (8.2); Papua New Guinea (6.2) Jordan (4.1), Kuwait (4.1), Singapore (4.1), India (3.1), Saudi Arabia (3.1), Malaysia (3.1), Bangladesh (2.1); and China (2.1). Sectors include the following: Conventional Power & Water (32.7); Integrated LNG (20.8); Renewable Power (12.9); Metals and Mining (11.9); Transportation Infrastructure (7.9); Energy Shipping (5.9); Other Oil and Gas (5.0); and Gas Infrastructure (3.0).

The underlying loans came from the DBS Bank, HSBC, Mitsubishi UFJ Financial Group, Standard Chartered, Clifford Capital, and Sumitomo Mitsui Banking Corporation outstanding loan portfolios. Notes were issued in four classes (A, B, C, Sub), with credit ratings ranging from Aaa to Baa3 sold to institutional investors, with Clifford Capital retaining subordinated notes representing 10 percent of the total issuance to prevent moral hazard. The subordinated tranche is structured to take first loss on defaults and ensures that Clifford Capital would be among the first to absorb any losses. The subordinated tranche also results in credit enhancement of the other tranches, increasing their respective ratings. At issuance, all tranches were oversubscribed, and Moody's Investors Service recently upgraded the ratings of the B notes to Aa2 and the C notes to Baa2. Figure 9 shows the amounts and ratings of the four classes of notes.

The issuance received investments predominantly from the following sources: insurance companies, pension funds, and endowments (39 percent); bank treasuries (33 percent); asset managers (21 percent); and private banks (7 percent). Among investors, 65 percent were from the Asia-Pacific region, with 23 percent from Europe, and 12 percent from the Middle East.

Figure 9 Bayfront Infrastructure Capital four note classes

The Class A Notes, Class B Notes and Class C Notes are rated by Moody's and listed on the Singapore Exchange. The Subordinated Notes are solely held by Clifford Capital as Sponsor and Manager of the transaction.

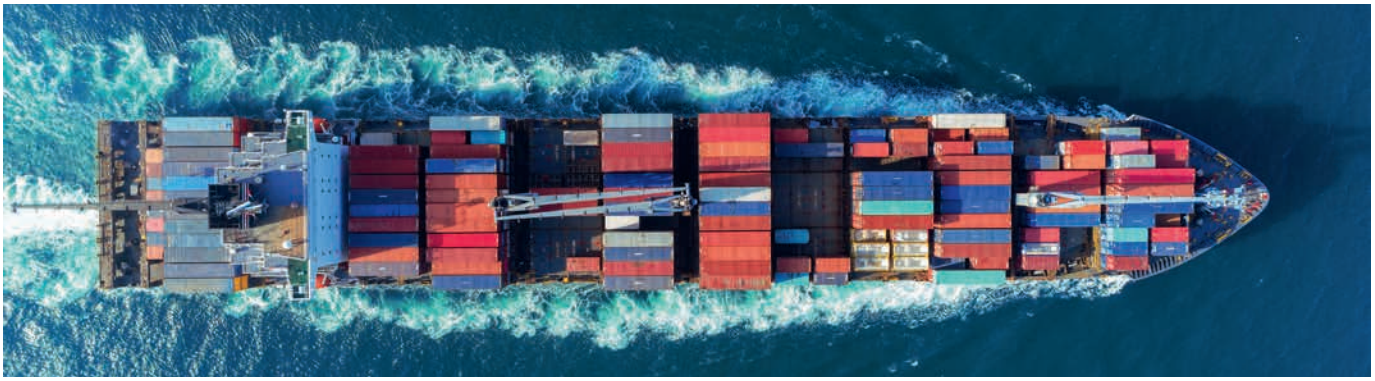
Class	Amount Issued (US$ million)	Amount Outstanding[2] (US$ million)	Issue Ratings (Moody's)	Spread[3]	Legal Maturity Date
A	320.6	247.3	Aaa (sf)	145 bps	11-Jan-2038
B	72.6	72.6	Aa3 (sf)[4]	195 bps	11-Jan-2038
C	19.0	19.0	Baa3 (sf)[4]	315 bps	11-Jan-2038
Subordinated[1]	45.8	45.8	Not rated	N.A.	11-Jan-2038

[1] Retained and not offered.

[2] As of 13 January 2020.

[3] Spread is applied over 6 months LIBOR.

[4] Ratings for Class B and Class C Notes were upgraded by Moody's to Aa2 (sf) and Baa2 (sf) respectively on 21 August 2019.



The Asian Infrastructure Investment Bank (AIIB) and Clifford Capital recently announced the establishment of Bayfront Infrastructure Management Pte. Ltd. (BIM) to help close the infrastructure financing gap in the Asia-Pacific region. The BIM platform will acquire project and infrastructure loans from financial institutions with the goal of selling securitized notes to institutional investors through the public markets.

Securitization platforms like Bayfront Infrastructure Capital and BIM will be fundamental in enabling institutional investors to benefit from the expertise of experienced institutions in the project finance space while supporting climate-smart investments and enabling lenders to recycle capital to continue supporting new projects. The approach can be replicated with loans to climate-smart projects globally; this would not only free up capital for lenders so they could support additional greenfield (i.e. new) projects, but it would also create a pipeline of green collateralized loan obligations and brownfield (i.e. established) projects in which institutional investors could invest.

The issuance included project finance loans to renewable energy projects demonstrating that securitization models like this case study hold the potential to recycle lender capital and create opportunities for institutional investors to invest in renewable energy projects in emerging markets. Models like this can unlock $1 to 1.5 trillion in additional capital annually (White & Case 2018) in support of climate-smart infrastructure. This compares to $1.6 trillion to $3.8 trillion of annual investment needed for supply-side energy system investments to keep global warming to less than 1.5°C (IPCC 2018). A similar approach can be found in the Renewable Energy Platform for Institutional Investors (REPIN) proposed by the European Investment Bank (CFL n.d.a).

> AIIB's investment in BIM is closely aligned with our objectives of developing Asian infrastructure as an asset class and supporting private capital mobilization. Through robust environmental, social and governance criteria, the platform provides institutional investors with a unique opportunity to support sustainable infrastructure projects in Asia.
>
> *AIIB Vice President and Chief Investment Officer D.J. Pandian*

Attracting Institutional Investment

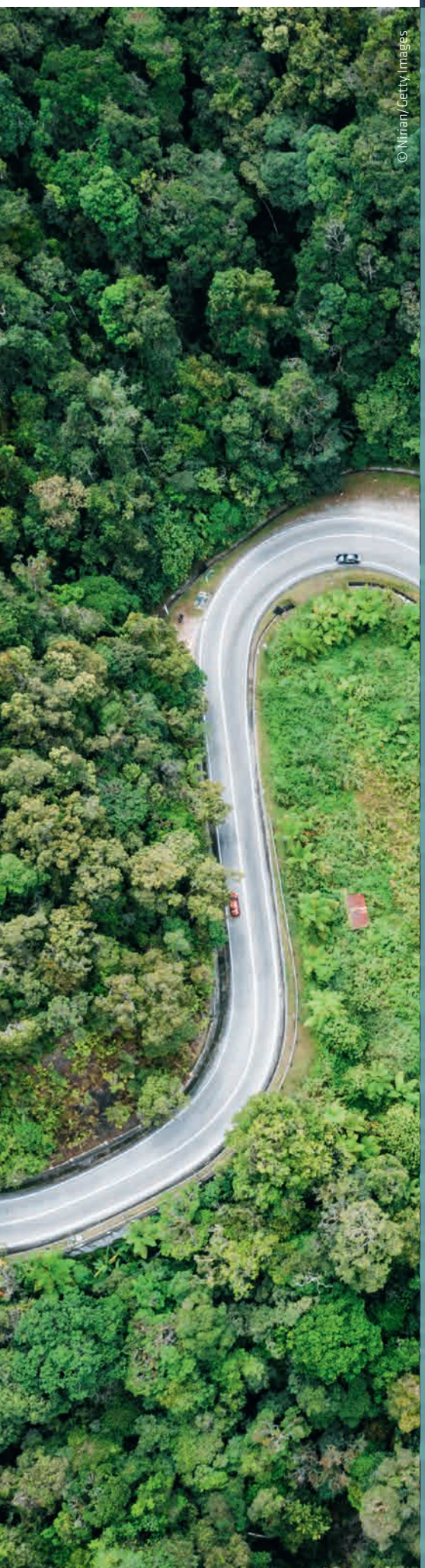
Addressing barriers specific to institutional investors to unlock additional pools of capital to close the climate investment gap is of critical importance to ensuring a transition to a low-carbon, climate-resilient economy.

Although significant attention has been paid in recent years to finding ways to attract institutional capital to infrastructure finance, these efforts have not reached the level of success needed because of the challenges they present such as restrictions on institutional investor asset allocation, the limited risk appetite required, and limitations on exposure to emerging markets. "*Infrastructure accounts for less than 1% of pension fund assets, a number which needs to increase to about 3-4% by 2030 to deliver on the SDGs* (Blended Finance Task Force 2018)."

To attract local and international institutional investors to infrastructure projects in developing countries, the following conditions are fundamental:

- Sound project structures (including a fair risk allocation and appropriate levels of government support in the concession agreement).
- Sound operating and financial performance in the case of brownfield projects (including payment track record from the off-taker, as applicable).
- An investment-grade equivalent credit rating for any securities involved (with the sovereign credit rating often constraining project-level risk assessments).
- Sufficient transaction size to attract institutional interest.
- Appropriate risk management of price risks, foreign exchange risks, and operating risks
- Overall sound host country macroeconomic and policy situation.

However, "*even within developed economies where returns have generally been strong, private investors still perceive infrastructure as a hard asset class. It is illiquid. Regulatory frameworks limit the potential for institutional investors to play. The business models often involve substantial counterpart risk. FX hedges are expensive and typically only available over a relatively short time-frame. Infrastructure remains a sector which is prone to corruption. Institutional weaknesses and missing markets act as barriers to matching large-scale capital with sustainable investment opportunities. And international private capital will only participate at scale if complemented by sizeable amounts of domestic private capital. All this compounds to limit capital flows, especially cross-border into emerging markets.* ***But these risks are often as much perceived risks, as they are real*** (Blended Finance Task Force 2018)." The next section provides a detailed discussion of barriers to enabling institutional investment in climate-smart infrastructure.



04

BARRIERS TO INSTITUTIONAL INVESTMENT IN CLIMATE-SMART INFRASTRUCTURE

04 | Barriers to Institutional Investment in Climate-Smart Infrastructure

> Delivery on the SDGs and the objectives of the Paris Agreement will require scaled-up flows of public and private investment in infrastructure that is socially, economically and environmentally sustainable. To reach these goals, there is a broad consensus in the international financial community that the main barrier to increased investment is not a lack of available finance, but rather a lack of well-prepared and investment-ready bankable projects – i.e., whether a project is attractive enough for investors to decide to invest. This is evident in developing countries, where there is often limited capital available for project preparation, but also in developed economies – in the G20, only half the countries publish infrastructure pipelines.
>
> *The Global Commission on the Economy and Climate. "Finding the Pipeline: Project Preparation for Sustainable Infrastructure."*

Institutional investors face significant barriers in deploying their capital to support climate-smart infrastructure. Institutional investor-specific barriers necessitate not only good underlying project design, but also investment opportunities and securities that meet their requirements and are of sufficient size to be of interest. For example, pension funds are restricted in the level of credit risk they can tolerate and diversification they need (e.g., fixed income investments such as investment-grade liquid bonds, listed equities, and listed funds). This emphasis on liquid marketable securities has left pension funds and other investors heavily exposed to market fluctuations, as the market effect of the novel coronavirus pandemic has demonstrated. Domestic and international institutional investors each also face barriers unique to their own situations. Global institutional investors prefer large well-structured projects whereas domestic institutional investors may be able to support smaller well-structured projects in sectors of less interest to global institutional investors. Domestic institutional investors may also be able to accept a domestic investment grade rating depending on the regulatory environment whereas global institutional investors will seek ratings from international ratings agencies. Medium-sized international institutional investors may also take comfort from the participation of a domestic institutional investor group to bolster due diligence and show local support. Domestic and international institutional investors both have critical roles to play in meeting the goals of the Paris Agreement.

Domestic institutional investors often lack access to international partners and have limited experience with climate-smart infrastructure. Local financial markets are also constrained in their ability to provide local currency financing at the levels needed to support large-scale infrastructure investment, and local bond markets are often undeveloped. Domestic institutional investors seeking to invest in projects with an international component would also face currency exposure should they be required to invest using foreign currencies. However, participation by domestic institutional investors is often helpful in attracting international capital.

"*Failure by domestic investors to allocate enough capital to sustainable infrastructure assets in their own country sends a strong signal to international investors – that even the locals think that the returns are not high enough to justify the risks. As*

a result, finding ways to crowd in domestic private capital into infrastructure deals is particularly significant; it is central to inspiring confidence in the international markets – no foreign institutional investor will be comfortable taking risks that the local pension funds or insurers won't take (Blended Finance Task Force 2018)."

"*Furthermore, the willingness and ability of the host country and its population (pensions, entrepreneurs, SWFs, development banks, etc.) to invest alongside international investors on pari passu or junior terms can also demonstrate local will and execution capacity, as well as local and non-local financial alignment* (CFLI 2020a)." While the lack of domestic institutional investment can hinder international institutional investment, work is being done to facilitate domestic investment.

"*The WBG Finance Competitiveness & Innovation group is working on amendments to local regulations that would allow domestic institutional investors to invest in infrastructure in numerous markets. It is often overlooked that many developing countries have high savings rates relative to developed countries. These domestic resources can be used to finance infrastructure, thereby avoiding hard currency debt (which can prove crippling for projects and countries to pay back if their home currencies devalue). A focus on local markets also helps "crowd in" local financial institutions and investors thereby developing experience and skills which can be used for future projects. This provides benefits in the long run by reducing reliance on international banks and development agencies* (Blended Finance Task Force 2018). "

International institutional investors may have limited experience investing directly in climate-smart projects in developing economies and are often constrained in terms of the types of investments they can make and minimum investment criteria. For example, many pension funds are restricted to investing in listed and liquid securities and funds or bonds with an external credit rating (by Moody's, Fitch, or Standard and Poor's) exceeding BBB to A depending on the type of investment. International institutional investors also often lack the capacity to navigate the complexities of domestic regulatory environments and to assess the risks associated with each project. As such, they depend heavily upon the structuring capabilities of MDBs, the expertise of specialist infrastructure asset managers, and the ratings of the international ratings agencies. Currency controls and political risks such as expropriation are also of concern to international investors, and political risk insurance from entities such as MIGA will often be required to provide the comfort needed to attract international institutional investment.

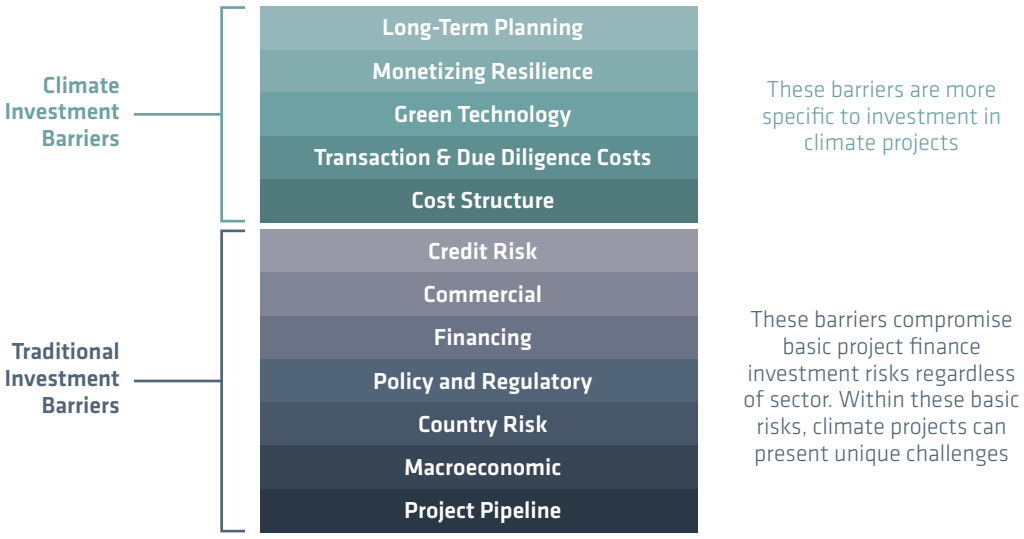
"A low carbon transition requires increased long-term finance flows to developing countries and a bigger share allocated to low-carbon investments (World Bank 2015b)." This necessitates addressing the obstacles to attracting investment to both increase the financing available for infrastructure to "grow the pie," and increasing the portion flowing to low-carbon investments to "green the pie" (World Bank 2015b). Many countries still lack the public funds and local capital markets that can facilitate infrastructure investment at the levels needed, particularly for long-term investments. As such, addressing barriers that affect the ability of all infrastructure projects to leverage existing sources of finance, and facilitating the use of financing models such as those presented in the case studies to attract new sources of capital, can help grow the pie. Additionally, it is important to address the barriers to investment in low-carbon technologies, which can range from differences in upfront and life cycle costs to different risk perceptions compared to conventional technologies. Therefore, enabling financing models that allow climate-smart infrastructure projects to be financed on a long-term basis can facilitate countries in being able to take advantage of the opportunities being created by new technologies to further green the pie.

This section provides a framework for understanding the main barriers to expanding institutional investment in climate-smart infrastructure projects and discusses the importance of the governance framework in creating an enabling environment that can attract private sector capital. It builds on a literature review of existing publications and initiatives to expand private sector investment. To better understand the challenges of investing in climate-smart infrastructure in emerging markets, this report identified two categories of barriers that must be overcome to enable investment at the scale needed to address climate change.

The **first** category of barriers focuses on traditional risks and obstacles that affect both climate-smart and conventional infrastructure projects, while the **second** focuses on barriers specific to climate-smart infrastructure more broadly. Considering these barriers together allows investors and other stakeholders to better understand how these barriers interact with one another and to develop potential solutions to address specific challenges. It should be noted that this list of barriers is not intended to be exhaustive but rather is focused on the barriers that most directly impact the ability of institutional investors to support climate-smart infrastructure in developing countries. Additional barriers including market imperfections and behavioral-related barriers such as the lack of a carbon price in many markets, and other impacts from perceived risks, can also play an important role as discussed in more detail in other reports such as *Decarbonizing Development: Three Steps to a Zero-Carbon Future* (World Bank 2015b).

Case studies are interspersed throughout to provide examples that have been successful in addressing specific barriers. It is important to note that the solutions presented are not prescriptive but are provided to give examples of the ways that risks and barriers have been addressed successfully. Given the bespoke nature of many infrastructure projects in emerging markets, solutions often need to be tailored to the circumstances of the host government. Figure 10 provides a visual representation of how the cumulative effect of these barriers can make it challenging for the private sector to invest in climate-smart infrastructure projects in emerging markets.

Figure 10 Private Sector Investment Barriers



Traditional Investment Barriers

This section reviews traditional barriers to private investment and how these barriers manifest in climate-smart infrastructure projects, summarized in figure 11. There is an additional focus on how these barriers may be exacerbated in climate-smart infrastructure as a result of the additional complexity of climate projects and intricacies of the climate finance architecture. Each barrier impacts the various stakeholders, including the government authority and private investors.

Project Pipeline Barriers

- Limited national government and local developer capacity to create well-structured and bankable projects
- Limited early-stage project preparation support
- Government identification and prioritization of projects can be inconsistent

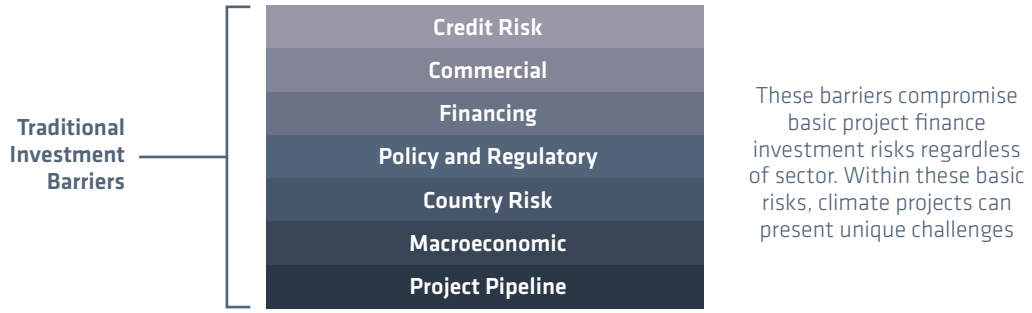
***"Public and private investors broadly see that lack of investment-ready, 'bankable' projects as a major constraint to greater investment in low-carbon and climate resilient infrastructure"* (GCEC 2016).**

The lack of a bankable pipeline of projects is perhaps the most significant barrier to private investment in climate-smart infrastructure in emerging markets. To attract private sector capital, projects require a sufficient quality and size and should offer a fair risk allocation among the host government, the buyer or off-taker, and private investors. Figure 12 shows the rising amount of unallocated funds held by asset managers that have yet to find suitable infrastructure projects in which to invest, with such "*dry powder*" exceeding $200 billion at the end of 2019 (Preqin 2020). The amount of unallocated funds is a direct result of the "*lack of a significant pipeline of well-prepared and well-structured infrastructure projects in emerging markets* (World Bank 2017)."

The lack of bankable projects is often attributed to limited local government and developer capacity for designing and structuring transactions that are attractive to private sector investors, with the lack of capacity resulting in weak project-related contractual frameworks (GCEC 2016).

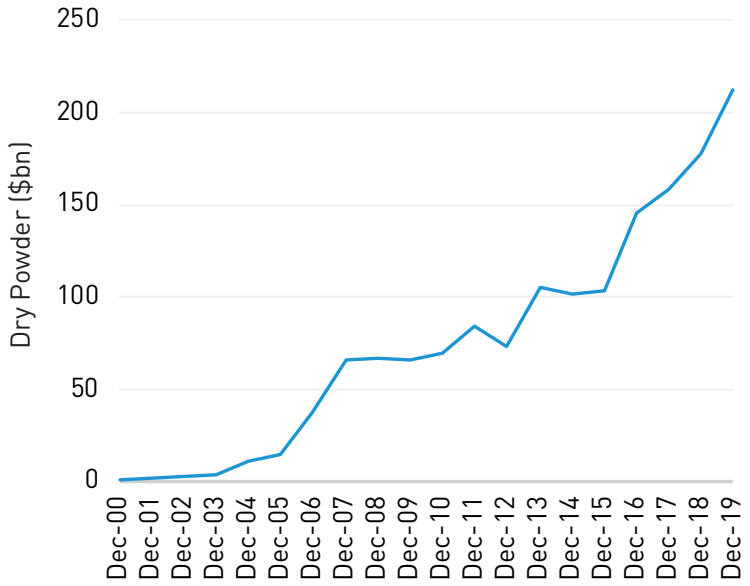
To help address the critical need for project preparation support and pipeline size, the Global Infrastructure Facility was established in 2014 as a G20 initiative[14] to support governments at the national and subnational level—including cities—and multilateral development banks with funding and hands-on technical expertise to design and structure

Figure 11 Traditional Investment Barriers



14 G20 is an international forum for governments and central bank governors of 19 countries and the European Union.

Figure 12 Unallocated investment "dry powder" for unlisted infrastructure



Source: Preqin. 2020.

infrastructure investment opportunities that are attractive to private capital.[15] It was designed to address pipeline size through standardization, aggregation, and concerted private sector engagement to generate interest in projects.

Even before selecting specific projects, investors can struggle to identify climate-smart infrastructure projects in developing countries that align their return expectations with their expectations about the effect that the project will have. **SDG Impact**, a flagship UNDP program, has developed bottom-up investor maps for a series of priority countries that potential investors can use to screen investment opportunities according to sector, subregion, return expectation, investment size, and sectors (including climate, energy access, sustainable infrastructure, and agriculture).

Initiatives to offer replicable frameworks such as Open Source Solar,[16] a joint effort of International Renewable Energy Agency and the Terrawatt Initiative, and the International Finance Corporation's Scaling Solar[17] program can also facilitate and streamline development of bankable projects. It is important to note that experienced subject matter experts must adapt these programs to local market conditions, and the programs cannot be used off-the-shelf in all situations. These programs are also solar-specific, and a transition to a low-carbon economy will require support for all renewable electricity types, energy storage, transportation, water and waste management, and other types of climate-smart infrastructure and technologies.

Box 2 highlights the new Climate Investment Platform, which is being designed help address the project pipeline barrier by assisting governments with support to design bankable project frameworks, providing a marketplace to match projects with investors, and making financial de-risking support available.

Case study 2 demonstrates an approach that has proven effective at addressing project pipeline barriers by engaging in long-term planning and removing policy barriers to enable commitments totaling over $14 billion in Colombia's roads from both domestic and international institutional investors (World Bank n.d.a.d.). Long-term planning barriers and regulatory barriers are discussed in their relevant sections below. Approaches like the one used in case study 2 can be adapted to facilitate investment in climate-smart infrastructure to help accelerate decarbonization. Implementing models that improve the efficiency of spending through improved procurement and competition for public works can help increase infrastructure construction without the need to change public budgets.

15 See https://www.globalinfrafacility.org/sites/gif/files/GIFBrochure.pdf

16 See https://opensolarcontracts.org/

17 See https://www.scalingsolar.org/

Box 2 Spotlight: Climate Investment Platform

Source: https://www.climateinvestmentplatform.com/

Launched at the U.N. Secretary General's Climate Summit in late 2019, the Climate Investment Platform is an inclusive global partnership led by International Renewable Energy Agency, the United Nations Development Programme (UNDP), Sustainable Energy for All, and the Green Climate Fund. The first phase is focused on the transition to renewable energy, with subsequent service lines dedicated to climate adaptation, sustainable land use, cities, and infrastructure being introduced in 2020.

The platform consists of four tracks: supporting governments in specifying ambitious energy targets and increasing their nationally determined contributions; establishing well-designed, well-implemented, well-enforced renewable energy policies and regulations; reducing the financial risk of energy projects; and providing a marketplace where renewable energy investors and project sponsors can connect.

A crucial component of the platform is the Track 2 policy risk reduction work, which UNDP is leading. This track will offer various services to assist countries with renewable energy policies and regulations, including facilitating and match-making between countries and partners involved in Track 2; providing direct technical assistance to governments on drafting, implementing, and enforcing well-designed policies; promoting transparent communications and data on domestic renewable energy policies and investment risks, including diagnostics and targeting information gaps; and facilitating knowledge and sharing of the latest international good practices and innovations in policy design.

This track will involve close work with the Center for Policy De-risking, a new initiative to provide developing countries with rapidly deployable, hands-on, in-country technical support in policy design and implementation.

Case Study 2: Colombia's Fourth Generation (4G) Roads Concession Program

© Arturo Rosenow/Getty Images

Structure	Technical assistance and public private partnership program
Size	$14.8 billion
Region or country	Colombia
Barriers addressed	Project Pipeline, Long-term Planning, Policy and Regulatory, Financing

Colombia's Fourth Generation Roads Concession Program (4G) was developed to address the need for improved road infrastructure, which was hampering Colombia's further growth and competitiveness. The World Bank Group provided advisory and financing support to identify improvements in the local regulatory and institutional frameworks to enable both domestic and institutional investors to support building critical roadways. IFC provided transaction advice in the award of 32 road projects totaling $14.8 billion. As part of the program, IFC also invested $50 million in a domestic infrastructure debt fund

and $70 million in Financiera de Desarrollo Nacional (FDN), Colombia's national infrastructure bank. MIGA provided a loan guarantee for FDN.

The program was developed using World Bank Group's MFD approach and included assistance in developing an enabling environment through revisions to the regulatory and institutional framework, expanding the pre-existing PPP program, capacity building for local officials and investors, and direct investment in FDN. The enabling environment was improved through the passage of a new PPP umbrella framework, with further reforms suggested in 2014, along with the establishment of a new transportation concessions body called the "Agencia Nacional de Infraestructura," and the co-investment by IFC and FDN in the Colombia Infrastructure Collective Debt Vehicle, which facilitates institutional investment in infrastructure. The work also created a standardized project bond and guarantee structure and associated regulations and pricing benchmarks. The PPP program was improved through the advice of the IFC, which helped the government to standardize transaction documents, streamline processes, reduce transaction costs, and increase efficiency. IFC also supervised transaction advisors in the first three 4G projects that were tendered. The investment by IFC in FDN was accompanied by $78 million from Inter-American Development Bank and $50 million from the Corporación Andina de Fomento (CAF), which was also an anchor investor alongside IFC in a local infrastructure fund which mobilized domestic institutional investors for one of the projects.

The initial results of the 4G program were promising with nine projects representing $4.6 billion reaching financial close by the end of 2017. However the program was temporarily paused due to delays and other challenges. It was restarted in early 2019 with the 176-km Autopista del Mar 1 project reaching financial close, new disbursements occurring, and several of the previously awarded concessions nearing completion during 2019. This case study provides a valuable template and lessons learned that can be adapted to address project pipeline, policy and regulatory, financing, and long-term planning barriers to institutional investment in climate-smart infrastructure. The case study also demonstrates the importance of participation by domestic institutional investors and ways to attract international institutional investment.

Macroeconomic Barriers

- Foreign exchange risk
- Interest rate risk
- Inflation

"***Strong institutions with a track record of good governance and the commitment and capacity to provide stable macroeconomic management is a major factor for investors as are sound macroeconomic policies to drive broad-based growth, provide investors with broad assurance of the financial sustainability of their investments* (CFLI 2020)."**

For foreign investors, currency volatility is one of the most pervasive challenges to investing in developing countries over the long term. Foreign investors typically denominate their balance sheets in hard currencies, such as dollars, yen, euros, or pounds. Investments in local currencies, especially for long-term infrastructure projects, can create an asset-liability mismatch and can expose investors to significant foreign exchange risk (Blended Finance Task Force 2018; CFLI 2020). Denominating projects in hard currencies can be better for foreign investors but can expose the local offtaker to more foreign exchange risk unless proper government support is contained in the concession agreement.

Some solutions to currency risks include hedging instruments and local currency financing to the private sector. For example, Guarantco and the Currency Exchange Fund offer investors and

governments opportunities to hedge their currency exposure. The Currency Exchange Fund pools foreign exchange risk into a global fund with a first-loss tranche that allows foreign lenders to provide local currency loans, and Guarantco offers local currency guarantees. To mitigate the risk of currency fluctuations and asset–liability mismatch, international financial institutions, such as the International Finance Corporation, can provide local currency financing to the private sector, including loans, swaps, guarantees, and risk-sharing facilities,[18] although these solutions are not sufficient to address the need, and more sustainable solutions will come from more developed local capital markets and an expansion of local currency financing through local and international commercial banks (IISD 2015).
In traditional project finance transactions with international developers and sponsors, currency and inflation risk can also be captured in the project structure. The tariff can be paid and indexed in a hard currency or the currency of the private sector investors in the project (CFLI 2020), the tariff can also include inflation indexation for the cost components vulnerable to inflation.

Two networks have formed to share best practices and experiences on macroeconomic, fiscal, and public finance management policies for low-carbon, climate-resilient growth. The Network of Central Banks and Supervisors for Greening the Financial System, launched in 2017, is a group of central banks and supervisors willing to share best practices and contribute to the development of environmental and climate risk management in the financial sector and to mobilize mainstream finance to support a transition to a sustainable economy. Similarly, the Coalition of Finance Ministers for Climate Action, which the World Bank and the International Monitory Fund co-convened in 2018, recognized the unique role of finance ministers in addressing climate challenges and developed the Helsinki Principles and the Santiago Action Plan (World Bank 2019; Coalition of Finance Ministers for Climate Action 2019). The coalition brings together 50 finance ministries and institutional partners, including UNDP, OECD, the United Nations Framework Convention for Climate Change Secretariat, UNEP Finance Initiative, the European Commission, the Nationally Determined Contributions Partnership, and the Network for Greening the Financial System.

Currency barriers can also be addressed through green bond issuance. Case study 3 is a novel approach whereby a green bond was issued in Europe to institutional investors and then swapped using derivatives to both refinance brownfield projects and issue new loans to greenfield renewable energy projects in Mexico. This approach addressed interest rate and foreign currency concerns and created an opportunity for institutional investors to support climate-smart infrastructure in the process.

18 The International Finance Corporation has provided more than $13 billion in local currency financing (see https://www.ifc.org/wps/wcm/connect/corp_ext_content/ifc_external_corporate_site/Solutions/Products+and+Services/Treasury-Client-Solutions).

Case Study 3: Refinancing with Green Bonds: North American Development Bank (NADB 2018)

Structure	Green bond issuance and refinance
Size	$126.4 million (bond issuance), $53.06 million (refinance)
Region or country	United States (issuer), Mexico (recipient), Switzerland (country of issue)
Barriers addressed	Macroeconomic, Financing, Transaction and Due Diligence Costs

North American Development Bank (NADB) is a 25-year old development finance institution capitalized by the governments of the United States and Mexico that supports infrastructure projects that preserve, protect, or enhance the environment along the U.S.-Mexican border. NADB leveraged its strong ratings of AA/F1+ from Fitch Ratings and AA1/PRIME-1 from Moody's Investors Service to issue its first green bond in 2018, which was issued in accordance with NADB's Green Bond Framework (NADB n.d.a.), and adheres to the International Capital Market Association green bond principles (ICMA 2020). The purpose of the green bond issuance was to finance and refinance eligible projects.

The green bond was issued for $126.4 million equivalent under management by Credit Suisse with a coupon rate of 0.3000 percent and a maturity in July 2026 in the Swiss franc market, with a value of 125 million Swiss Francs. The proceeds were converted to U.S. dollars through a cross-currency swap, resulting in a rate equivalent to a three-month London Inter-Bank Offered Rate plus 42.20 basis points. The proceeds are being used to support six renewable energy projects with a cumulative installed capacity of 1,118 MW generating an estimated at 3,312 GWh in renewable energy annually. This is equivalent to the amount of electricity that 438,000 households use annually. These projects are expected to help avoid more than 1.45 million metric tons of greenhouse gas emissions, the equivalent of taking 309,440 cars off the road annually.

> // The issuance of our first Green Bond in 2018 represents a logical step in our evolution and our desire to be at the forefront of innovation.
>
> *NADB Acting Managing Director Calixto Mateos-Hanel*

Of the green bond proceeds, $53.06 million was used to refinance NADB's loan to the 199.5-MW EDP Renewables North America Wind farm in Coahuila, Mexico, which was initially financed with an $89.8 million loan from NADB and began operations in September 2017. The Mexican mining company Industrias Peñoles, S.A.B. de C.V. purchases power from the project under a long-term power purchase agreement. The project generates approximately 699 GWh per year, equivalent to the energy that 89,791 households use per year, avoiding 337,680 metric tons of carbon dioxide equivalent annually.

The remaining $73.36 million was used to finance five projects: the 317.5-MW Puerto Libertad project in Sonora, Mexico; the 148-MW Santa Maria project in Chihuahua, Mexico; the 125-MW Orejana project in Sonora, Mexico; the 250-MW El Mezquite wind project in Nuevo Leon, Mexico; and the 5-MW SEPV project in California. Combined, these projects are expected to produce 2,613 GWh of electricity annually, equivalent to 348,410 households, and they are expected to avoid 1,137,781 metric tons of carbon dioxide equivalent emissions annually.

This green bond issuance enabled international institutional investors to support the refinancing and financing of renewable energy projects in a middle-income country, and it provides a model for a bond issuance in a foreign currency with proceeds ultimately used to support climate-smart investments locally. Such models can be used to overcome financing barriers to enable institutional investment in climate-smart infrastructure in countries lacking a local green bond market. The projects also benefited from the involvement of a development finance institution whose expertise in financing projects such as these ensured that the projects were properly structured and were aligned with the host government's renewable energy policies.

Country Risk Barriers

- Currency convertibility, transferability
- Breach of contract
- Expropriation
- War, terrorism, civil disturbance

***"Policy risks, such as expropriation, sovereign breach of contract, or lack of availability of hard currency, are crucially important considerations for investors* (CFLI 2020)."**

Although some country risks, such as currency convertibility, transferability, breach of contract, and expropriation, are clearly within the control of the host government, others, such as embargos, war, terrorism,

and civil disturbance, may be outside a government's control. Country risks can be addressed by including appropriate provisions in the project agreements and further mitigated using political risk insurance or partial risk guarantees if structured properly.

Foreign currency convertibility risks can be addressed by having the tariff paid in a major currency or including appropriate indexation and timing provisions and ensuring that proper transferability provisions are included in the concession or implementation agreement and can be covered by political risk insurance. "*The degree to which a country can peg its currency to a hard currency, or denominate project revenues in a hard currency is thus an important consideration* (CFLI 2020)."

Similarly, provisions governing events such as expropriation, war, terrorism, and civil disturbance can be captured in the project agreements, including the concession agreement. With such a framework in place, political risk insurance from an organization such as the Multilateral Investment Guarantee Agency (MIGA) or the U.S. International Development Finance Corporation; a partial risk guarantee from an organization such as the Japan Bank for International Cooperation, the African Development Bank, the International Bank for Reconstruction and Development, or the International Development Agency; or a partial credit guarantee from the Asian Development Bank can be used to mitigate country risk.

Some of these macroeconomic or country risks can also be partially mitigated by involving domestic institutional investors, who have more than $5 trillion in assets under management (Blended Finance Task Force 2018). These local investors have a stronger understanding of domestic markets than outside investors, so they may be more comfortable with country-specific and political risks. Local investors also avoid concerns over currency risk and are often not bound by the same investment restrictions that international institutional investors face (see appendix 3). Bringing local and international investors together in a climate infrastructure deal can have powerful co-benefits (Blended Finance Task Force 2018).

Policy and Regulatory Barriers

- Restrictions related to international financial regulations (e.g., capital requirements, treatment of guarantees)
- Change in law
- Policy inconsistency
- Lack of strong, efficient, impartial domestic dispute resolution system

***"Low-carbon projects are particularly vulnerable to policy risk, such as the ability to predict and rely on stable tariffs, due to declining input costs and a reliance on government subsidies* (CFLI 2020)."**

Long-term investment in infrastructure, climate-smart or otherwise, requires a strong enabling environment to ensure sufficient capital flows, including a strong rule of law with clear rights and obligations of private investors and an efficient, transparent, impartial dispute resolution system. Without an appropriate policy and regulatory environment, many developing countries will struggle to encourage private investment. DFIs and both domestic and international institutional investors can also face regulatory hurdles that can create barriers to investment in clean infrastructure.

With an annual climate investment gap of $2 trillion to $3 trillion, mostly in the developing world (Blended Finance Task Force 2018), governments will need to develop appropriate enabling environments and strategically use limited public funding to attract private capital to meet their climate ambitions. "*With insufficient public finance comes the need for government to set market conditions for attracting capital through effective regulation, budgeting, budget and investment forecasting, and project development*

and management. This can strongly influence the investment environment for public infrastructure and improve project bankability GCEC 2018b."

At the investor level, institutional investors both domestic and international can face regulatory restrictions on the types of investments they can make. "*Local pension funds are often restricted by law from investing in infrastructure. Policy-makers play an important role here: for example, the Colombian government recently implemented regulatory changes to allow pension funds to invest in infrastructure-debt funds, meaning they could invest in the country's Fourth Generation '4G' roads project, giving confidence to international investors. The Peruvian infrastructure bonds market has also seen strong success partly because local pension funds were allowed to invest in infrastructure bonds in 2001* (Blended Finance Task Force 2018)." Some investors may also be subject to financial regulations that prohibit or restrict them from investing in developing countries or in infrastructure more broadly (Blended Finance Taskforce n.d.a). Appendix 3 provides a summary of many of the regulations affecting institutional investors in the US, UK, and Europe.

At the project level, regulations and policies also have significant impact, and adverse changes in governing laws can lead to losses. To address weaknesses in local law, the parties can agree to have a more widely used legal system (often the U.K. system) govern the project agreements. Similarly, if local dispute resolution mechanisms are lacking, the parties can agree to international arbitration by a recognized arbitration center. Provisions governing change in law and dispute resolution can then be covered through political risk insurance or guarantees, enabling institutional investment. Change in law can be addressed through provisions the project agreements, specifically to ensure that the project SPV is compensated through a revised tariff as the result of any adverse change in the law and that such adjustment is also captured in the concession or implementation agreement so that it can be covered by political risk insurance or a guarantee.

Although guarantees are effective at de-risking infrastructure investment, the regulatory constraints of using guarantees can make it difficult for originating banks to sell their exposures to a given asset, and the subsequent illiquidity can reduce the attractiveness of guarantees to risk managers and regulators (Blended Finance Task Force 2018). Conversely, public sector organizations have disincentives to use guarantees because OECD pledges are counted based on money spent rather than money leveraged. Given the power of guarantees to unlock and increase private capital for climate-aligned development, demand is increasing for MDBs and institutional investors to reassess the regulatory treatment of infrastructure investment (G20 Group 2018); but until these changes are in place, existing regulations remain a barrier to institutional investment. Nevertheless, the G20 Eminent Persons Group (G20 Group 2018) and other think tanks and industry associations are increasingly encouraged that the capital requirements for institutional and MDB investment in infrastructure can be reassessed.

Financing Barriers

- Underdeveloped capital markets
- Limited access to affordable and concessional capital, especially in local currency
- Limited risk capital, first-loss financing, or junior tranche equity that can unlock commercial financing in emerging markets
- Lack of standardized term sheets

***"The challenge of limited local commercial banking experience and capabilities, such as the lack of long-term, fixed-rate, non-recourse debt and limited liquidity in local debt and equity markets, can be a hindrance for investors* (CFLI 2020)."**

There is often a mismatch between local currency deposits and the need for long-term financing for infrastructure projects. This inherent mismatch between assets and liabilities can make it difficult for local banks to provide long-term loans. Projects also take time to construct and cannot service loans until after the commercial operation date. This concern over the timing of when a project will start repaying investors can make it difficult for local banks to lend to greenfield projects. The limited access to affordable, long-tenor loans in local currency, can force developers to seek out loans denominated in dollars or other hard currency, which can expose the project to significant foreign exchange volatility and undermine profitability. Private developers also face challenges in funding climate projects. In many developing countries, proven, commercially viable climate-smart technologies (e.g., off-grid power, solar mini-grids, distributed urban solar farms, energy- and water-efficiency technologies) are unfamiliar to domestic investors and commercial banks (Convergence 2019).

Investors have the ability to access development finance from a variety of sources, including private sector arms of MDBs, such as the International Finance Corporation, and climate funds, such as the $10.3 billion Green Climate Fund, $8.4 billion Climate Investment Funds, and $21 billion Global Environment Facility. But these funds are inadequate to meet demand, and the process to access this funding can be lengthy and complex (Blended Finance Task Force 2018). Of the 88 entities accredited to access capital from the Green Climate Fund, only 16 (18 percent) are from the private sector, and only six of these have signed the necessary legal agreements with the Green Climate Fund to begin funding projects (GCF n.d.a.). The private sector received 25 percent of the investments from Climate Investment Funds, and approximately one-third of co-finance is coming from the private sector (CIF n.d.a.), which shows how difficult it can be for private investors to access concessional capital.

To address the shortage of local currency loans available for climate-smart projects, the Development Bank of South Africa launched the Climate Finance Facility (CFF) in February 2019. The CFF is the first green bank model in an emerging market with support from the Green Climate Fund and Convergence Blended Finance. The CFF offers two main credit enhancements in the form of concessional finance to attract private investments and address market gaps: long-term subordinated debt and tenor extension of up to 15 years because the CFF does not face the same regulatory constraints as local lenders. The CFF works with domestic commercial banks to blend public and private capital at the project level and invests in local currency (South African rand), with the goal of leveraging an overall portfolio ratio of 1:5 (Convergence n.d.a.). By working through local banks to offer credit enhancements, CFF fills a necessary financing gap while increasing the capacity of local financial institutions to finance climate projects.

Project size and deal flow pose additional challenges for climate-smart infrastructure projects in developing countries and "*offer less opportunity for financial institutions to reach economies of scale in their financing activities* (CFLI 2020)." A green bond market would be possible; however, aggregation and securitization are limited by market size and the lack of a standardized approach. "*Regional integration may address this challenge, but creates new credit, structuring, and legal complexity* (CFLI 2020)." As such, standardization of project agreements can increase the attractiveness of these smaller investments and facilitate aggregation in addition to reducing transaction and due diligence costs.

Properly structured infrastructure investments, particularly those aligned with the SDGs, can be an attractive asset class in which institutional investors can diversify. Case study 4 presents a model of the use of alternative investment funds to refinance debt in the Indian market to create opportunities for institutional investors to support infrastructure assets.

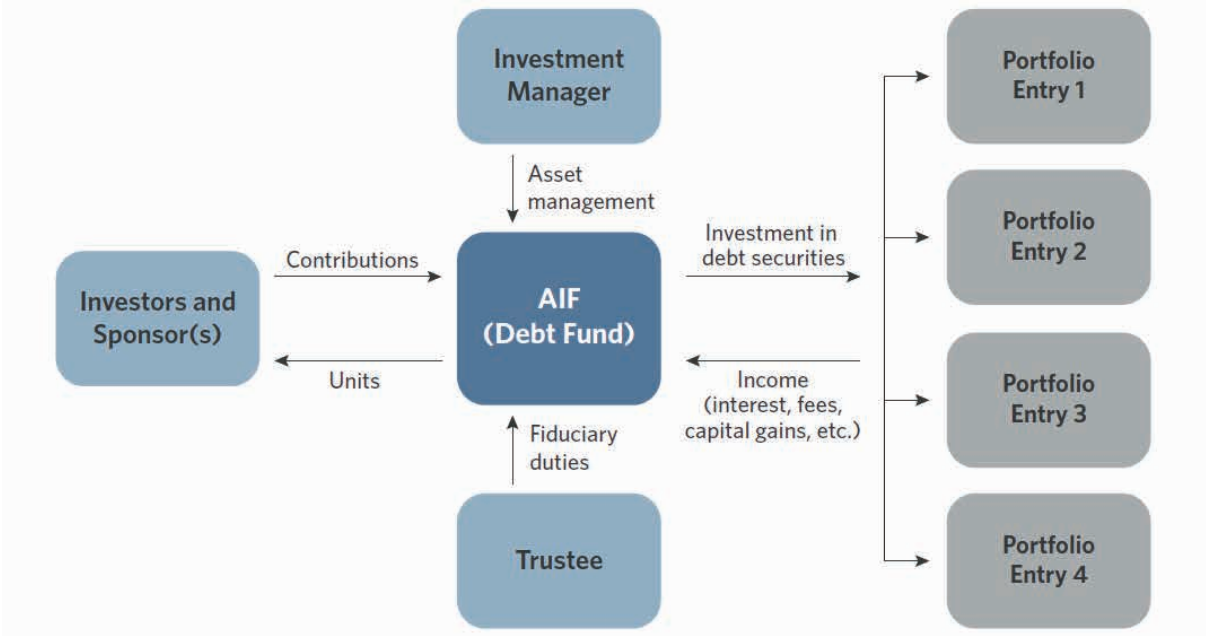
Case Study 4: Take-Out Financing Using Alternative Investment Funds (AIFs) - Indian Renewable Energy Development Agency (Singh et al 2019)

Structure	Alternative investment funds, green Masala bond issuance
Size	$300 million (London Stock Exchange Group 2017)
Region or country	India (fund domicile), UK (Masala bond issuance)
Barriers addressed	Financing, Policy and Regulatory, Transaction and Due Diligence Costs

Rules governing Alternative Investment Funds (AIFs) in India were proposed in 2011 and finalized in 2012. AIFs are private investment vehicles that pool funds to be invested under a predefined investment policy and are equivalent to alternative investment funds in the United States and AIFs in the European Union. This example presents opportunities that could be replicated in other markets to support climate-smart investments. Figure 13 shows how an AIF would operate.

The Indian Renewable Energy Development Agency (IREDA) is a government of India enterprise under the administrative control of the Ministry of New and

Figure 13 How an alternative investment fund would operate



Source: Singh et al 2019.

Renewable Energy that was established as a public limited government company and a nonbank financial institution in 1987 for the purpose of promoting new renewable sources of energy. In collaboration with the Climate Policy Initiative, IREDA has advanced the concept of using AIFs in India to expand capital market access to renewable energy in the medium term while the country addresses other structural challenges. IREDA issued the first-ever green Masala bond on the London Stock Exchange International Securities Market (London Stock Exchange Group 2017). The Climate Bond Initiative certified the issue (CBI 2020a). The $300 million bond had a 7.125 percent coupon and a 5-year maturity. Proceeds from the bond issuance were earmarked to finance wind and solar projects across India totaling 831 MW. Prior to this issuance, IREDA had raised capital through Masala bonds issued in the domestic market.

IREDA is working with the Climate Policy Initiative to advocate for several ways to shift project debt to capital markets: securitizing diversified loan portfolios; using the proceeds of capital market issuances to retire existing debt rather than refinancing the loans directly; increasing investor protection in the event of default; developing risk-transfer mechanisms such as credit default swaps to make investments more attractive; and using AFIs to bridge the $315 billion need for debt finance for renewable energy projects by 2030, assuming the 70/30 debt versus equity split typical in India (Singh et al. 2019). An AIF issuance can benefit from the ability of entities like IREDA to offer a partial credit guarantee, improving the risk profile of the issue; act as an aggregator to bundle multiple project loans into securities; and crowd in long-term institutional investors by acting as an anchor investor.

IREDA offers its own credit enhancement product in the form of a partial credit guarantee (IISD 2018), which is offered to developers of wind and solar

projects in India when issuing green bonds. IREDA can offer an unconditional partial credit guarantee on up to 25 percent of the bond issuance, not to exceed 20 percent of total project costs. Tools such as these can enhance the credit rating of bond issuances, increasing their credit rating and marketability.

> // There is an indisputable shift in momentum in green and sustainable financing across the world and London Stock Exchange Group is proud to be spearheading the growing global green and sustainable financing movement, developing innovative products and services in partnership with our customers.
>
> *LSE Group CEO Xavier Rolet*

An example of an AIF in India selling debentures to institutional investors to refinance climate-smart loans was the issuance of $35 million in nonconvertible debentures to institutional investors to refinance loans to two solar projects recently acquired by the Infrastructure Development Finance Company (Susmit 2017). The Infrastructure Development Finance Company was created in 1997 to support development of infrastructure projects throughout India (IDFC 2020). The debentures were sold to institutional investors through India Infrastructure Fund II, an AIF owned by Infrastructure Development Finance Company Alternative Ltd., a subsidiary of Infrastructure Development Finance Company.

Commercial Barriers

- Demand for infrastructure services and competitive environment
- Local developer and contractor capabilities, particularly in construction and operation
- Resource risks
- Market size limitations on project or investment

"*Smaller markets do not necessarily present greater risk, but generally offer less opportunity for financial institutions to reach economies of scale in their financing activities*" (CFLI 2020).

Commercial risks are inherent to the project or the market in which it operates. Commercial risks can consist of commercial viability and revenue risk, construction risk, operating risk, resource or other supply risk, and natural force majeure risk. All these risks affect the ability to structure the project so that it provides a reasonable economic return to investors in any market and can be more pronounced in emerging and developing countries.

Commercial viability and revenue risk, using power projects as an example, is often addressed through contractual structures, such as power purchase agreements, which ensure that new generation capacity is fully used and that the power produced is purchased. The challenge in achieving a bankable state is to ensure not only a fair risk allocation, but also that creditworthy entities support payment obligations, which often requires government guarantees and political risk insurance. For projects exposed to demand and price risk, such as power projects selling into a wholesale market without a power purchase agreement, this risk can be mitigated using tools such as contracts for difference,[19] although these are unavailable in many markets.

19 Contracts for difference, used in some countries with wholesale markets, are contracts between a low-carbon electricity provider and a government or other entity that guarantees the generator a price for electricity over the life of the contract regardless of market price fluctuations. For more detailed information, see https://www.emrsettlement.co.uk/about-emr/contracts-for-difference/

Construction risk hinges on availability of experienced local developers and contractors to build a project to specifications and meet "conditions precedent" for commercial operation. Locating such parties can be challenging in developing markets. This risk is typically mitigated by ensuring that the engineering, procurement, and construction contractor is an experienced entity with the financial capacity to meet any potential financial obligations under the engineering, procurement, and construction contract. Such payment obligations consist of items such as liquidated damages, should the project not be completed on time or to specification, and warranty payments for a period after completion.

Similarly, the project must be maintained and operated to ensure that it performs according to expectations and maintains any warranty coverage. This operational risk can be addressed in an operations and maintenance agreement with a reputable operator of similar projects.

Natural force majeure risk is the risk of a prolonged disruption to operations or destruction of the facility due to a natural occurrence outside the control of the project sponsors, such as fire, storm, earthquake, flood, or other natural disaster. Although this risk is typically addressed through insurance, it is also important that the effect of any force majeure event be captured properly in the contractual framework of the project to relieve parties of their obligations should such an event occur.

Input supply or feedstock risks are risks such as resource risks for wind and solar projects. These risks can be addressed using conservative estimates of resource performance (e.g., using an exceedance probability of P90, which means that the resource is expected to outperform the estimate 90% of the time), a make-up well drilling program in the case of a geothermal project, or financial derivatives or insurance. As will be seen in case study 4, new insurance products can provide lenders and investors with greater comfort regarding the cash flow of a project, even one that relies on intermittent

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sources of energy such as solar or onshore wind. Similar products could be developed for other types of infrastructure as well, for example, ridership insurance for light rail.

Finally, the commercial viability of the project is contingent upon the type of infrastructure being used. This risk is substantially mitigated in the case of conventional power projects by take-or-pay provisions in the power purchase agreement, although renewable energy projects are often granted only priority grid access. With the greater reliability associated with hybrid projects involving one or more generation types combined with some form of energy storage, including take-or-pay provisions in the power purchase agreement would help level the playing field and further decrease the cost of electricity for renewable energy projects. For other types of infrastructure, such as rail or water, this risk can be somewhat mitigated using market studies and including availability-type payments in the project agreements.

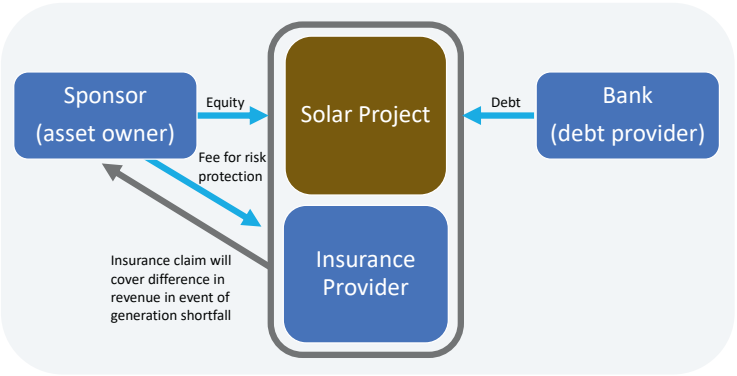
Case study 5 presents a new type of insurance product being used to mitigate several of these commercial risks.

Case Study 5: Using Innovative Financial Tools to Refinance on Better Terms—kWh Analytics

Structure	Refinance using a "solar revenue put"
Size	23 MW & 173 MW
Region or country	United States
Barriers addressed	Commercial, Financing, and Green Technology

Invenergy LLC recently used an innovative "solar revenue put" insurance policy provided by a wholly owned subsidiary of kWh Analytics, with the insurance policy underwritten by insurer Swiss Re Corporate Solutions, to refinance loans from Mitsubishi UFJ Financial Group for its Grand Ridge Solar project. This was the first Contract for Difference (CFD) to benefit from kWh Analytics' solar revenue put. Figure 14 gives an overview of the solar revenue put structure.[20]

Figure 14 Solar Revenue Put Structure



Source: Adapted from Bloomberg NEF 2018 and kWh Analytics n.d.
Note: Gray lines represent Solar Revenue Put coverage

Invenergy is a Chicago-based developer, owner, and operator of more than 146 power facilities, including wind, solar, gas, and energy storage totaling more than 22,600 MW across the Americas, Europe, and Asia. Invenergy's award-winning (Invenergy 2020) Grand Ridge project includes a 210-MW wind farm; a 20-MW (23 MW direct current) solar farm; and three energy storage units of 31.5 MW, 3 MW, and 1.5 MW. Hybrid configurations such as this enable more reliable energy output than wind or solar alone, making them attractive to grid operators. The Grand Ridge project is one of the largest hybrid renewable projects operational globally and is in La Salle County, Illinois. kWh Analytics also recently structured another solar revenue put for the refinancing of the 173 MW direct current Cal Flats solar project in Monterey California.

The solar revenue put is an insurance product and credit enhancement that guarantees up to 95 percent of a solar project's P50 exceedance probability. Although the specific terms of this refinancing have not been publicly disclosed, projects are typically financed on a P75 or P90 basis with a debt service coverage ratio of 1.3x or higher. Using a solar revenue put enables financing with a target debt service coverage ratio of 1.1x to 1.15x. Although this is unlikely to substantially affect loan pricing, the put enables the project to support as much as 10 percent higher debt levels and can potentially enhance returns for equity sponsors.

Although products such as the solar revenue put, or the wind proxy revenue swap that insurer Allianz offers (Allianz 2016), are unavailable in many

20 A contract for differences (CFD) is an arrangement made in financial derivatives trading where the differences in the settlement between the open and closing trade prices are cash-settled. See: https://www.investopedia.com/terms/c/contractfordifferences.asp

developing markets, these products offer greater certainty regarding product cash flows and therefore improve the credit profile of the project.

> // Investors have long sought assurance that solar power plants will perform as promised. With kWh Analytics and Swiss Re now protecting their investments, stakeholders are better able to invest the hundreds of billions of dollars that the solar industry requires in the coming years.
>
> *kWh Analytics CEO Richard Matsui*

Credit Risks

- Creditworthiness of emerging markets and developing countries
- Counterparty risk and creditworthiness of offtaker

Whether the counterparty is a government, utility, state-owned enterprise, or private project developer, project participants must have sufficient balance sheets, track records, and management and operations systems to meet bankability requirements or be otherwise supported by credit-worthy entities.

In on-balance-sheet asset finance and typical project finance structures, cash flows associated with the asset are critical for loan repayment, so the credit risk assessment extends beyond the borrowing entity. In project finance particularly, a new special-purpose vehicle without a track record will be responsible for owning and operating the assets of the project. Therefore, the operations and maintenance agreement is relied on to ensure that qualified, experienced parties will be responsible for operating the asset. The off-take and concession agreements govern the cash flow of the project, so the credit of the other counterparties, particularly the offtaker, becomes a critical risk in assessing the bankability of the project and likelihood of repayment.

Structuring a bankable project often requires that counterparties have support in the form of a guarantee or letter of credit from an investment-grade-rated entity, and that a creditworthy entity can be substituted if a counterparty's rating is or becomes short of what is required. This assumption is reflected in the Standard & Poor's Counterparty Risk Framework and Methodology (S&P 2014), which assumes that a counterparty can be replaced when it falls below the acceptable rating. Lenders also require step-in rights in the project documents so that they can take over the project to replace the operator in an event of default. Such provisions become even more important in the context of securitization, under which investors in a security are typically further removed from the operation of the project.

Even with credit enhancements and other tools such as guarantees and political risk insurance, credit rating agencies will rarely pierce the sovereign ceiling for a bond. Exceptions happen in cases such as the recent debt financing of the Elazig Hospital in Turkey, which benefited from political risk insurance from MIGA combined with an 89 million euro interim liquidity facility from the European Bank for Reconstruction and Development, allowing Moody's to assign the project bond a Baa2 rating, two notches above Turkey's sovereign rating (EBRD 2016). Ninety-three percent of low- and middle-income countries are below investment grade or are unrated (GCEC 2018b) which is a significant barrier for private investors who are restricted to investment-grade assets.

Case study 6 presents an approach that enabled green bonds to be issued to finance affordable and environmentally friendly housing for college students in Kenya with higher a credit rating than the sovereign.

Case Study 6: Green Bonds Programme - Kenya (GBP Kenya n.d.a.)

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Structure	Technical assistance and green bond issuance
Size	$42.5 million
Region or country	Kenya
Barriers addressed	Financing, Green Technology, Transaction and Due Diligence Costs, Credit Risk

Kenya's first green bond issuance closed in October 2019 and was subsequently listed on the Nairobi Securities Exchange as the first environmentally friendly fixed income security in the exchange's 65-year history (Reuters 2020b). The issuance was Climate Bonds Certified and rated B1 by Moody's, one notch higher than Kenya's B2 sovereign rating (CBI 2019b). The issue was supported by Guarantco, structured by Stanbic Kenya, and verified by DNVGL. The issue enabled both domestic and international institutional investors to support issuer Acorn Holdings development of environmentally friendly, affordable housing for 5,000 university students in Nairobi (CGTN Africa 2019).

The bond was the first to be issued under the Green Bonds Programme – Kenya, which was brought together by the Kenya Banker's Association, Climate Bonds Initiative, Nairobi Securities Exchange, FMO, and Financial Sector Deepening Africa. IFC and the WWF – Kenya provided technical assistance and the program itself is endorsed by the National Treasury, Central Bank of Kenya, and Capital Markets Authority. The program was designed not only to support Kenya's first green bond issuance, but also to support the development of a domestic green bond market. The program had seven work streams and outputs: researching green bond potential in Kenya; engaging with local and international investors to develop a pipeline of green investments; leveraging leading banks and corporates to support demonstration issuances; promoting use of green Islamic finance; creating Kenya-based verifiers; creation of a cooperative fixed income facility to enable smaller entities to access the capital markets; and replicating the Kenya experience across the East Africa Community. A similar approach was taken by Nedbank, which launched South Africa's first Renewable Energy Bond on April 30, 2019 on the Johannesburg Stock Exchange (SFI 2019). Models such as these can help attract domestic institutional capital as well as capital from international institutional investors interested in supporting climate-smart infrastructure in a specific country. For those investors seeking exposure to greenfield projects and geographic diversification, and who are willing to accept exposure to a single-developer and technology, bonds such as Scatec Solar's (Scatec 2017) are also an option.

Climate Investment Barriers

This section highlights barriers specific to climate-smart infrastructure projects and how they interact with other barriers, summarized in figure 15. The section also highlights ways these barriers may be misperceived and can be mitigated.

Cost Structure (Upfront Costs vs. Life cycle Costs)

Climate mitigation projects, including renewable energy and electric transport projects, may require higher upfront capital expenditures than conventional approaches but often exhibit lower operating and life cycle costs. This dichotomy between upfront costs and life cycle costs can make it challenging for investors (government and private) to justify higher upfront capital costs despite that such investment often results in the ability to lower the overall cost of services provided to end customers, unless financing is available to enable investors to benefit from a life cycle cost approach.

For example, the life cycle cost for power projects is represented by the levelized cost of energy (LCOE), which equates to the electricity tariff under a power purchase agreement. Capital costs for solar photovoltaic ($900 to $1,100 per kW) and onshore wind ($1,100 to $1,500) are comparable with gas peaker ($700 to $950) and gas combined cycle ($700 to $1,300) but significantly lower than coal ($3,000 to $6,250) as of 2019 (Lazard 2019). However, as shown in figure 16 below, given the lack of a fuel cost, and low operation and maintenance costs for solar and wind, the LCOE for solar and onshore wind is generally below even gas combined cycle. This makes

Figure 15 Climate Investment Barriers

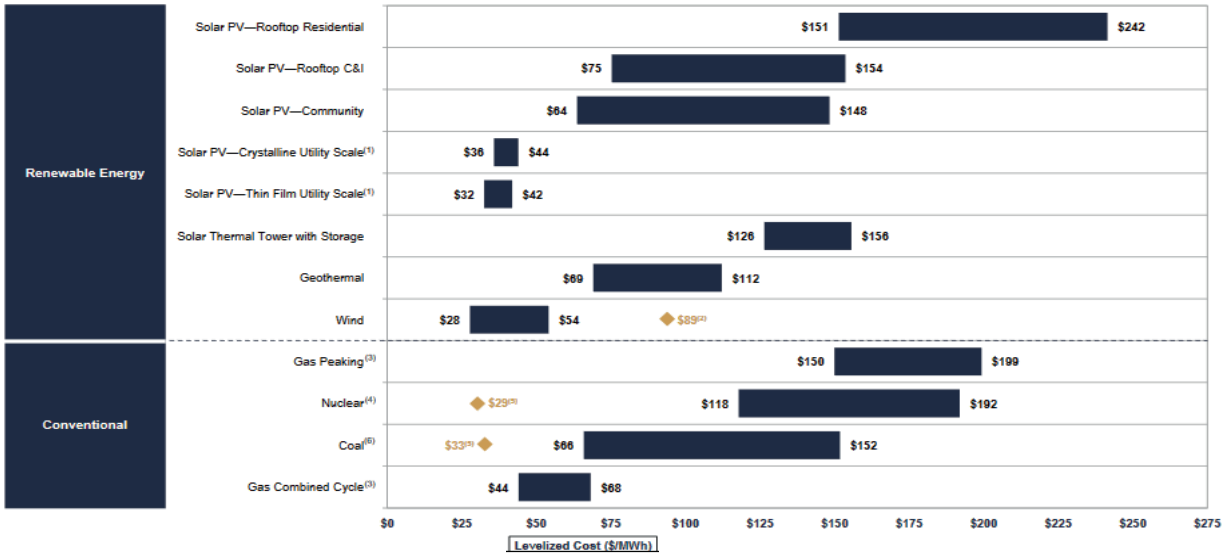
renewable energy from solar and wind the cheapest form of electricity generation on a LCOE basis in many markets (Lazard 2019; BNEF 2019). The cost to both construct and operate new-build wind and solar is expected to fall below the operating costs, let alone capital costs, of conventional generation some time over the next decade (BNEF 2019). This is already the case in the United States, where "*local wind and solar could replace approximately 74% of the U.S. coal fleet at an immediate savings to customers* (EI 2019)."

When fossil fuel subsidies are added back to the levelized cost of energy from these generation sources, the cost savings associated with renewable energy become even more pronounced. For example, adding back the $2 trillion of 2017 post-tax coal subsidies (IMF 2019) to the levelized cost of energy would result in a levelized cost of energy of $266 per MWh to $352 per MWh for coal, versus $28 per MWh to $54 per MWh for wind and $32 per MWh to $44 per MWh for solar.

Constructing new buildings to be all-electric and exclude gas infrastructure can reduce capital costs by 13 per cent or more and result in substantial operating cost savings, leading to significant life cycle cost savings for green buildings (RMI 2018b). Similarly, electric buses, particularly when powered by renewable energy grids, demonstrate significantly lower life cycle costs than traditional diesel buses. Upfront costs for electric transit buses are $200,000 higher than for conventional buses, but lifetime fuel and maintenance savings are approximately $400,000, resulting in a net savings of approximately $200,000 if not financed (USPIRG 2018). Box 3 below provides a real-world example where electric buses reduced the cost per kilometer to 70 Chilean pesos from 300 pesos per kilometer for traditional buses (Enel X n.d.a).

The ability for governments and investors to take advantage of these lower life cycle costs in renewable energy hinges on the availability of financing, which is itself contingent upon bankable project governance frameworks (CFLI 2020). Box 3 illustrates the use of innovative financing models being used to enable a transition to clean transportation.

Figure 16 Levelized Cost of Energy for Electricity Generation Types



Source: Lazard 2019.

Note: Unsubsidized Analysis. Selected renewable energy generation technologies are cost competitive with conventional generation technologies under certain circumstances

Transaction and Due Diligence Costs

"***Transaction costs are already higher for infrastructure than many other asset classes and are then magnified by the real and perceived challenges of new green technology, the small scale of some projects, and the complexity of cities' project development and financing systems***. *Inefficient processes and delays, high due-diligence costs for investors, and the high cost of capital also drive up transaction costs. Since many transaction costs are fixed, this is especially challenging for small projects* (CCFLA 2015)."

One solution to financing smaller climate projects is bundling them together in a blended finance vehicle to "*increase transaction size, improve liquidity of long-term assets, diversify risks, enhance the underlying creditworthiness of the assets and create separate tranches of capital that appeal to different types of institutional investors* (Blended Finance Task Force 2018)." In addition to bundling projects, standardizing successful models once they have been proven would help channel critical funding to climate projects in the $1 million to $5 million range

Box 3 Innovative Financing for Clean Transportation

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More cities are testing electric bus (e-bus) technology to address urban air pollution while providing flexibility and lower cost than building light rail or metro systems. Globally, sales of e-buses increased 80-fold between 2011 and 2017 (WRI 2019).

E-Buses in Chile

In the past few years, Santiago, Chile, has procured an impressive 400 e-buses and now has the largest city fleet outside of China. The program was piloted in 2016 when Enel made Chile's first electric bus available to the Santiago city government. By the end of 2018, the program had expanded to 100 electric buses under a public-private partnership, with Enel X purchasing the buses from Chinese manufacturer BYD and the local bus company MetBus operating them. The buses have zero emissions and *"also provide a cheaper option in terms of operating costs, which are up to 70 percent lower than diesel-powered units. The new electric buses cost 70 Chilean pesos per kilometer traveled, while traditional buses run at around 300 pesos per kilometer."* By the end of 2019, the number of electric buses had risen to 386 (Enel X n.d.a).

Box 3 Innovative Financing for Clean Transportation (continued)

Enel X provided a turn-key solution for Chile under the program, handling engineering and construction of the project and the associated charging infrastructure and provisioning of the power required to charge the buses. Enel X also constructed Chile's first three electric bus terminals and implemented a real-time charging solution that enables the buses to maximize power from the grid and fully recharge in five hours to enable high up-time and low operating costs.

Proterra E-Buses

Proterra, a U.S.-based zero-emissions bus company, piloted an innovative financing model to address the problem of enabling investors to take advantage of lower life cycle costs. Proterra sells battery-powered electric buses to cities for the cost of a diesel bus and leases them the battery for 12 years through a performance-based contract that includes a battery warranty. This allows cities to buy zero-emissions buses using the same financing model that they are accustomed to while removing the perceived technology risk of electric batteries. The Proterra model addresses the financing barriers of electric bus adoption, but some countries are limited in their procurement of these buses because national regulations require that buses be manufactured locally. There is substantial opportunity for private companies to offer similar financing models in developing countries that have the capacity to produce zero-emissions buses locally or are not limited to buying locally manufactured buses.

that often struggle to access capital, although blended finance transactions are often bespoke to meet the specific needs of different investors and based on country and sector context; this can make them difficult to replicate and expand.

This is also why financing models that pool and diversify risk - such as green bonds, asset-backed securities such as outlined in case study 1, yieldcos, or clean energy investment trusts (CPI 2017), and alternative investment funds backed by infrastructure assets - can be particularly attractive. There is a growing trend of pension funds investing in infrastructure through comingled funds, such as Brookfield Renewable Energy's recent $20 billion close of its global infrastructure fund Brookfield Infrastructure Fund IV, and through direct investment in project finance transactions. Direct investment requires significant manpower and knowledge of the local energy markets, which is why it is often limited to developed markets such as the United States or Europe, and large pension funds with the ability to allocate significant resources to each market. Replicating successful models of securitization and comingled funds can help bridge the infrastructure investment gap and the funding gap for pension funds.

Case study 7, although it occurred in an OECD country, is an example of an approach that can be replicated in other markets to crowd in finance by pooling green assets to reach an issue size that would be of interest to domestic and international institutional investors. Securitization has been attempted in developing country bond markets; however, many project bond issues are not large enough to attract international interest. Standardization and aggregation of a number of these issues across borders would not only increase diversification and reduce the foreign exchange risk of the portfolio, but also help the issue reach a transaction size that would be more appealing to institutional investors.

Case Study 7: Green Asset-Backed Securities – FlexiGroup (NAB 2016)

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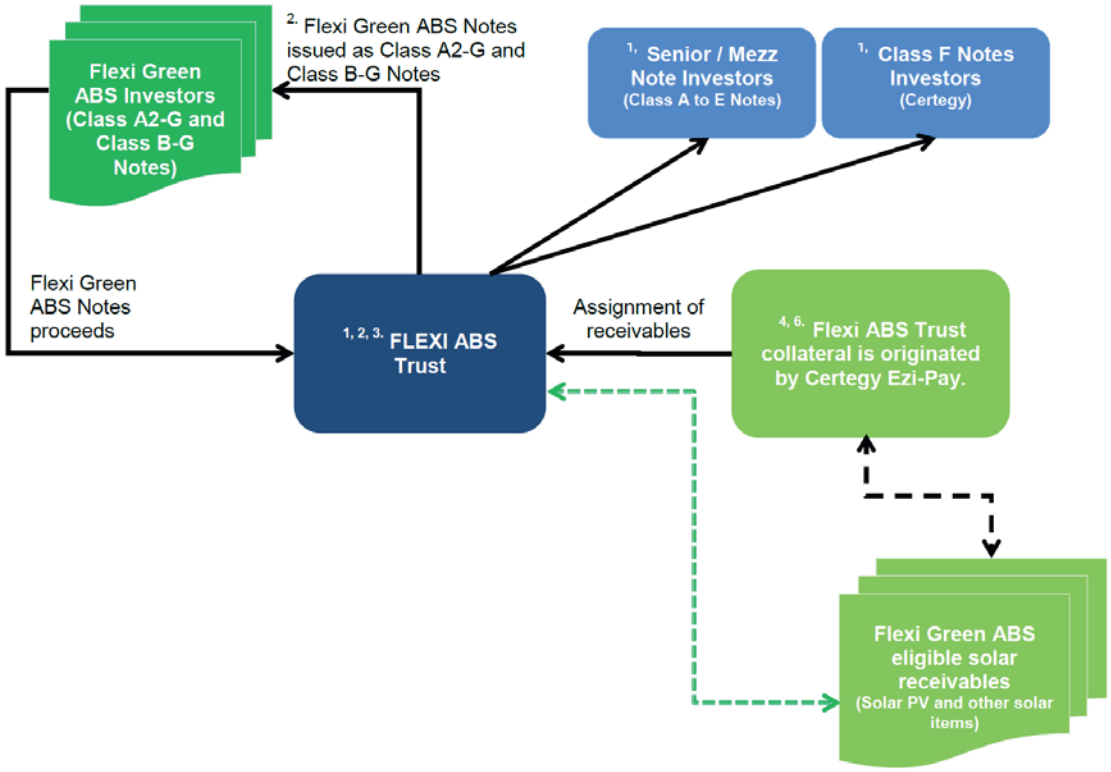
Structure	Green Asset-Backed Securities
Size	$39 million (2016), $38 million (2017), $61.7 million (2018), $65 million (2019)
Region or country	Australia
Barriers addressed	Transaction and Due Diligence Costs, Financing, Green Technology

FlexiGroup's 2016 issuance of green asset-backed securities is the first green securitization that the Climate Bonds Initiative certified (CBI 2020b) and was Australia's first green asset-backed issuance. FlexiGroup is a provider of finance products and payment solutions that operates in Australia, New Zealand, and Ireland and has been listed on the Australian stock exchange since 2006. The class A2-G green notes obtained a rating of AAA from Fitch Ratings and Aaa from Moody's. Figure 17 shows the structure of the issuance.

The initial bond was part of a larger AUD260 million issuance, with National Australia Bank acting as

Figure 17 FlexiGroup ABS Structure



Source: CBI 2020b.

sole arranger and joint lead manager. The trust is backed by AUD256.2 million in consumer receivables originated by Certegy Ezi-Pay Pty Ltd., a wholly owned subsidiary of FlexiGroup that finances consumer receivables; 33.5 percent of the initial issuance was backed by residential solar photovoltaic receivables, resulting in the AUD50 million ($39 million) class A2-G certified green bonds, with these proceeds earmarked to refinance existing solar photovoltaic systems.

The class A2-G bonds were priced five basis points lower than the non-green notes in the same issuance. The bonds have a coupon of one-month bank bill swap rates plus 150 basis points, with a legal maturity of five years, but were expected to be repaid within one and a half years of the issue date because of the amortization profile of the underlying assets.

The success of this program resulted in subsequent issuances for each of the following three years, with the AUD90 million issuance in March 2019 being the largest yet and the first to simultaneously back energy storage assets. This enabled institutional investors, such as Australia's Clean Energy Finance Corporation, to help support investment in rooftop solar photovoltaic systems and small-scale energy storage. Asset-backed securities like these are appropriate for bundling smaller receivables together for residential renewable energy projects to attract institutional investors interested in a specific market. Receivables across geographies can also be bundled into larger securitizations, offering a model to allow developers of smaller-scale projects to recycle capital by attracting international institutional investment in countries lacking an established green bond market.

However, successful securitization would likely require availability of reliable customer payment data and the participation of a strong financial intermediary or DFI.

> We believe the financial sector has an important role to play in supporting the transition to a low-carbon economy, and the exciting opportunities this provides, not only for NAB, but for customers such as FlexiGroup.
>
> *Steve Lambert NAB Executive General Manager, Capital Financing*

Green Technology Barriers

"***Managing perceptions of risks is also vital for ensuring bankability. Even as new technologies and business models become better established, risk perception may be higher for renewable energy and energy efficiency investments as investors tend to view these as less familiar or more exposed to risks of policy changes compared to fossil fuel technologies or centralized utility models*** (GCEC 2016)."

Despite the promise of new low-carbon technologies, climate-smart infrastructure projects can face barriers due institutional inertia and lack of familiarity among lenders (GCEC 2018b) and institutional investors (OECD 2013), and uncertainty caused by the rapid pace of technological change (Deloitte 2018). This inertia is partially due to misperceptions of the relative riskiness of new sustainable technologies versus conventional fossil fuel technologies, which face an increasing risk of becoming stranded assets going forward (OECD 2017, IADB 2016). Regardless of the dislocation between risk perceptions and reality, "*the swift infrastructural, technological and industrial shifts implied by low-emission pathways to 2050 demand more rapid resource reallocation and faster technology diffusion*" (OECD 2017), necessitating an embrace of new clean technologies. Governments that work together to enact policies to encourage private sector investment and to encourage the transition to a low-carbon economy can reap significant benefits (OECD 2017). Blended finance can also be utilized to help de-risk and more rapidly diffuse new technologies (OECD 2017). Private equity funds (GCEC 2018b) and accelerators can also work with newly created DFI venture funds to further increase the rate of adoption and deployment of new low-carbon technologies.

"*We are on the cusp of a new economic era: One that is driven by the interaction between rapid technological change, sustainable infrastructure investment and increased resource productivity*... m*any technologies that can accelerate the energy transition over the coming decades are already known, proven, and starting to be deployed at scale* (GCEC 2018)." Rapidly declining costs and technological advances are causing sustainable investments to become increasingly attractive, with many renewable energy technologies now costing less than traditional fossil fuel-based technologies (GCEC 2018). New economic models that can capture the benefits of transformative technological advances are needed, as are well-capitalized public-private partnerships that can pilot and scale the deployment of new climate-smart technologies (GCEC 2018).

"Yet supportive policies and market incentives to further [sustainable technologies] are lagging, and financiers in local capital markets are reticent to invest due to limited experience (GCEC 2018)." Bankability decisions can be impacted by a lack of capacity within financial institutions, which can fail to engage because of unfamiliarity with the technology, business model, or geography and risk-averse credit committees (GCEC 2016). Institutional investors can also be hesitant to invest in climate-smart infrastructure due to uncertainty around energy and environmental regulations and policies, and challenges for rating agencies to give investment grade ratings to new technology related projects (OECD 2013).

"*Technological breakthroughs are changing the very nature of infrastructure investing as well as the speed and efficiency of the investments* (Deloitte 2018)." This is causing new complexity as technologies can rapidly become obsolete (Deloitte 2018). "*Lenders worry that if any technology used in the project performs badly that will hamper operations, the project will lose revenue, and the sponsor won't be able to repay its debts. This is one of the main reasons why financiers and sponsors seek tried and tested technologies that are not likely to become obsolete during the life of the project* (Deloitte 2018)." The concerns described by Deloitte apply precisely to fossil fuel-based technologies, which are quickly becoming obsolete or more expensive than the latest clean technologies, leading to stranded asset risk (IADB 2016; Financial Times 2020), which makes fossil fuels a better target for such risk aversion. Fossil fuels also face risks of long-term unavailability, such as the 2018 gas explosion in British Colombia that forced an outage of a baseload gas-fired plant (The Columbian 2018), gas explosions such as those in Texas (Daily News 2020), and gas leaks such as experienced in California (Alter 2015). **Over the last 20 years the United States experienced 5,741 significant or serious incidents, resulting in 282 fatalities and $9.5 billion in costs from fossil fuel pipeline incidents alone** (USDOT 2020). Fossil fuel plants also face regularly scheduled maintenance requirements that can take entire facilities off-line for weeks or months at a time, necessitating significantly underused peaker plant backup or energy imports to make up the gap in fossil fuel generation. Clean technologies do not face these issues.

Policy support is needed at a government level to strengthen cooperation on technology development, to promote deployment of the best technologies and business models available today, and to promote investment and deployment of next-generation technologies (GCEC 2018). To drive investment and remove bottlenecks in clean technology finance, governments need to enhance public-private cooperation, improve business models for climate-smart infrastructure, ensure the availability of bankable infrastructure project structures and power purchase agreements for local offtakers, and tie NDCs to credible and effective domestic policies that have the flexibility to adjust to new technologies (OECD 2017). "*Climate change mitigation action requires flexibility: old technologies and infrastructure need to be replaced by new ones. New OECD research… shows that governments need to provide a flexible regulatory environment – which does not restrict firm creation, market entry or competition – to encourage private investment and innovation and thus make the most out of the low-carbon transition… Reforms to reduce the costs of structural change and boost technology diffusion would therefore be particularly relevant* (OECD 2017)." Policies can be enacted that stimulate economic growth, support investment in low-emission infrastructure, and stimulate diffusion of new low-carbon technologies to ensure a cost-effective low-carbon transition (OECD 2017). Policies to support the low-carbon transition can be disruptive, but the disruption can be offset by spreading the benefits of growth widely through policies that improve access to new economic opportunities and provide an adequate social safety net to workers (OECD 2017). Governments working together and taking advantage of new technology trends early stand to reap even greater benefits through economies of scale in climate solutions, hastened declines in technology costs, faster penetration of new low-carbon technologies, and other "first-mover" advantages (OECD 2017). New solar panel designs and materials can achiever lower cost and efficiencies up to 47.1% versus 8-12% in the 1970s (NREL n.d.a.). New wind turbines can reach capacity factors of 60% (NREL n.d.a.b), particularly in offshore wind, higher than typical fossil fuel based capacity factors (USDOE 2015). New energy storage technologies promise longer life and lower life cycle costs (Reuters 2020). The faster these technologies can be deployed in commercial projects the greater the benefits to governments (OECD 2017).

Private sector and DFI initiatives can also help accelerate the adoption of new technologies.

"*Innovative blended finance instruments, structures, and pooled funds therefore offer a way for investors to participate in clean energy investment opportunities in countries with riskier policy environments, often encapsulated by a lower credit rating, and/or technologies and business models without an established track record* (Blended Finance Task Force 2018)." Private equity (PE) firms and infrastructure funds have an estimated US$2.7 trillion in assets under management, with many PE first targeting returns between 15 percent and 25 percent, and "*strategies such as taking technology risk (innovative deployment of emerging technologies) do offer one area where these return expectations may be met* (GCEC 2018b)." SWFs can also co-invest with local PE companies and technology companies to address capacity constraints (GCEC 2018b). DFIs can also play a role at the early stage of technology development as demonstrated by the United Nations Children's Fund (UNICEF n.d.a.) and the Asian Development Bank (ADB 2020), which both recently announced the creation of new venture funds to support impact technology startups in line with the SDGs.

Monetizing Resilience Barriers

Adaptation and resilience projects are often focused on reducing losses from event-driven or acute effects (e.g. severe weather events) and long-term or chronic changes (e.g. drought) associated with climate change rather than generating revenue. One of the barriers to greater private sector participation is the challenge of monetizing benefits and identifying clear revenue streams that would allow investors to recover their full costs over the lifetime of an asset. Large infrastructure adaptation projects can incur high upfront costs and may not prove their value for decades, such as infrastructure built to withstand 50- or 100-year flood events (CCFLA 2015). These projects can also involve the complex challenge of quantifying the value of natural infrastructure such as coral reefs and mangroves to mitigate the effects of climate-related natural disasters for a combination of reasons (WBG 2019b), such as the inherent difficulty of monetizing socioeconomic benefits; the often large and diverse stakeholder groups, including vulnerable populations without the ability to pay for benefits from the interventions; and uncertainties related to climate effects and timing of benefits that depend on when an extreme climate event might occur.

To help monetize investment, governments, cities, and the private sector need approaches to properly price risk and incorporate costs of externalities into economic analysis and financial planning. Nevertheless, although insurance and catastrophic risk transfer markets offer proxy markets to price risk, this is complex, because there is no single metric, such as a price on carbon for climate mitigation, that applies to all sectors and countries. Many climate risks are local, and risks and prices will differ according to location (GCA 2019). Much more international collaboration is needed to produce global data on hazards and exposures, calculations of probabilities, and knowledge of local conditions and vulnerabilities and to create new risk management products and pool risk across countries. In addition, establishing clear climate goals, including at the city level, is particularly important for many essential adaptation projects that may not be bankable in the traditional sense but could attract investment if prioritized (CCFLA 2015).

The private sector has a critical role to play in reducing, preparing for, and recovering from shocks and disasters; and with changing risk perceptions, is increasingly investing in resilience through innovative financing approaches and business models that blend finance and share risk and value (GCA 2019). To help coordinate efforts across the private sector, the World Economic Forum, Willis Towers Watson, the Global Commission on Adaptation, the government of the United Kingdom, and the Government of Jamaica are developing the Coalition for Climate Investment, a private sector–led coalition with assets of $5 trillion that brings together companies all along the infrastructure investment value chain (IIGCC 2019).

Long-Term Planning Barriers

Climate-smart investments and planning need to account for the effect of long-term climate trends and build in flexibility to harness new clean technology innovations and promote cross-sectoral, systems-based approaches. Current procurement processes often contain inefficiencies that prevent the rapid expansion needed to achieve the goals of the Paris Agreement and fail to take a long-term planning perspective. Countries need to develop robust least-cost long-term planning, which often requires analysis beyond the capacity and resources available locally. For example, feed-in tariffs typically result in a higher cost of electricity than can be achieved through a competitive tender (IRENA 2015). The literature review also indicates that combining multiple distributed generation facilities, co-locating solar and wind where possible, and using offshore wind where available is the lowest-cost, fastest way for countries to decarbonize electricity generation and maintain reliability (Brown et al 2018; RMI 2018; Jacobson et al. 2019; NREL 2012). This pathway is followed by many of the **27 countries that generate more than 80 percent of their electricity from renewable energy** (World Bank n.d.a.c), yet few procurement processes or integrated resource plans enable this approach. As countries such as Uruguay have demonstrated, effective procurement requires a long-term commitment to decarbonization and regulations and rules that enable it (IEEFA 2018).

The effect of climate change on the spatial distribution and intensity of natural hazards also makes planning challenging and all assessments uncertain. For instance, climate change models show a wide range of possible futures for global sea level rise and change in timing and intensity of climate patterns. The effects of technology shifts, as mentioned above, also need to be considered. Methodologies and approaches to long-term investment and planning within the context of uncertainty constitute a new field and include robust decision making, decision trees, and adaptive pathways. This new field also considers methodologies that favor robust solutions that perform well across a wide range of futures, preferences, and worldviews, although it may not be optimal in any particular one. However, the complexity and lack of such robust, long-term methodologies and policies present a barrier to private sector signaling and investment (WBG 2019b).

There are a number of initiatives focusing on long-term planning at the global, national, and municipal level that need to be well coordinated, interlinked, and reinforcing at all levels, including the 2050 Pathways Platform,[21] which supports countries seeking to develop long-term net-zero-GHG emissions and climate-resilient sustainable-development pathways; Vision 2050 of the World Business Council for Sustainable Development, which convenes 200 forward-thinking global companies; and the C40 Climate Action Planning Program, which supports almost 100 cities in planning for net neutrality pathways by 2050. For instance, Costa Rica launched its decarbonization plan in February 2020 that covers 10 sectors and policy packages up to 2050.[22] The long-term planning process helped set sectoral milestones for 2030 as well as a list of priority actions and investments (e.g., in electric transit) and is helping address some of the barriers identified.

Case study 8 features a software tool developed by the WBG that helps cities improve their long-term strategies for climate investments, policies, and planning opportunities. It provides powerful, data-driven scenario planning that helps city officials make decisions about the future of their energy, transport, and waste systems.

21 See https://www.2050pathways.org/resources/

22 https://www.2050pathways.org/costa-rica-launches-decarbonisation-plan/

Case Study 8: The Environment Positive Innovations for Cities Investment Planning Tool (EPIC)

Structure	Planning software
Size	Not applicable
Region or country	Global
Barriers addressed	Long-Term Planning

The IFC is piloting a new software called the Environment Positive Innovations for Cities (EPIC) to help cities prioritize and transition to a low-carbon and resource efficient urban growth pathway.[23] The on-line software is an early-stage pre-feasibility climate investment tool that helps cities identify and evaluate green investments, policies, and planning opportunities.

EPIC starts with a baseline-case, projected business-as-usual scenario to 2030. Users can quickly see the effect of different measures on the city's business-as-usual performance into the future, including on future energy consumption, water requirements,

23 Please note the EPIC tool has been built on and evolved from a previous version developed by the World Bank in collaboration with C40, Bloomberg Philanthropies, and the Global Covenant of Mayors, known as CURB (Climate Action for Urban Sustainability) and applies the same GHG methodologies and approaches. See https://www.worldbank.org/en/topic/urbandevelopment/brief/the-curb-tool-climate-action-for-urban-sustainability

waste production, private vehicle travel, carbon emissions, and air quality. It then aggregates emissions, showing the baseline case and the target trajectory with the savings from selected measures. EPIC will be used to identify a list of low-carbon investments and track the effect of investments based on costs, payback, GHG emissions, and feasibility, leading to a pipeline for climate financing (e.g., green bonds, green loans).

In Ho Chi Minh City, Vietnam, EPIC helped identify essential policy and planning actions needed to ensure the efficacy of public transport investments. In Ahmedabad, India, EPIC was used to assess actions in the city's "carbon neutrality vision" presenting a climate investment opportunity of $1.8 billion. IFC is in the process of investing in Ahmedabad Municipal Corporation.[24]

24 See https://www.proptiger.com/guide/post/ahmedabad-municipal-corporation-to-raise-through-dollar-bonds

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05

CONCLUSION

05 | Conclusion

Investment in *climate-smart infrastructure* will need to be accelerated rapidly to achieve the 1.5°C target under the Paris Agreement. Much of the infrastructure investment required under a 1.5˚C scenario is needed in the emerging markets, creating investment opportunities that could exceed $23 trillion by 2030 for institutional investors should barriers to investment be addressed. Decarbonization requires the reversal of deforestation, the adoption of sustainable agricultural practices, and the elimination of fossil fuels from the world's electricity generation, industry, and transport. The burning of fossil fuels for energy is responsible for 73 percent of all anthropogenic carbon emissions; as such, investments in climate-smart infrastructure to help decarbonize the energy system can go a long way toward meeting the goals of the Paris Agreement. *Robust certification standards* can help prevent instances of greenwashing and ensure infrastructure investment is truly climate-smart and aligned with a low-carbon pathway. All stakeholders have critical roles to play in bridging the *climate investment gap* and accelerating the energy transition. Doing so will result in an estimated $28 trillion or more in net benefits to society.

Through the literature review, barriers analyses and case studies, the report identifies promising opportunities and models for institutional investors to support climate-smart infrastructure in emerging markets. Should barriers be addressed, and project pipelines reach the levels required to achieve the Paris Agreement targets, it is likely that lenders, including commercial banks, DFIs and other financial intermediaries, will run into capital constraints. Institutional investors, despite having capital sufficient to address the problem and a need to generate returns, also face barriers to supporting climate-smart infrastructure. *Refinance and securitization* can help recycle capital at financial institutions and create opportunities for institutional investors to invest in climate-smart infrastructure and bridge the climate investment gap. The bond markets could provide $1 trillion to $1.5 trillion annually in additional funding for climate-smart infrastructure through the increasing use of securitization, enabling lenders to recycle capital to support additional projects. Wide scale securitization can be facilitated through bankable governance frameworks and policies, standardization of terms for the underlying projects, and innovative platforms such as shown by *Bayfront Infrastructure Capital* in case study 1. The report identifies several case studies that create opportunities for further research and pilot programs in emerging markets such as India.

Governments wishing to benefit from both economic growth and climate-smart infrastructure need to enact supportive policies and effective governance structures to support the achievement of their NDCs and long-term climate objectives. Enacting long term climate planning into law can provide the signaling and incentives needed to attract institutional investment and address the "credible commitment" challenge. *DFIs* play a critical role in providing technical assistance to support governments in developing bankable project structures and participating in blended finance transactions to help de-risk climate-smart infrastructure projects in the markets they serve. The identification of a strong intermediary is critical to the structuring of many innovative financing solutions. DFIs are well-placed to play such an intermediary role. *Institutional investors* have more than sufficient resources to bridge the *climate investment gap* and can use investments in climate-smart infrastructure to help bridge pension shortfalls and achieve return targets. New models for *infrastructure finance*, such as *green bonds*, *green securitization*, and the use of new financing tools can help create opportunities for institutional investors to support the transition. Domestic and international institutional investors both have critical roles to play in meeting the goals of the Paris Agreement. Participation by domestic institutional investors is central to inspiring confidence in attracting international capital to emerging markets.

Investment in *climate-smart infrastructure* can be accelerated by addressing *traditional barriers*

inherent in infrastructure projects generally consisting of pipeline, macroeconomic, country risk, policy and regulatory, financing, commercial, and credit barriers. Most significantly, *governments* need to work actively to create a governance structure and enabling environment that would address the *pipeline* shortage of bankable projects by engaging with DFIs and the private sector on initiatives like the *Climate Investment Platform* presented in box 2. Additionally, governments must tackle project pipeline, long-term planning, and regulatory and policy barriers by enacting a robust public-private partnership program to mobilize both domestic and international institutional investment as demonstrated by *Columbia* and the *World Bank Group* in case study 2. *Macroeconomic* barriers, such as currency exchange rate fluctuations and inflation, can be addressed through government policy, appropriate provisions in the project agreements, and use of derivatives markets and offerings from entities like *Guarantco* and *The Currency Exchange Fund.* When possible, green bonds can also be issued internationally to provide local financing both for greenfield projects and refinance, as demonstrated by *NADB* in case study 3. *Country risk* can be addressed through the project governance framework and the use of political risk insurance or partial risk guarantees from entities like *MIGA* and the *Japan Bank for International Cooperation*, and the greater involvement of local stakeholders. *Policy and regulatory* barriers, such as concerns over changes in law, can be partially addressed through project structures and the use of guarantees. However, institutional investors can face additional regulatory barriers that limit infrastructure investment and cannot be addressed through project governance. Regulations governing the accounting for guarantees can also provide disincentives for their use. *Financing barriers,* such as limited local financial market capacity, can only partially be addressed through access to DFI concessional capital, structures like the Development Bank of South Africa's *Climate Finance Facility*, securitization, and the use of *alternative investment funds* as presented in case study 4. *Commercial barriers* are traditionally addressed contractually using long-term concession agreements and conservative lending criteria; however, new financial instruments, such as contracts for difference and "solar revenue puts" as shown in case study 5, are also offering new ways to address commercial barriers. *Credit risks* are typically covered through meticulous credit analysis, credit ratings, and through the support or substitution of credit-worthy counterparties. However, the development of a local green bond market can enable developers, even of smaller projects, to raise capital from institutional investors and issue green bonds above the sovereign rating as demonstrated in case study 6, *Green Bond Programme - Kenya*.

Addressing investment barriers specific to *climate-smart infrastructure*, such as the cost structure, transaction and due diligence costs, green technology barriers, challenges with quantifying the benefits of adaptation and resilience investments, and long-term planning barriers, can also help accelerate the transition. The *cost structure* of climate-smart projects may create barriers due to higher up-front costs despite lower life cycle costs and significant lifetime savings; the availability of long-term financing and innovative approaches, such lease financing as offered by *Proterra,* and bulk procurement and public-private partnerships, as offered by *Enel X* in box 3, can enable a life cycle cost view and the development of climate-smart infrastructure. *Transaction and due diligence costs* for project finance transactions often preclude smaller projects from utilizing this approach. However, *bundling assets* into vehicles such as clean energy investment trusts, alternative investment vehicles, and asset-backed securities - such those issued by FlexiGroup and NAB in case study 7 - can help defray transaction and due diligence costs and achieve a transaction size attractive to institutional investors. *Green technology barriers* can be addressed through government policy, blended finance approaches, and new capital being made available at DFI venture funds, such as those offered by *UNICEF* and *ADB*. Innovative approaches

to help quantify and monetize the benefits of *climate resilience and adaptation investments* are also being pursued. As presented in case study 8 and case study 2, *long-term planning barriers* also require governments to implement policies that enable the use of the best technologies and approaches for decarbonization, and tools such as the EPIC software being piloted by the World Bank Group can assist with long-term planning.

Innovative financing approaches, such as those outlined in this report, are being developed and deployed to address barriers to climate-smart infrastructure investment; but significantly more work remains to be done to support governments in achieving low-carbon, resilient development pathways. There is no single solution to overcoming the complex, multifaceted barriers that institutional investors face in financing climate-smart infrastructure. Implementing a competitive PPP program, as in *Case Study 2: Colombia's Fourth Generation (4G) Roads Concession Program* targeted at climate-smart infrastructure, can help create a robust pipeline of projects in which domestic and international investors with the requisite capacity can invest directly. Increasing the project pipeline through the use of such approaches for the energy sector and the implementation of Basel III may lead to an increase in the number of lenders facing capital constraints. *Refinance and securitization* approaches such as the one used in *Case Study 1: Clifford Capital CLO Infrastructure Take-Out Facility* will become increasingly important to help recycle lender capital to reinvest in climate-smart projects in emerging markets. These innovative approaches also create opportunities for institutional investors that may not be able to invest directly at a project level or in other types of green assets to support decarbonization indirectly. Strong certification standards can help prevent greenwashing when using these approaches. Further work is also needed to facilitate investment in adaptation and resilience projects. In all cases, governments, DFIs, and institutional investors must each play a key role in creating an enabling environment and ensuring that critical investments in climate-smart infrastructure are made in time to close the climate investment gap and keep global warming to less than 1.5°C.

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Appendix 1: Invest4Climate

To address the climate investment gap, the World Bank Group and the United Nations Development Programme (UNDP) co-launched the Invest4Climate platform in September 2017. Invest4Climate aims to mobilize, coordinate, and deliver finance to close the climate financing gap and help countries transition to a resilient low-carbon future that supports jobs and growth.

Invest4Climate **acts as a convener, facilitator and knowledge provider to leverage finance and facilitate scaled-up approaches to tackle climate's biggest challenges**

	Convener	Deal Facilitator	Knowledge Provider
– Mobilizing existing teams and relationships in developing countries – Drawing on WBG unique suite of financial tools, resources and knowhow – Incorporating blended finance and maximizing finance for development approaches – Amplifying success stories at global scale to influence the regulatory and policy environments	– Convening potential providers of finance at senior decision-making level around common challenges and specific climate mitigation and resilience investment opportunities – Convening governments, financial institutions, investors, philanthropists, and multilateral banks to support policy reform and crowd in private investment	– Bringing respective UN & WBG experience in pipeline identification – Assisting potential climate focused transactions to prepare for and come to market for finance – Facilitating the identification and allocation of risks to providers of finance that can best manage them. – Leveraging investment and de-risking instruments though targeted policy and regulatory support; technical assistance and advocacy; financial engineering (loans, grants, guarantees, policy lending, results based finance	– Driving knowledge sharing and capacity building on climate action and finance – Piloting and demonstrating viable deals, standardization and new models for de-risking and scaling climate investment

Appendix 2: Types and Availability of Financing

Characteristics of various types of financing

The table below sets out the characteristics of the various types of financing available

Type of finance	Available to	Short term vs. long term	Cost	Sectors	Complexity	Geography	Potential scale $M
Municipal bonds	Government	Medium to long term	Low-medium	Transport, schools, airports and seaports	Low	Used globally, but mainly in the US	200–billions
Dim sum/ Panda bonds	Corporate/ government	Long term	Low-medium	Corporate finance	Medium	China	200–billions
Qualified public infrastructure bonds	Government focused	Long term	Low-medium	Public Infrastructure	Medium	US	200–billions
Industrial revenue bond	Corporate/ government	Medium to long term	Low-medium	Airports/ sewage facilities	High	US	100-500
TIFIA loans	Government	Medium to long term	Low	All infrastructure	Low	US	
Tax increment financing	Corporate	Medium term	Low-medium	Construction	Medium	US	
Debt							
Institutional investors (incl. pension funds)	Mainly corporate focused, although now entering project market	Medium to long term	Medium (High in case of equity)	All sectors – depending on experience may only finance post-construction phase	Medium	Mainly developed countries such as Canada, the Netherlands, UK, and US	50-1,000
Senior debt – bank funding	Corporate/ project finance	Short to long term	Low-medium	All sectors	Low	Used globally, although not all banks/countries provide long-term debt products	50-2,000
Project bonds	Project focused	Long term	Low-medium	All sectors	Low	Globally used	200-2,000
Sukuk bonds	Project focused	Medium to long term	Low-medium	Renewables social development	Low	Islamic-based countries (e.g., Middle East, Southeast Asia)	50-1,000
Export credit (ECA)	Corporate/ government	Medium to long term	High	Corporate finance/projects	Medium	Globally used	20-500

Type of finance	Available to	Short term vs. long term	Cost	Sectors	Complexity	Geography	Potential scale $M
Green bonds	Corporate/ project	Long term	Medium-high	Utilities/sewage facilities/ renewables	Medium	Globally used	100-2,000
Social impact bonds	Corporate/ project	Long term	Low-medium	Social development	High	Globally used	0-100
Hybrid Financing Products							
International nongovernmental organizations	Project/ corporate/ government	Long term	Low-medium	Social development	High	Emerging/ Underdeveloped countries – capital being provided by developed countries (e.g., EU/ EIB, World Bank, USAID)	20-500
Multilateral financing	Project/ corporate/ government	Short to long term	Low-medium	All sectors	Medium	Developing countries	50-1,000
Mezzanine/ subordinated debt	Corporate/ project	Short to long term	Medium	All sectors	Medium	Globally used	20-500
Vendor finance	Project/ corporate	Short/ Medium term	Low-medium	Energy/ technology	Medium	Globally used	0-200
Alternative lenders	Project/ corporate	Short/ Medium term	Medium-high	All sectors	High	Developed markets	25-500
Equity							
Contractors (e.g., construction firms and operators)	Project	Medium to long term	High	All sectors	Low	All countries	5–10% of equity
Infrastructure funds Project	Project	Medium to long term	High	All sectors	Medium	Developing countries	50–1,000
Sovereign wealth funds	Project	Medium to long term	High	All sectors	Medium	All countries	100–1,000
Crowdfunding	Corporate focused	Long term	High	Social development, technological infrastructure	High	Mainly North America and Europe	

Source: Deloitte 2018.

Appendix 3: Financial Regulations for Institutional Investors

Financial Regulations and Their Effect on Institutional Investor Segments in the United States, European Union, and United Kingdom

	Legislative Region	Leverage limits	Collateral req.	Liquidity req.	Central clearing	Private equity limits	Trading tax	Brokerage fee limits	Deposit and reporting req.	Compensation limits	Pension funds	Insurance companies	Banks	Asset/wealth managers	Private equity
Dodd-Frank Wall Street Reform and Consumer Protection Act	US	■	■	■	■								■		■
619 (12 U.S.C. 1851) of the Dodd-Frank Act (Volcker Rule)	US					■							■		■
Foreign Account Tax Compliance Act	US								■				■	■	■
Third Basel Accord / Capital Requirements Directive	All	■	■	■				■	■	■			■	■	■
Undertakings for the Collective Investment of Transferable Securities V	EU								■					■	
Alternative Investment Fund Managers Directive	EU								■					■	■
Solvency II Directive	EU	■	■										■		■
Markets in Financial Instruments Directive II	EU							■	■			■			■
European Market Infrastructure Regulation	EU		■		■				■					■	
European Commission's Liikanen proposals	EU					■						■	■	■	
Financial Transaction Tax	EU					■							■	■	
Packaged Retail Investment Products	EU								■			■	■	■	
International Financial Reporting Standards	EU/ US		■						■		■		■		■
Retail Distribution Review	UK							■						■	

Source: Better Finance, Better World 2018 Report.

Appendix 4: Definition for Private Sector Mobilization and Private Sector Catalyzation

Private Sector Mobilization: The MDB harmonized definitions for mobilized private sector capital are detailed in the **Joint MDB reporting on private investment mobilization: methodology reference guide 2017**. The current methods for the estimation of investments mobilized from the private sector are limited to flows within the project boundary – direct and indirect financing at investment commitment as per the table below.

Table MDB harmonized definition of private co-financing and mobilization

<table>
<tr><th>Private Co-financing/ Mobilzation</th><th>Private Direct Mobilization</th></tr>
<tr><td rowspan="2">The investment made by a private entity, which is defined as a legal entity that is
– Carrying out or established for business purposes and
– Financially and managerially autonomous from national or local government.
Some public entities that are organized with financial and managerial autonomy are counted as private entities. Other examples include registered commercial banks, insurance companies, sovereign wealth funds, and other institutional investors investing primarily on a commercial basis.</td><td>– Convening potential providers of finance at senior decision-making level around common challenges and specific climate mitigation and resilience investment opportunities
– Convening governments, financial institutions, investors, philanthropists, and multilateral banks to support policy reform and crowd in private investment</td></tr>
<tr><td>Private Direct Mobilization
Financing from private entities provided in connection with a specific activity for which an MDB is providing financing, where no MDB is playing an active or direct role that leads to the commitment of the private entity's finance. PIM includes sponsor financing, if the sponsor qualifies as a private entity.</td></tr>
<tr><td colspan="2">Private Direct Mobilization + Private Indirect Mobilization = Private Co-Financing/Mobilization</td></tr>
</table>

Source: MDB Task Force 2019

Private Sector Catalyzation: Currently there is no common MDB definition or methodology for estimating investment flows catalyzed beyond the project boundary. The **2017 Report on Mobilization of Private Finance by Multilateral Development Banks and Development Finance Institutions** presented a diverse set of case studies of MDB activities with individual proposals to calculate catalyzed finance. Given the wide range of estimations, tools, and approaches used, MDBs have not yet agreed on a harmonized methodology for tracking catalyzed private finance (MDB Task Force 2019).