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BLENDING CLIMATE FUNDS TO FINANCE LOW-CARBON, CLIMATE-RESILIENT INFRASTRUCTURE

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at BROOKINGS

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EXECUTIVE SUMMARY

Climate, development and Low-Carbon Climate Resilient infrastructure

The world's core infrastructure—including our transport and energy systems, buildings, industry, and land-related activities—produce more than 60 percent of all greenhouse gas (GHG) emissions globally.

By 2030 the world will need to build approximately $85 trillion in low-carbon climate-resilient (LCR) infrastructure in order to meet the Paris climate change agreement's goal of keeping the global average temperature increase well below 2 degrees Celsius by 2050. Meeting this infrastructure investment need will require doubling today's global capital stock. This paper defines LCR infrastructure as including renewable energy, more compact cities, and suitable mass transit as well as energy efficiency measures.

Whether the world builds LCR infrastructure will also determine whether the Sustainable Development Goals (SDGs) are achieved. Around 60 percent of LCR infrastructure needs are in developing countries.

LCR infrastructure links the climate and development agendas in multiple ways. For one, the impact of climate change is being felt most acutely by the poorest and most vulnerable people in developing countries. This link between climate change and poverty is reflected in the SDGs, which recognize addressing climate change as a development outcome.

Infrastructure also has a direct effect on development outcomes. For example, building renewable energy instead of coal-fired power stations can reduce air pollution and produce better health outcomes. Building compact cities with access to mass transit affects access to other key services such as health and education.

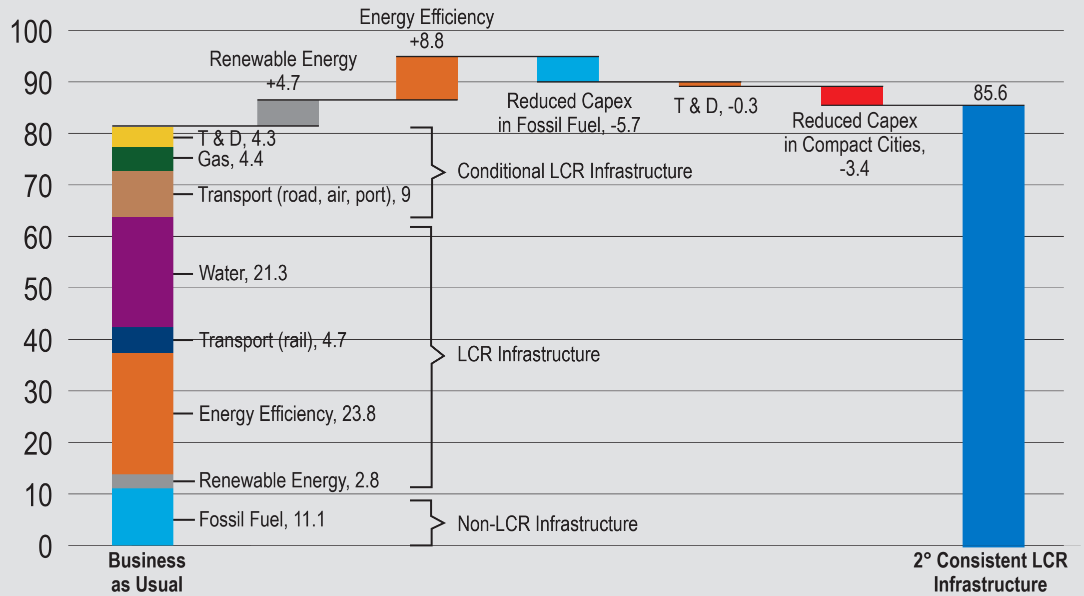
Global infrastructure needs

Figure ES.1 shows business-as-usual (BAU) infrastructure investment as well as the additional investment in LCR infrastructure needed to be consistent with the below 2-degree Celsius climate goal. As can be seen, investments under BAU over 2015-2030 would likely include significant investment in LCR infrastructure in the range of $53-$70 trillion. The large range reflects the conditional nature of some of the infrastructure being built under BAU. For instance, gas-fired electricity could be consistent with a below 2-degree Celsius gain scenario if gas is a bridging fuel towards a zero-carbon electricity sector.

LCR infrastructure needs consistent with the climate goal of well-below 2 degrees Celsius will require additional investments of $13.5 trillion in renewable energy and energy efficiency, or around $1 trillion per year. Under the well-below 2-degree scenario there will be reduced investment needs in fossil fuels and infrastructure due to more compact cities, resulting in a net increase in investments in LCR infrastructure of $4 trillion. This does not take into account potential lower operating costs from LCR infrastructure, which the Global Commission on the Economy and Climate estimates could be around $5 trillion.[1]

[1] "Better Growth, Better Climate: The New Climate Economy."

Figure ES.1: LCR Infrastructure Needs (2015-2030)



Source: NCE 2014 and author calculations

Financing LCR infrastructure—the need for increased private investment

Because public finances are constrained, private capital will be required to meet these LCR infrastructure needs. Increasing private investment into infrastructure can also deliver efficiency gains.

Fortunately, there is no shortage of private capital globally. In particular, institutional investors have assets under management of $85 trillion and this is expected to be over $110 trillion by 2020. However, current allocations from institutional investors into infrastructure are low—approximately 1 percent of total asset allocations. Moreover, there is a shortage of other private capital for infrastructure, particularly LCR infrastructure in developing countries.

Risks to financing LCR infrastructure raises the cost of capital

The lack of investment in infrastructure by institutional investors as well as the private sector more broadly is due to infrastructure risks and other barriers. Moreover, LCR infrastructure carries additional risks. For instance, a limited (or complete lack of) investment track records for new climate technologies raises risk. Reliance on government support for LCR infrastructure such as feed-in-tariffs or subsidies creates additional political risk. LCR infrastructure risks are also higher in developing countries, given greater political instability, poor investment environments, and currency risks.

LCR infrastructure risks vary over the project lifecycle. For instance, risks are high in the early project preparation stage, due to challenges related to developing often complex infrastructure plans and obtaining permits. As project construction commences, risks grow due to macroeconomic and business uncertainties as well as possible construction delays, permit cancellations, and sudden shifts in the availability of finance. It is not until the project is operating that cash flow turns positive, risks decline, and it is finally possible to deliver a return on investment.

A key consequence of these LCR infrastructure risks is that the cost of capital climbs and finance becomes scarce. For instance, the high risks during project preparation and construction has meant that available private finance is most often sponsor equity and short-term bank loans. Yet, even here private investor interest is limited, and this is particularly the case for LCR projects in developing countries.

This in turn stymies LCR infrastructure projects and diverts investment into what is often lower-cost but higher-carbon alternatives.

Addressing these LCR infrastructure investment challenges requires aligning public and private finance in a manner that allows for the full risks to be borne.

Blending climate and MDB finance can lower risk and crowd-in private capital

Combining sources of public finance—such as from multilateral development banks (MDBs) and climate funds—is a form of blended finance that can reduce risk, lower the cost of capital, and crowd-in private sector capital into LCR projects.

The Multilateral Development Banks

The MDBs have the knowledge and financial position to play a central role in blending their own capital with climate finance to reduce risk and crowd-in private sector capital.

MDBs are increasing their climate investments, yet they face constraints in terms of the amount of finance they can provide and the risks they can accept. For example, except for grants by the International Development Association (IDA), which are only for low-income countries, concessional finance by the World Bank still needs to be repaid.[2] In effect, this constrains MDB risk appetite.

MDBs also have to balance climate and development goals. This can lead to an investment portfolio not entirely aligned with the Paris climate agreement goal of keeping average temperature increase well below 2 degrees Celsius.[3]

The Multilateral Climate Funds

Among the ranks of global climate funds, seven can be categorized as multilateral climate funds (MCF): the Green Climate Fund (GCF); the Global Environment Facility (GEF), which has responsibility for the Least Developed Countries Fund and the Strategic Climate Change Fund; the Adaptation Fund; and the two funds within the Climate Investment Funds Funds (CIF)—the Clean Technology Fund (CTF) and the Strategic Climate Fund.

This paper focuses on the CIFs, the GEF, and the GCF, which represent over 90 percent of multilateral climate finance.

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[2] "Loan Handbook for World Bank Borrowers.

[3] Giulia Christianson et al., "Financing the Energy Transition: Are World Bank, IFC, and ADB Energy Supply Investments Supporting a Low Carbon Future?"

The MCF are blended finance facilities designed to co-finance with other public and private sources of capital.

The MCF can have the greatest impact financing LCR infrastructure by providing small amounts of highly-concessional finance alongside other public finance to reduce risk and crowd-in private capital into transformative LCR projects.

The MCF provide two types of loans depending on project risk. The CTF for example, provides:[4]

- Less concessional (hard) loans for projects with rates of return near normal market threshold but below risk premiums for project type, technology, country, or acceleration in deploying low-carbon technology; and

- Highly concessional (soft) loans for projects with negative rates of return or below the normal market threshold.

The GCF and the GEF provide concessional finance on similar terms to the CTF.

The MDBs are also a source of concessional finance. However, this finance is less concessional than what, for instance the CIFs provide. Take IDA—the concessional arm of the World Bank—which provides loans on terms similar to highly concessional CTF finance. Yet, IDA is limited to low-income countries whereas CTF funds have been deployed in middle income countries where a lot of the LCR infrastructure is needed. In contrast, harder World Bank support in the form of loans from the International Bank for Reconstruction and Development are less concessional than the CTF.

Those using the MCF to fill financing gaps for LCR infrastructure investments must recognize its scarcity as a source of ultra-concessional finance, with interest rates and maturities that are even more generous than MDB facilities.

For example, the MCFs can support project preparation through technical assistance that helps countries incorporate climate goals into infrastructure plans. This could include developing the capacity to consider use of best available climate technology to reduce emissions. Multilateral climate funds can also help build consideration of the maximum 2-degree Celsius climate goal into the project preparation stage.

Larger amounts of finance are needed at the project construction phase and it is at this point that high costs of capital can render infrastructure projects financially unfeasible. Blending finance from the MDBs and the MCF can reduce risks sufficiently to attract private sector capital into transformative climate technologies in developing countries.

In addition to using the MCF to reduce the risk of LCR infrastructure, an improvement to countries' enabling environments can also reduce the risk across the infrastructure project lifecycle. Interventions that aim to strengthen country's investment environment and institutional capacity is often undertaken by the MDBs to improve development outcomes. The MDBs also support more targeted efforts to build an infrastructure- specific enabling environment, including through the establishment of a Global Infrastructure Facility to help governments develop infrastructure projects.

Often this work, even when focused on infrastructure, is not specifically aimed at developing the capacity to

[4] "CTF Financing Products, Terms and Review Procedures for Public Sector Operations."

build LCR infrastructure. This is where the MCF can be used to link MDB support for the enabling environment with efforts to boost country-level capacity to assess LCR alternatives and to help build a pipeline of LCR infrastructure projects.

Co-financing and leverage ratios

Using scarce public finance to crowd-in private sector capital into LCR infrastructure has led to a focus on rates of private sector co-financing as a measure of success.[5]

Co-financing occurs at the project level as well as the fund or facility level.[6] For instance, the MCF invest directly in LCR infrastructure projects and in domestic financial entities (DFEs), which then on-lend to other LCR infrastructure projects.

A complimentary measure of success in mobilizing private capital is the notion of leverage, which captures a larger financing envelope that includes additional resources committed either as a result of the infrastructure project or due to policy reforms that strengthen the enabling environment.[7] For instance, this could include a renewable energy project that becomes viable as a result of the MCF investments in transmission and distribution (T&D).

Blended finance using the Clean Technology Fund

The CTF is the largest provider of blended financing amongst the MCF to date. Outcomes from CTF blending with MDBs and the private sector provides insights into the success of blending to achieve climate and development goals.

Using data provided by the Climate Investment Funds' Administrative unit, supplemented with desk research, this paper analyzes investments blending CTF and other public finance and its capacity to crowd-in private capital. The data encompasses 126 projects with CTF financing of $5.25 billion. This is broken down into 70 private projects with CTF financing of $1.89 billion and 56 public projects with CTF financing of $3.63 billion.

The following conclusions that link allocation of finance and investment risk levels are tentative, as the allocation of a risk level to a given investment takes into account local and project specific factors that limit the ability to compare risk levels across investments.

The available data is also more detailed for public investments where data on risk levels is available. Data on risk levels are not available for investments into private projects, such as those undertaken by the IFC.

Key findings from the data for investments in public projects are:

- The majority of CTF finance was in the form of soft loans, which also went toward investments with the highest risks.
- CTF share of total finance (public and private) was highest for projects with the highest risk level.
- The CTF was most successful at mobilizing private finance for investments with the highest risk.

[5] The World Bank Operations Manuel: Operational Policies on Cofinancing"; Stacy Swann, "Blending Donor Funds for Impact."
[6] Joint Report on Mobilization of Private Finance by Multilateral Development Banks."
[7] "Assessing 'Leverage' in the Climate Investment Funds."

Data on CTF financing of private investments shows that a given amount of CTF finance mobilized higher amounts of private capital than was the case for public investments. However, this is to be expected, given that MDB private sector investments are mandated to mobilize private capital. In addition and as discussed, some CTF financing of public projects such as T&D might not initially attract private captal, but can leverage further investments in LCR infrastructure, such as a renewable energy project.

This paper also distinguishes between two broad types of CTF investments—direct investments in projects and indirect investments in DFEs, such as local banks and facilities that then on-lend to LCR projects. Investments in DFEs captures some of the impact of investing in capacity building and improving a country's enabling environment. Investments in DFEs also captures one dimension of how initial investments can leverage additional private capital.

Investments in DFEs tend to be smaller and in areas such as improving energy efficiency or distributed solar projects. This is in contrast to larger direct investments by the CTF into LCR infrastructure projects such as concentrated solar or wind energy.

Investments in DFEs often include capacity building as well as a loan or guarantee. For instance, CTF finance helped build the capacity of national development banks in Mexico to evaluate large-scale wind power projects and in Turkey the CTF supported the development by financial intermediaries lending for energy efficiency.

Direct CTF investments in LCR infrastructure mobilized more private sector capital than investments in DFEs. Yet, DFEs can leverage additional public and private resources through their own loans. For example, (while a GEF example), the IFC China Energy Efficiency Program, with support from the GEF and China's Finance Ministry, involves a grant to local banks that then lend to market participants such as utilities and businesses to implement energy efficiency measures.[8] While the IFC estimates that its grants have directly mobilized approximately 1.5 times that amount of private capital, the CHUEE program estimates that other elements of the program, including building the understanding and capacity of banks to engage in energy efficiency financing and building an energy efficiency market, have mobilized an addition $1.8 billion or nearly 3 times the IFC investment.[9]

Conclusion: Blending multilateral climate funds for investment in LCR infrastructure

Multilateral climate finance will remain a small part of the financing needs for LCR infrastructure. Blending the MCF with MDB finance has reduced LCR infrastructure risk and crowded-in private sector finance. To address LCR infrastructure needs going forward will require the MCF to push into high risk climate projects that would not otherwise be viable, even with MDB support.

Approaches that effectively deploy the MCF are evolving fast. As the MDBs ramp-up their climate financing and are guided by the cascade approach to finance, which emphasizes risk mitigation before direct loans, the MCF should be prepared and able to address the remaining financing gaps.

[8] "Terminal Evaluation of China Utility Based Energy Efficiency Program (CHUEE)."
[9] "IFC China Utility-Based Energy Efficiency (CHUEE) Program."

Yet, as the MCF focus on blending finance for LCR infrastructure, it is important to avoid excessive reliance on co-finance ratios to measure success. In fact, there are important limits to using such metric. In particular:

- High private co-financing can signal a lack of risk taking by multilateral lenders and could even indicate some crowding-out of private sector investment.

- There is no inherent link between high private co-financing and climate outcomes. This suggests that there are projects with higher risks where private sector appetite is limited but in which environmental payoffs are significant.

- The capacity for the MCF to mobilize private capital will also depend crucially on the availability of bankable projects. Yet, a lack of bankable projects remains a key barrier to increasing investment in LCR infrastructure.[10]

There is also a role for including leverage ratios in assessing how the MCF has been mobilizing private sector capital. Such ratios are harder to measure than co-financing ratios, but are likely to be an important channel by which MCF will scale the financing needed for LCR infrastructure. This also underscores the importance of addressing the enabling environment for LCR infrastructure. Strengthening the enabling environment will reduce LCR infrastructure risk across the project cycle, creating additional opportunities for private capital to finance such projects. This should free up the MCF to invest in even higher risk and transformational LCR infrastructure projects.

[10] Aaron Bielenberg et al., "Financing Change: How to Mobilize Private Sector Financing for Sustainable Infrastructure."

BLENDING CLIMATE FUNDS TO FINANCE LOW-CARBON, CLIMATE-RESILIENT INFRASTRUCTURE

Joshua P. Meltzer

SECTION 1. INFRASTRUCTURE AND CLIMATE CHANGE

Infrastructure use drives global greenhouse gas emissions, including those from energy and transport systems, buildings, industrial operations, and land use. In fact, the world's existing infrastructure and its uses are associated with more than 60 percent of the world's total greenhouse gas (GHG) emissions.

Infrastructure associated with energy production, transmission, and consumption is a notable source of GHGs. The burning and use of fossil fuels in the production of power and its consumption in sectors such as transport, industry, and building account for almost three-quarters of all GHG emissions (**Figure 1.1**). Moreover, between 2000 and 2010, the entire increase in anthropogenic (i.e., human-related) GHG emissions flowed from direct energy use: power, industry, transport, and buildings.[11] Accounting for indirect emissions raises the contributions of the buildings and the industry sectors. Agriculture, forestry, and land-use are the other main sources, although around 2 percent of emissions from this sector stem from energy use.[12]

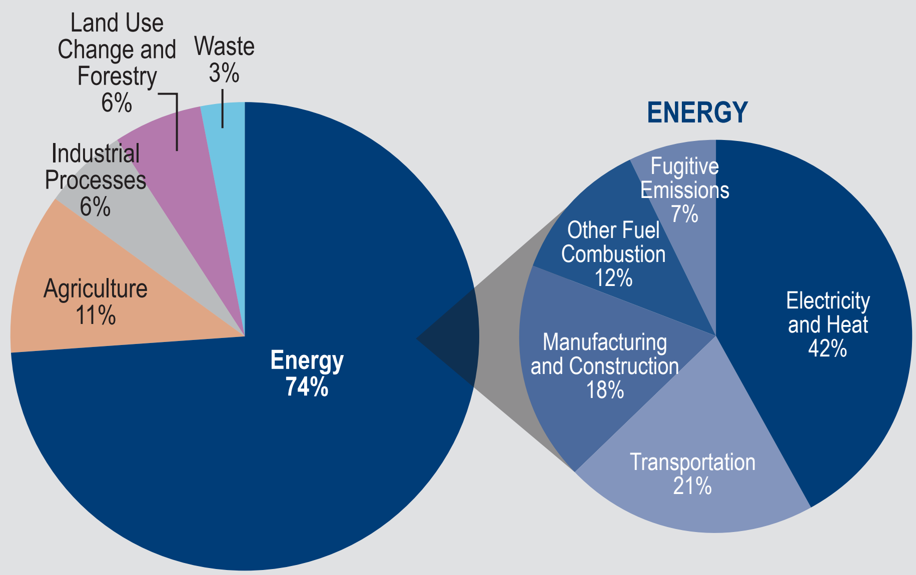
Figure 1.2 highlights the predominant power-consuming sectors, namely buildings and industry. Commercial and residential buildings usually rely on district heating systems, where central heating and cooling plants service large numbers of buildings and primarily use fossil fuels.

By 2030, the world will need to invest approximately \$94 trillion in sustainable infrastructure, doubling the current capital stock.[13] Of this amount, \$85 trillion must be low-carbon, climate-resilient (LCR) infrastructure.

The US Council of Economic Advisors defines 'core' infrastructure as referring to roads and other transportation facilities, power generation facilities and distribution networks and water and sewer systems.[14] Estimates of sustainable infrastructure needs by the New Climate Economy include includes these sectors as well as primary energy generation and investments

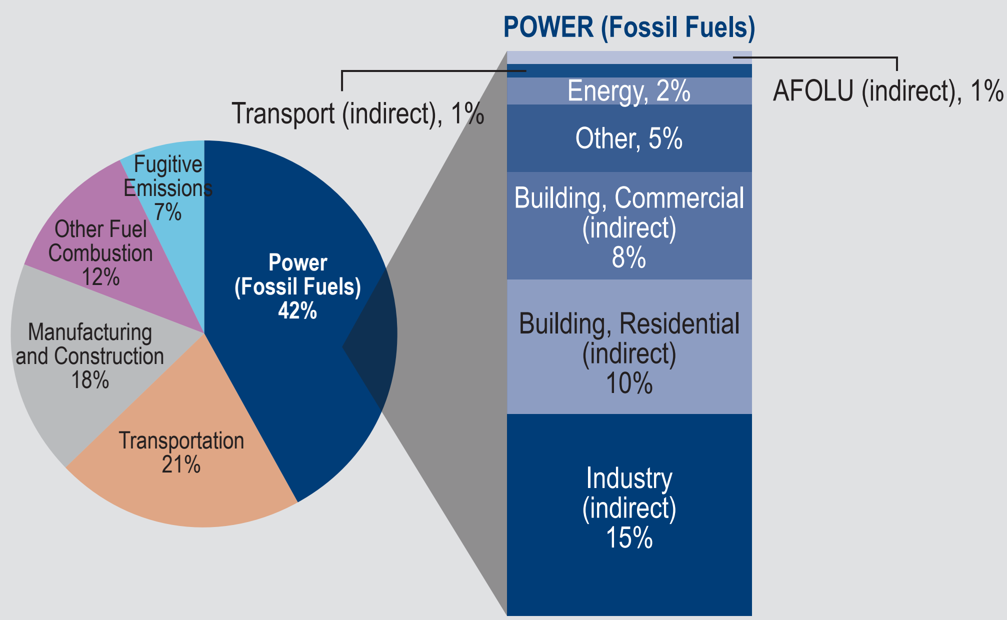
[11] "Climate Change 2014: Mitigation of Climate Change, Summary for Policymakers and Technical Summary."
[12] "Better Growth, Better Climate: The New Climate Economy."
[13] "Better Growth, Better Climate: The New Climate Economy."
[14] The Economic Benefits of Investing in US Infrastructure - Economic Report of the President.

Figure 1.1: Breakdown of GHG Emissions Highlights Significance of Energy Sector



Source: WRI CAIT Climate Data Explorer

Figure 1.2: Fossil Fuels (Power, Indirect) Emissions, Measured in Gton of CO_2-e (2010)



Source: WRI CAIT Climate Data Explorer in energy efficiency measures. Given the importance of such investments and in particular in energy efficiency for climate outcomes, this paper also includes these investments in LCR infrastructure. LCR infrastructure excludes high-carbon infrastructure, such as fossil-fuel power plants, as well as social infrastructure such as schools and hospitals, as well as telecommunications.

Failure to build LCR infrastructure will guarantee the world a high-carbon future and ensure it misses the Paris climate agreements' goal of keeping the global average temperature increase well below 2 degrees Celsius by 2050. LCR infrastructure can also contribute to climate resilience (through infrastructure that can withstand climate change impacts and extreme events) and its absence can likewise increase vulnerability, particularly for the poor.

Infrastructure and development

Building LCR infrastructure will also affect development and achievement of the SDGs. In fact, the building of LCR infrastructure links the climate and development agendas, as failure in one will undermine the other.[15]

Failure to address climate change will increase poverty in various ways. Climate change can trigger more frequent droughts, a reduction in rural household income owing to declines in primary sector productivity, an increase in food prices, and greater child malnutrition and stunting as a result of declines in food production.[16] Indeed, at the current pace of emissions, estimated climate change impacts will push up to 720 million people into extreme poverty between 2030 and 2050.[17] The World Health Organization (WHO) estimates that approximately 150,000 deaths per year are attributable to anthropogenic climate change, a figure that is projected to rise to 250,000 deaths per year by 2030.[18]

These links between climate change and poverty are evident in the SDGs, which recognized addressing climate change as a development outcome in itself.

Infrastructure also has a direct effect on development outcomes. For example, building renewable energy instead of coal-fired power stations can reduce air pollution and produce better health outcomes. Building compact cities with access to mass transit affects access to other key services such as health and education.

Construction of LCR infrastructure needs can be met without compromising economic growth in the process. There is increasing evidence that the additional costs associated with a low-carbon development path are not growth-constraining.[19] For example, by transforming the energy sector and reducing emissions by one-third compared to business-as-usual (BAU), India could boost gross domestic product (GDP) by an estimated 3.9 percent. Similarly, China could see an acceleration in GDP growth of 1.4 percent, in Indonesia by 2.4 percent, in low-income African countries by 2 percent, and in countries of the Association of South Asian Nations (ASEAN) by 1.6 percent.[20]

[15] Amar Bhattacharya, Jeremy Oppenheim, and Nicholas Stern, "Driving Sustainable Development through Better Infrastructure: Key Elements of a Transformation Program."
[16] Ilmi Granoff et al., "Zero Poverty, Zero Emissions: Eradicating Extreme Poverty in the Climate Crisis."
[17] Ibid.
[18] "Climate Change and Health."
[19] "Better Growth, Better Climate: The New Climate Economy"; Ilmi Granoff et al., "Zero Poverty, Zero Emissions: Eradicating Extreme Poverty in the Climate Crisis"; Antoine Dechezleprêtre, Ralf Martin, and Samuela Bassi, "Climate Change Policy, Innovation and Growth."
[20] Ilmi Granoff et al., "Zero Poverty, Zero Emissions: Eradicating Extreme Poverty in the Climate Crisis."

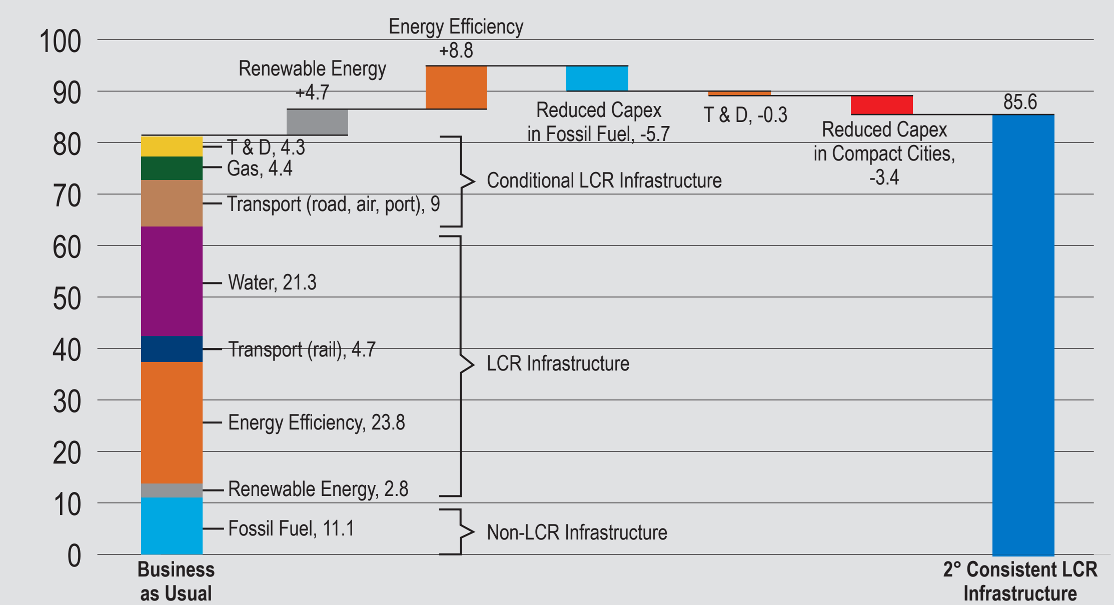
LCR infrastructure needs

Building needed LCR infrastructure is a short-term challenge. Unless the infrastructure built over the next 15 years is LCR, the world will lock itself onto a high-carbon path, missing the Paris climate goal of keeping the global average temperature well below 2 degrees Celsius and producing poor development outcomes inconsistent with the SDGs.

Figure 1.3 shows BAU infrastructure trends over 2015-2030 include investments in LCR infrastructure in the range of $53-70 trillion. The large range reflects the conditional nature of some of the infrastructure being built under BAU.[21] For instance, whether new roads, airports, and ports are LCR infrastructure will depend on the carbon emissions from the cars, planes, and boats that use it. Gas-fired electricity could be consistent with the below 2-degree Celsius climate goal if gas is a bridging fuel towards a zero-carbon electricity sector.[22] Similarly, an expansion of T&D—where this carries low-zero carbon electricity—would be consistent with the 2-degree Celsius goal.

Figure 1.3 also shows the additional investment in LCR infrastructure needed to be consistent with the below 2-degree Celsius climate goal. LCR infrastructure investment of $13.5 trillion or around $1 trillion per year in renewable energy and energy efficiency

Figure 1.3: LCR Infrastructure Needs (2015-2030)



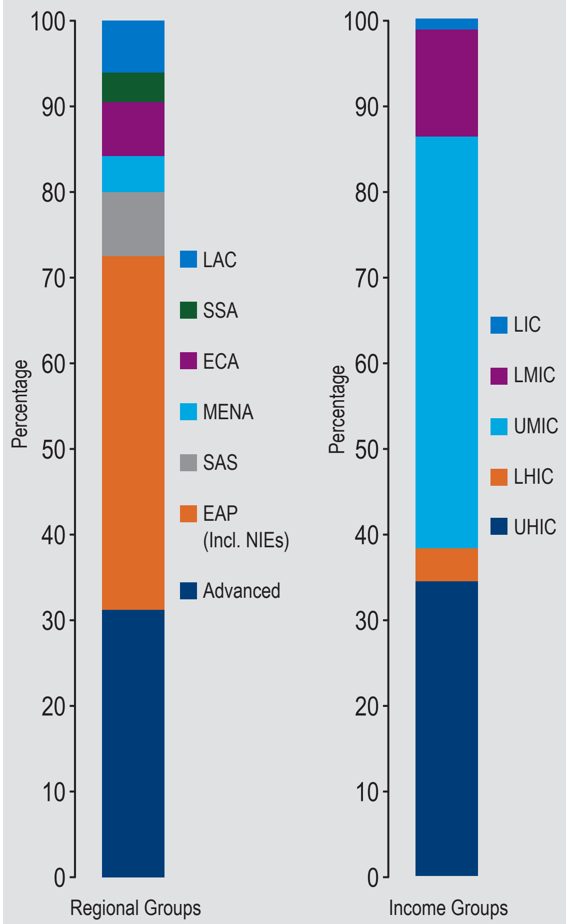
Source: NCE 2014 and author calculations

[21] Giulia Christianson et al., "Financing the Energy Transition: Are World Bank, IFC, and ADB Energy Supply Investments Supporting a Low Carbon Future?"; Jeffrey D. Sachs, "What's the Path to Deep Decarbonization?"
[22] Ibid.

represent the most critical areas requiring additional investment. Under the 2-degree scenario there will also be reduced investment needs in fossil fuels and other infrastructure due to more compact cities, resulting in a net increase in investments in LCR infrastructure over 2015-2030 of $4 trillion, to $85.6 trillion. This does not take into account potential lower operating costs of LCR infrastructure, which the Global Commission on the Economy and Climate estimates could be around $5 trillion.[23]

Figure 1.4 shows the distribution of infrastructure needs across countries. Over 60 percent of cumulative infrastructure needs out to 2030 are in developing countries, with the majority of infrastructure needs in upper-middle income countries. LCR infrastructure needs in the developing world are concentrated in East Asia and the Pacific, and Sub-Saharan Africa.

Figure 1.4: Projected Cumulative Infrastructure Demand by Region and Income (2015-2030)[21]



† LIC = low-income countries; LMIC = lower-middle-income countries; UMIC = upper-middle-income countries; LHIC = lower-high-income countries; UHIC = upper-high-income countries

[23] "Better Growth, Better Climate: The New Climate Economy."
[24] Amar Bhattacharya, Jeremy Oppenheim, and Nicholas Stern, "Driving Sustainable Development through Better Infrastructure: Key Elements of a Transformation Program."

SECTION 2: THE COST-OF-CAPITAL AND LCR INFRASTRUCTURE RISKS

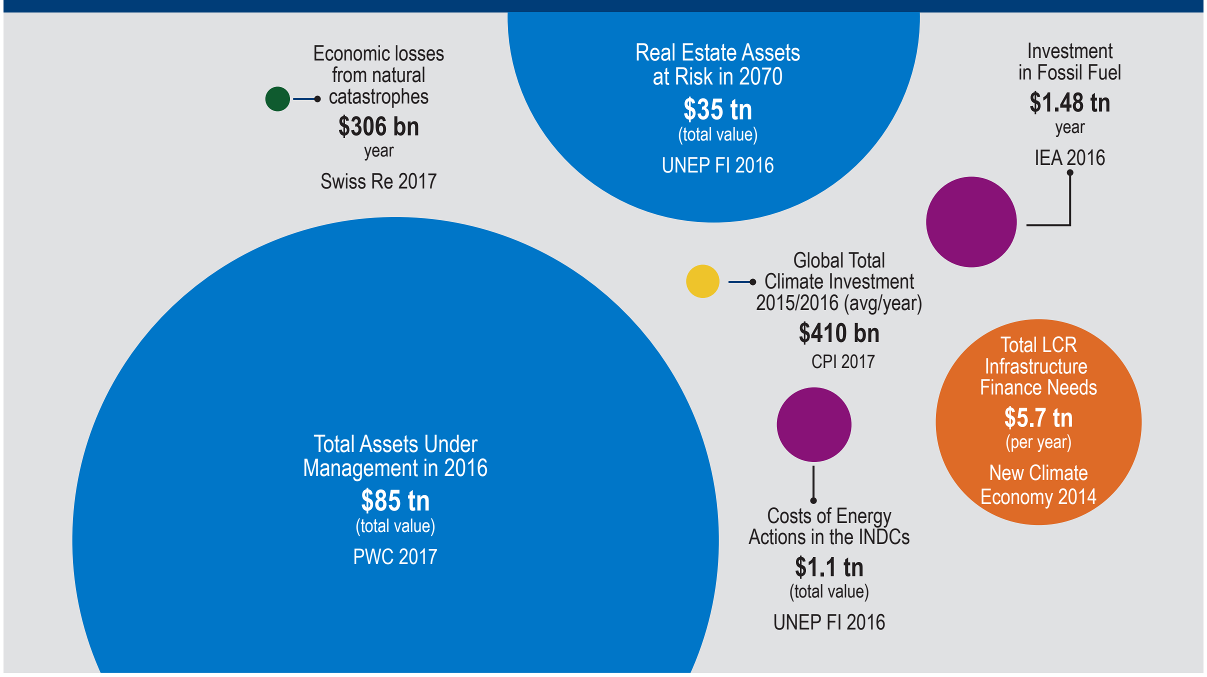
To finance LCR infrastructure needs, increased investment from public and private capital is needed.

However, there are limits to the scope for the public sector to finance the LCR infrastructure investment gap. For one, within developing countries, public budgets are constrained and borrowing capacity is low.[25] In addition, aid from the developed world is limited and cannot be expected to fill the financing gap in developing countries.[26]

Given these constraints on public budgets, the private sector will need to fill the gap. Estimates are that 35-50 percent of incremental investment in LCR infrastructure will need to come from the private sector.[27]

Figure 2.1 shows the amounts of available capital and climate investment needs. The table shows the relative paucity of climate investment are given the extent of LCR infrastructure needs. **Figure 2.1** also shows that while current levels of climate investment are inadequate given needs, there is no shortage of capital globally. In particular, institutional investors have assets under managements of around $75 trillion. The challenge is to channel additional public and private sources of capital into financing LCR infrastructure.

Figure 2.1: LCR Infrastructure Investment Needs in Context



Source: Author adaptation from UNFCCC Standing Committee on Finance Biennial Assessment and Overview of Climate Finance Flows Report, 2016

[25] Daniel Gurara et al., "Trends and Challenges in Infrastructure Investment in Low-Income Developing Countries."
[26] Stephany Griffith-Jones and Matthias Kollatz, "Infrastructure Finance in the Developing World."
[27] Aaron Bielenberg et al., "Financing Change: How to Mobilize Private Sector Financing for Sustainable Infrastructure."

The scope of the investment needs for LCR infrastructure and the limits on public finance underscores the need to channel private finance into LCR infrastructure projects.

As **Figure 2.1** shows, there is no shortage of capital and assets managed by institutional investors. The justification for increased investment by such investors into LCR infrastructure is that infrastructure can provide a counter-cyclical inflation hedge and the long life of the underlying assets can allow institutional investors (such as pension funds) to match similarly dated liabilities.

Currently, however, allocation by institutional investors into LCR infrastructure is low. Institutional investors typically allocate around 1 percent of total assets to infrastructure (although in some countries, such as Australia, allocations from institutional investors are closer to 5 percent).

LCR infrastructure barriers

The lack of investment by institutional investors as well as the private sector more broadly into infrastructure is due to risks and other barriers.[28] Moreover, LCR infrastructure carries additional risks such as uncertainty over new climate technologies and various policy risks, particularly where LCR infrastructure requires government support.[29]

LCR infrastructure risks are particularly high in developing countries because of political instability, poor investment environments, and currency risks. It is also the case that some of these risks are more perceived than real. For instance, credit performance of project loans in emerging market and developing economies debt is not substantially different from that of comparable debt in advanced economies.[30]

Risks

Table 2.1 lists the most significant infrastructure risks, broken out to show the additional risks of investing in LCR infrastructure and in developing countries. LCR infrastructure risks are particularly acute due to uncertainty over low-carbon technologies in areas such as concentrated solar, offshore wind, geothermal, and carbon capture and storage (CCS). Moreover, limited —or completely absent—investment track records for new climate technologies makes it difficult for investors to assess LCR infrastructure performance. The long life of infrastructure makes it particularly vulnerable to changes in regulatory environments that can render projects uncommercial. This is particularly acute for LCR infrastructure projects, which often rely on feed-in tariffs or tax breaks. The higher upfront capital costs of LCR infrastructure compared with low-carbon infrastructure (see **Table 2.1**) increases business and financing risk, including liquidity and foreign exchange risk, and hedging is often expensive and unavailable for such long-life projects.

When it comes to investing in developing countries, investors often face an uncertain political environment and a lack of broader macroeconomic stability. Underdeveloped legal systems also serve to create risk with regard to the enforceability of contracts.

[28] Raffaele Della Croce and Juan Yermo, "Institutional Investors and Infrastructure Financing"; Matthew Huxham et al., "Mobilising Low-Cost Institutional Investment in Renewable Energy."
[29] Ibid.
[30] Joaquim Levy, "Risk and Capital Requirements for Infrastructure Investment in Emerging Market and Developing Economies."

Table 2.1: Infrastructure Investment Risks

Risks	Risk Details	Additional LCR Risks	Additional Developing Country Risks
Political/Regulatory	Uncertainty in tax and/or regulation	✓	✓
	Changes in legal environment		✓
	Enforceability of contract		✓
	Currency convertibility		✓
	Fossil fuel subsidies	✓	
	Absence of carbon price	✓	
Macroeconomic and business	Default of counterparty		✓
	Inflation		✓
	Real interest rates		✓
	Exchange rate fluctuations		✓
	Liquidity		✓
	Refinancing risk		✓
	Lack of bankable project pipeline		
	Volatility in demand/market risk		
	Social acceptance	✓	
Technology	Project feasibility		
	Governance/project management		✓
	Environmental/climate	✓	
	Delays/overuns	✓	✓
	Deficit in physical structure/service	✓	
Knowledge	Limited capacity to structure infra deals, including PPPs		✓
	Uncertainty over climate impacts	✓	
	Absence of common standards for sustainable infrastructure	✓	

OECD 2015, author assessment

Viability gaps and knowledge gaps

In addition to the risks of investing in LCR infrastructure, there are gaps as regards viability and knowledge that increase uncertainty and the cost of capital. A viability gap arises when the project fails to generate a revenue stream sufficient to meet debt-servicing obligations. For instance, a user-pay system may be unable to generate sufficient revenue to justify the investment—a particular challenge in developing countries.[31] For renewable projects, viability gaps can arise where LCR infrastructure projects have lower output

[31] Michael Regan, "Infrastructure Financing Modalities in Asia and the Pacific: Strengths and Limitations."

per unit of capacity compared to conventional generation projects.[32] Perverse incentives from fossil fuel subsidies also increase viability gaps.

Another particular barrier to financing LCR infrastructure are knowledge gaps. For instance, many developing countries have only limited capacity to assess the impact of climate change, increasing uncertainty when planning infrastructure projects with time horizons of 30 years and beyond. The absence of any common understanding globally as to what constitutes LCR infrastructure is also a disincentive for investors who would otherwise prefer to increase allocations toward LCR infrastructure.

For developing countries, there is also often a lack of local capacity to structure public-private partnerships and ensure efficient allocation of risks among

Table 2.2: Risks Across the Infrastructure Project Lifecycle

<table>
<tr><th>Risk Categories</th><th>Development Phase</th><th>Construction Phase</th><th>Operation Phase</th><th>Termination Phase</th></tr>
<tr><td rowspan="8">Political and regulatory</td><td>Environmental review</td><td>Cancellation of permits</td><td rowspan="3">Change in tariff regulation</td><td>Contract duration</td></tr>
<tr><td rowspan="3">Rise in pre-construction costs (longer permitting process)</td><td rowspan="3">Contract renegotiation</td><td>Decommission</td></tr>
<tr><td>Asset transfer</td></tr>
<tr><td colspan="2">Currency convertibility</td></tr>
<tr><td colspan="4">Change in taxation</td></tr>
<tr><td colspan="4">Social acceptance</td></tr>
<tr><td colspan="4">Change in regulatory or legal environment</td></tr>
<tr><td colspan="4">Enforceability of contracts, collateral and security</td></tr>
<tr><td rowspan="7">Macroeconomic and business</td><td>Prefunding</td><td colspan="3">Default of counterparty</td></tr>
<tr><td colspan="2" rowspan="3">Financing availability</td><td colspan="2">Refinancing risk</td></tr>
<tr><td colspan="2">Liquidity</td></tr>
<tr><td colspan="2">Volatility of demand/market risk</td></tr>
<tr><td colspan="4">Inflation</td></tr>
<tr><td colspan="4">Real interest rates</td></tr>
<tr><td colspan="4">Exchange rate fluctuation</td></tr>
<tr><td rowspan="6">Technical</td><td colspan="3">Governance and management of the project</td><td rowspan="5">Termination value different from expected</td></tr>
<tr><td colspan="3">Environmental</td></tr>
<tr><td>Project feasibility</td><td rowspan="2">Construction delays and cost overruns</td><td rowspan="2">Quantitative deficit of the physical structure/ service</td></tr>
<tr><td>Archaeological</td></tr>
<tr><td colspan="3">Technology and obsolescence</td></tr>
<tr><td colspan="4">Force majeure</td></tr>
</table>

Source: OECD Taxonomy of Instruments, 2015

[32] Ibid.

parties. This includes inefficient bidding and procurement processes, which increase risk. The absence of common standards for public-private partnerships for investment in LCR infrastructure requires that each investment be tailored to individual projects, raising transaction costs.[33]

Financing over the LCR project lifecycle

The barriers to financing LCR infrastructure projects are also variable over the project lifecycle.

As can be seen in **Table 2.2**, there are significant risks in the early project preparation stage given the number of rigorous and critical steps: resource assessments, siting, coordination of multiple actors, and contractual negotiations, including the allocation of risks among parties. During project construction, the risks grow as the project is built. At this stage, there remain macroeconomic and business, as well as political risks. In addition, there are risks of construction delays, permit cancellations, and sudden shifts in finance availability. For LCR infrastructure, there are additional technology risks. It is not until the project is operating that cash flow turns positive and risks decline to deliver a return.

The cost of capital

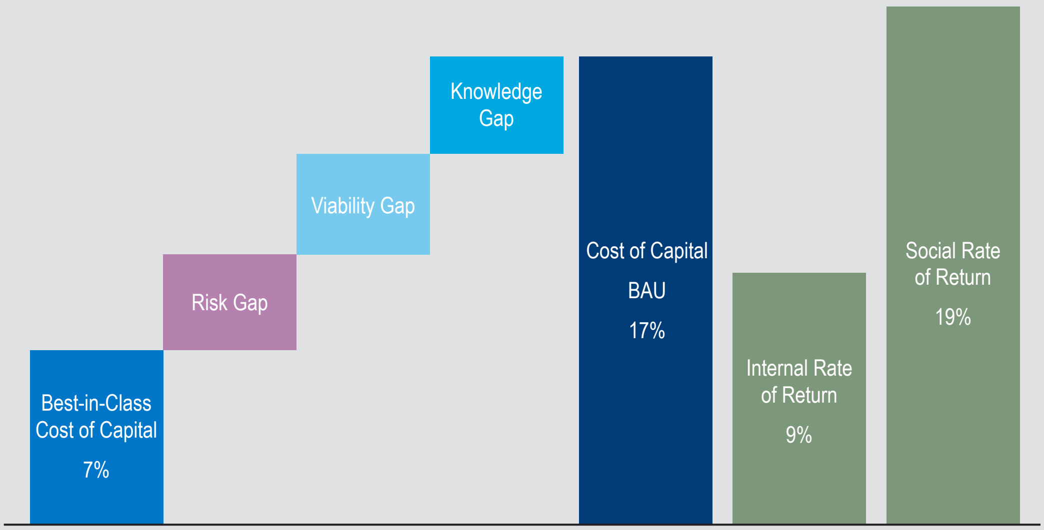
The risks of investing in LCR infrastructure and the gaps in viability and knowledge lead investors to seek higher returns, reflected in an increase in the cost of capital for LCR infrastructure.[34] **Figure 2.3** shows how best-in-class capital would allow an LCR infrastructure project to proceed, delivering an acceptable internal rate of return to investors and an even higher social rate of return. The internal rate of return is the measure that the private sector uses to determine whether a project delivers return to make investing worthwhile. Meanwhile, the social rate of return reflects the positive externalities from LCR infrastructure that are not able to be capture by the investor, such as those arising from reduced GHG emissions and the development impacts outlined in Section 2.[35]

High social rates of return are inherent in LCR infrastructure once the climate benefits from avoided greenhouse gas emissions are taken into account.[36] The risk, viability, and information gaps raise the cost of capital above the project's internal rate of return. This is the case even though the social rate of return justifies the project.

In the stylized example provided in **Figure 2.2**, the LCR infrastructure project would not proceed, as the cost of capital is above the projects internal rate of return. This figure underscores the need for public finance to de-risk LCR projects in order to reduce the cost of capital so that projects with high social rates of return can proceed. Specifically, concessional finance can address the risk, viability, and knowledge gaps in order to create risk-adjusted returns for LCR projects that are attractive to private capital (**Figure 4.1** addresses this in more detail). This is about unlocking the high development and climate change benefits of LCR infrastructure that are not reflected in the project's internal rate of return.

[33] Aaron Bielenberg et al., "Financing Change: How to Mobilize Private Sector Financing for Sustainable Infrastructure."
[34] Gianleo Frisari et al., "Risk Gaps: A Map of Risk Mitigation Instruments for Clean Investments."
[35] "Stern Review: The Economics of Climate Change."
[36] Ibid.

Figure 2.2. Costs Versus Returns, Both Social and Financial, in a Theoretical LCR Infrastructure Project



Source: Author's calculations

The argument for public financial support for private investment in LCR infrastructure also rests on the value-add that the private sector brings, and more generally the benefits of competitive markets and the profit motive that increases the efficiency of LCR project construction and operation compared with the public sector.[37] According to research by the International Monetary Fund comparing public investment in infrastructure across countries with measures of its coverage and quality "reveals average inefficiencies in public investment processes of around 30 percent."[38]

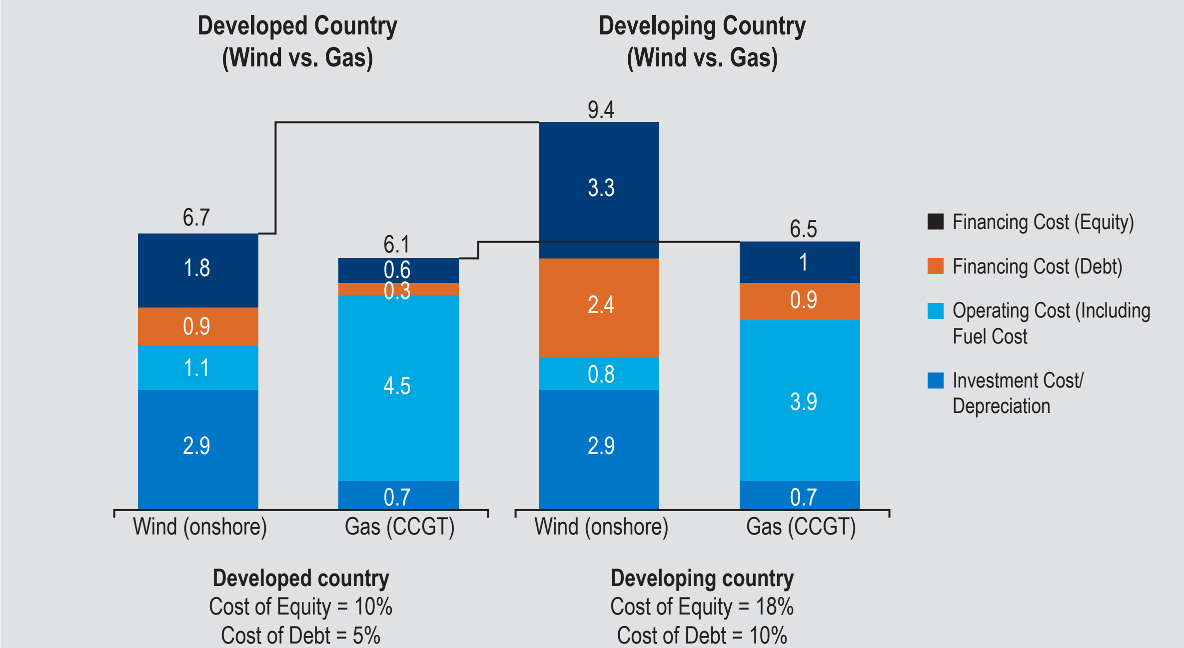
An assessment of the impact of the cost of finance on investors' decision whether to invest needs also to account for the alternative investment opportunities in carbon-intensive infrastructure. **Figure 2.3** illustrates the scale of financing costs for renewable energy compared with gas-fired power in both a developed and a developing country.

Even though the operating costs for wind turbines are lower in developing countries, the cost of investing in wind power in developing countries is 40 percent higher than in developed countries due to the relatively higher cost of debt and equity.

The figure also highlights how the upfront cost of infrastructure projects magnifies the impact of higher capital costs. For instance, the much larger upfront investment costs for wind compared with gas mean that more capital is needed at the initial stage of the in-

[37] Kathrin Bimesdorfer and Martina Richwien, "Climate Adaptation and the Private Sector."
[38] "Making Public Investment More Efficient."

Figure 2.3. Financing Cost Comparison for Developing and Developed Country Wind and Gas Projects



Source: Oliver Waissbein et al., "Derisking Renewable Energy Investment.

vestment. Even though wind has lower operating costs over the life of the project compared to gas, the capital needed to finance the upfront costs overwhelms the gains on the operating side.

Ultimately, finance can be a significant barrier to investing in LCR infrastructure and an even greater barrier in developing countries, given higher costs of capital. This is despite the fact that both capital and operating expenditures for wind in the developing country is lower than the equivalent costs for wind in the developed country.

While risks and other barriers to building LCR infrastructure in developing countries raises the cost of capital, developing countries often have limited capacity to deliver risk-adjusted returns from public resources by raising taxes or through user fees. This further limits the scope to attract private sector capital, with its demand for risk-adjusted return, into LCR infrastructure in developing countries.

Financing LCR infrastructure

To address the risks of investing in LCR infrastructure over a project life-cycle requires matching the public and private finance able to bare such risks. For instance, the highest risks during project preparation and construction has meant that private finance is often limited to sponsor equity and short-term loans. Yet, even here there is limited appetite from private investors to invest in climate technologies or in developing countries where the risks are even higher.

There is also limited interest from institutional investors in early-stage, high-risk project preparation and construction.[39] Such investments usually require a direct stake in the project, which necessarily entails infrastructure expertise sufficient to assess the risks. Some institutional investors are establishing deal teams with infrastructure expertise but, even here, the appetite to invest during project preparation and construction is limited by the high risks and lack of liquidity.[40]

Instead, institutional investors tend to invest indirectly in infrastructure via funds or bonds that are backed by infrastructure already operating and generating a reliable cash flow.[41]

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[39] Christopher Kaminker and Fiona Stewart, "The Role of Institutional Investors in Financing Clean Energy."
[40] Florian Bitsch, Axel Buchner, and Christoph Kaserer, "Risk, Return and Cash Flow Characteristics of Infrastructure Fund Investments."
[41] Raffaele Della Croce and Juan Yermo, "Institutional Investors and Infrastructure Financing."

SECTION 3: DEVELOPMENT AND CLIMATE FINANCE FOR LCR INFRASTRUCTURE

The role of multilateral development banks

MDBs can reduce risk and the cost of capital by providing concessional finance (e.g., loans at lower-than-market interest rates or with longer maturities), partial risk guarantees to backstop public-sector contractual guarantees, and partial credit guarantees to support longer loan terms and to reduce the cost of private debt.

MDBs also use the strength of their balance sheets and high credit ratings to reduce overall project risk and to give added certainty to project finance structures. In fact, MDB financing of infrastructure is often seen as a stamp of approval that provides investors with additional confidence and willingness to invest.[42]

As discussed in more detail in Section 4, the majority of IFC and Inter-American Development Bank Group (IDBG) private sector loans are at market rates (though for the recipient such loans may be concessional when they are on terms more favorable than is available on the private market). The MDBs deploy climate finance such as from the CTF alongside their own funds.

In addition to providing sources of finance and risk mitigation, MDBs bring sector specific knowledge and strategic local understanding of the market. MDBs also work to improve the capacity of governments and local financial institutions to undertake infrastructure financing.

As **Table 3.2** shows, MDBs intend to increase their financing of climate action. For example, the World Bank aims to increase climate finance from 21 to 28 percent of annual commitments by 2020. Similar ambitious targets have been set by the other regional development banks.

Table 3.1: MDBs Helping Drive Progress on Climate Goals

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

42 Chiara Trabacchi et al., "The Role of the Climate Investment Funds in Meeting Investment Needs."

Table 3.2: Recognizing the Shortfalls in MDB Financing for Infrastructure

MDB Climate Finance	US$ Bn
2017 Joint Report on MDBs Climate Finance	$35.2 (in 2017)
Climate Policy Initiative Global Landscape of Climate Finance 2017	$48.0 (in 2016)
MDB Infrastructure Finance	
2016 OECD Official Development Finance for Infrastructure Paper	$31.0
LCR Infrastructure Share	Approx. $11.5

Source: World Bank; OECD; author calculations

There are various estimates of MDB financing for infrastructure and MDB climate finance. **Table 3.2** provides two estimates of MDB climate finance; one from the MDBs themselves and the other from the Climate Policy Initiative. The differences are due to methodologies used to calculate climate finance where the MDBs' climate finance estimates only include the elements or portions of the project that directly contribute to or promote adaptation and mitigation.[43]

According to the MDBs, in 2017 they contributed $35.2 billion in climate finance. In contrast, the Climate Policy Initiative estimates that MDB climate finance was $48 billion. As not all climate investments by the MDBs are in LCR infrastructure, it is also useful to consider MDB investment in infrastructure. According to the OECD, the MDBs invested $31 billion in infrastructure in 2014. Of that $31 billion, only $11.5 billion was invested in LCR infrastructure.

What is climate finance?

There is no globally accepted definition of climate finance. The working definition adopted by the UN Framework Convention on Climate Change (UNFCCC) defines it according to "whether the financing aims at reducing emissions, enhancing sinks of greenhouse gases and…reducing vulnerability of, and maintaining and increasing the resilience of, human and ecological systems to negate climate change impact."[44]

The UNFCCC emphasizes the role of public finance in meeting the climate finance goal in the Paris Climate Change agreement and explicitly calls for support amounting to $100 billion per year by 2020. While the agreement does not cite a specific private sector funding target, it recognizes that private finance will play a role as well.[45]

The Multilateral Climate Funds

The following assesses the role of the MCF in financing LCR infrastructure.

Among the ranks of climate funds, seven can be categorized as multilateral climate funds (MCF): the GCF; the GEF, which has responsibility for the Least Developed Countries Fund and the Strategic Climate Change Fund; the Adaptation Fund and the two funds within the CIFs—the CTF and the Strategic Climate

[43] "Joint Report on Mobilization of Private Finance by Multilateral Development Banks."
[44] "Standing Committee on Finance 2014 Biennial Assessment and Overview of Climate Finance Flows Report."
[45] "The Paris Agreement."

Fund. The following is focused on the CIFs, the GEF, and the GCF that represent over 90 percent of multilateral climate finance.

The Global Environment Facility

The GEF was established in 1991 to provide grants and other concessional financing to pay for the incremental project costs of achieving global environmental benefits. When the UNFCCC was adopted in 1992, the GEF was designated as the operating entity of its financial mechanism.[46] At the Seventh Conference of the Parties to the UNFCCC (COP7), the Least Developed Country Fund and Special Climate Change Fund were created to serve the Convention and these funds are also operated by the GEF.[47]

The GEF is funded via four-year replenishment cycles, the latest being GEF-6 over 2014-2018 at $4.43 billion. Of this total, $1.26 billion was allocated for climate change.

The Green Climate Fund

The Green Climate Fund (GCF) was established as the second operating entity of the UNFCCC's financial mechanism. The 2015 Paris Agreement clarified that the GEF and the GCF are also the financial mechanisms of the Paris Agreement.[48] The GCF has received pledges so far of $10.3 billion.

Climate Investment Funds

In 2008, developed countries and the MDBs established the CIFs as an interim measure to increase financial flows for climate. The CIFs comprise the CTF and the Strategic Climate Fund (SCF). The SCF itself includes three programs: The Pilot Program for Climate Resilience, the Forest Investment Fund, and the Scaling-up Renewable Energy in Low Income Countries facility.

The CIFs have been capitalized at $8.1 billion, with $6.4 billion approved projects and programs as of 2017.[49]

The CIFs and GCF have a specific mandate to mobilize private sector capital. In addition, the CIFs, GEF, and GCF have a mandate to be transformative: to make investments that are not merely one-offs, but that can be replicated or that catalyze replication and expansion with the aim of phasing out reliance on public finance.

[46] "UN Framework Convention on Climate Change," Article 11.
[47] "UNFCCC Decision 7/CP.7: Funding Under the Convention."
[48] "The Paris Agreement," Article 9.8.
[49] Climate Funds Update 2017.

Table 3.3: Multilateral Climate Funds

	Green Climate Fund	Global Environment Facility	Clean Technology Fund	Forest Investment Program	Pilot Program for Climate Resilience	Scaling-up Renewable Energy Program
Founded	2010	1991	2008	2008	2008	2008
Cumulative pledged funding	10.3 bn	3.03 bn	5.57 bn	0.768 bn	1.190 bn	0.780 bn
Funding approved	1.48 bn	2.54 bn	4.5 bn	0.315 bn	0.950 bn	0.289 bn
Projects approved	35	379	91	22	60	21
Countries with projects approved	52	137	25	8	18	11
Average fund contribution per project	42.3 mn	6.7 mn	49.5 mn	14.3 mn	15.8 mn	9.4 mn

SECTION 4: BLENDING MULTILATERAL CLIMATE FINANCE

The OECD defines blending as "the strategic use of development finance for the mobilization of additional finance towards sustainable development in developing countries."[50] The OECD definition focuses on whether the source of finance is development focused, which would include official development assistance (ODA, concessional and non-concessional) as well as private funds with a development mandate (e.g. philanthropic).

The use of blended finance represents a broader development opportunity to leverage private finance for climate action and to achieve the SDGs.[51] Blending different sources of concessional climate finance to reduce risk is one way to address the abovementioned LCR infrastructure barriers and to mobilize private sector capital.

This paper focuses on the use of concessional finance from the MCF to reduce risk and thereby mobilize additional MDB capital as well as 'real' private sector capital chasing commercial returns into LCR infrastructure.[52]

What is concessional finance?

What constitutes concessional finance is a relative notion. **Table 4.1** compares the terms of finance provided by the World Bank (IDA and IBRD), the CTF, the GCF, and GEF. The data are only for finance provided to the public sector, as private sector finance terms are confidential.

Table 4.1: Terms for Climate Finance

	Country	Maturity	Grace	Interest	Other charges*
CTF Public	Highly concessional	40	10	0.25	0.43
	Less concessional	20	10	0.75	0.93
GCF Public	Vulnerable	40	10	0.25	1.25
	Others	20	5	0.75	1.25
GEF Public	Vulnerable	40	10	0.25	
	Others	20	10	0.75	
IDA	Grant	NA	NA	NA	NA
	Small economy	40	10	0	0.75
	Regular	38	6	0	0.75
	Blend	30	5	1.35	0.75
IBRD		20+		Libor + 1.50** Libor + 0.95	0.5

*CIF service fee + MDB fee; CIF service fee + commitment fee; IDA service fee; IBRD service fee
**Fixed and flexible rates

Source: World Bank

[50] "Making Blended Finance Work for the Sustainable Development Goals," 50.
[51] "The State of Blended Finance."
[52] Hannah Pitt and Laurence Blandford, "Mobilizing Private Sector Investment in Support of Nationally Determined Contributions."

The MCF provide two types of loans depending on project risk. The CTF for example, provides:[53]

- Less concessional (hard) loans for projects with rates of return near normal market threshold but below risk premiums for project type, technology, country, or acceleration in deploying low carbon technology; and
- Highly concessional (soft) loans for projects with negative rates of return or below the normal market threshold.

The GCF and the GEF provide concessional finance on similar terms to the CTF.

Another source of concessional finance is from IDA, the concessional arm of the World Bank. Regular IDA lending is provided on terms similar to the highly concessional CTF finance. Yet, IDA support is limited to low-income countries, whereas CTF funds have been mainly deployed in middle income countries that do not qualify for IDA funding. In contrast, IBRD loans are significantly less concessional than the CTF, even though IBRD funds are offered at terms better than those these borrowers could obtain in the private market. As a share of total World Bank loans, IDA commitments in 2016 were $16.2 billion and IBRD commitments were almost $30 billion.[54]

The role of the MDBs in blending climate finance

The MDBs have the knowledge and financial position to play a central role blending their own capital with the MCF to reduce risk and crowd-in private sector capital.[55] The MDBs also have private sector arms (i.e. World Bank Group has IFC, the Asian Development Bank has a Private Sector Operation Department) that invest at market or near market-rates but with a development mandate.

There is now a high-level commitment by governments and the MDBs to support blended finance. The G20 International Financial Architecture Working Group includes principles for MDBs for crowding-in private finance. The MDBs themselves have released a Joint Statement of Ambitions for Crowding in Private Finance.

The MDBs are increasingly developing mechanisms for blending finance. For instance, there is a new IDA "Private Sector Window" for blending and the IFC has a specific blended finance unit.

MDBs have also developed a cascade approach to blending aimed at maximizing their development resources. The cascade uses a sequencing approach to assess when MDB support should be provided. MDBs first assess whether the projects can be financed with private capital. If this is not possible, upstream reforms are to be prioritized to improve the sector or country's enabling environment, so as to reduce risk to a level that will make the project attractive to private sector investors. When such reforms cannot adequately address risks, MDBs can use guarantees, credit enhancements, and risk-sharing instruments. And only if such risk mitigation instruments are insufficient to lower risk and crowd-in private capital should MDBs use their own capital to make concessional loans.

[53] "CTF Financing Products, Terms and Review Procedures for Public Sector Operations," 10.
[54] "Joint Report on Multilateral Development Banks' Climate Finance."
[55] "Making Blended Finance Work for the Sustainable Development Goals"; "The State of Blended Finance."

Blending multilateral climate finance

The MCF are themselves blended finance facilities designed to co-finance climate outcomes with other public and private sources of capital.

The Climate Investment Funds, by virtue of having the MDBs as implementing agencies, have developed integrated mechanisms for blending finance. This has led to the development of an important two-way relationship where co-financing from the CIFs alongside MDB resources has amplified the CIF's impact and helped to mainstream climate objectives into MDB work. Assessment of the impact of financing from the CIFs on MDB projects has found that these projects would not have proceeded without their resources.[56]

Approximately one-third of GEF funding has been blended with World Bank and IFC capital.[57] Projects supported by GEF and the IFC have included innovative climate change interventions such as risk-sharing guarantee and other concessional finance. Combined with IFC experience in financial markets and its work with the private sector, this has served to mobilize additional private-sector financing.[58]

So far, the GCF has co-financed fifteen projects with the MDBs worth close to $4 billion. Though the MDBs are only one of many entities receiving GCF finance. For instance, as of January 2018, 59 entities were accredited to apply for GCF funding and a further 198 entities were undergoing accreditation. Additionally, the GCF lacks the close institutional proximity with the MDBs enjoyed by the CIFs.

The role of multilateral climate finance

How to most effectively blend the MCF needs to be assessed in light of the other available sources of finance and their risk tolerance. This includes other types of MDB financing, as well as bilateral funds, development finance institutions, and domestic finance. Then there is private sector capital, which itself comprises different sources of capital (i.e., banks, corporate balance sheets, sovereign wealth funds, pension funds) and risk profiles.

As a general proposition, multilateral climate finance should then be aimed at those risks that MDBs and other public finance are unable to address and that remain as barriers to investing in LCR infrastructure in developing countries. This is necessarily a dynamic assessment, particularly as the MCF ratchet up their financing of LCR infrastructure. The MCF use should adapt accordingly. For instance, increased MDB support for risk mitigation instruments rather than direct loans should require the MCF to take on more risk.[59]

There are other limits to MDB finance for LCR infrastructure. For one, not all MDB infrastructure finance is concessional, thereby limiting the scope for MDBs to reduce project risk. Allocations of concessional/non-concessional finance varies by MDB, but the OECD reports that overall concessional financing by the MDBs was 35 percent of the total.[60]

The capacity for MDBs to finance high-risk, transformative LCR infrastructure is also limited by their risk

[56] Chiara Trabacchi et al., "The Role of the Climate Investment Funds in Meeting Investment Needs."
[57] Independent Evaluation of the Climate Investment Funds.
[58] Ibid.
[59] "High Level Panel on Infrastructure, Recommendations to G20 - Final Report."
[60] Kaori Miyamoto and Emilio Chiofalo, "Official Development Finance for Infrastructure: With a Special Focus on Multilateral Development Banks."

appetite. This can limit the scope for MDBs to address the full range of LCR infrastructure risks outlined earlier in this paper.

MDBs must balance climate and development goals. This can lead to an investment portfolio not entirely aligned with the Paris climate agreement goal of keeping average temperature increase well below 2 degrees Celsius.[61]

Multilateral climate finance should be used to fill in LCR financing gaps that other sources of finance cannot bridge. This is an extension of the MDB cascade approach to the MCF as a framework for effectively husbanding the even scarcer MCF resources while also seeking to maximize impact. When it comes to LCR infrastructure, this would entail addressing those risks that prevent investments into transformative LCR infrastructure. The MCF should be used to provide ultra-concessional finance that is even more generous than MDB facilities in terms of interest rates and maturities. There would also need to be a greater appetite for higher risk and an ability to deploy funds at a pace that can meet private sector expectations.

Figure 4.1 provides a stylized presentation of risks and cash flow over the project lifecycle and identifies the corresponding scope for blending the MCF, MDB finance, and private capital to reduce risks and finance LCR investment.

As mentioned, heightened policy and regulatory risks are among the key challenges to financing LCR infrastructure, particularly in developing countries. As such, improving the enabling environment can reduce risk across the infrastructure project lifecycle. Estimates of MDB financing to improve the enabling environment for infrastructure vary from around 30 percent of total infrastructure investment for the European Bank for Reconstruction and Development (EBRD) to over 20 percent for the World Bank Group.

In addition, a poor enabling environment hinders investments in development more broadly and as a result is a focus for the MDBs. This includes MDB financed technical assistance aimed at improving governance, developing legal systems, and building government capacity to negotiate and implement partnerships with the private sector. Notably, the MDBs have also been working to improve the infrastructure specific enabling environment and have established the Global Infrastructure Facility to help governments develop infrastructure projects and bring them to market by assisting with project preparation, such as through feasibility studies and partnership structuring, documentation preparation, and the design of risk mitigation packages.[62]

The MCF also strengthen the enabling environment for LCR infrastructure by providing technical or policy assistance that helps build a pipeline of LCR infrastructure projects. Such work could compliment efforts by the World Bank and other MDBs by focusing specifically on what is needed to support LCR infrastructure —the GIF is for all infrastructure. This could include policy reforms that can incentivize investment in LCR infrastructure, such as tax breaks or feed-in tariff for renewable energy and technical assistance in assessing the risk of new climate technologies.[63]

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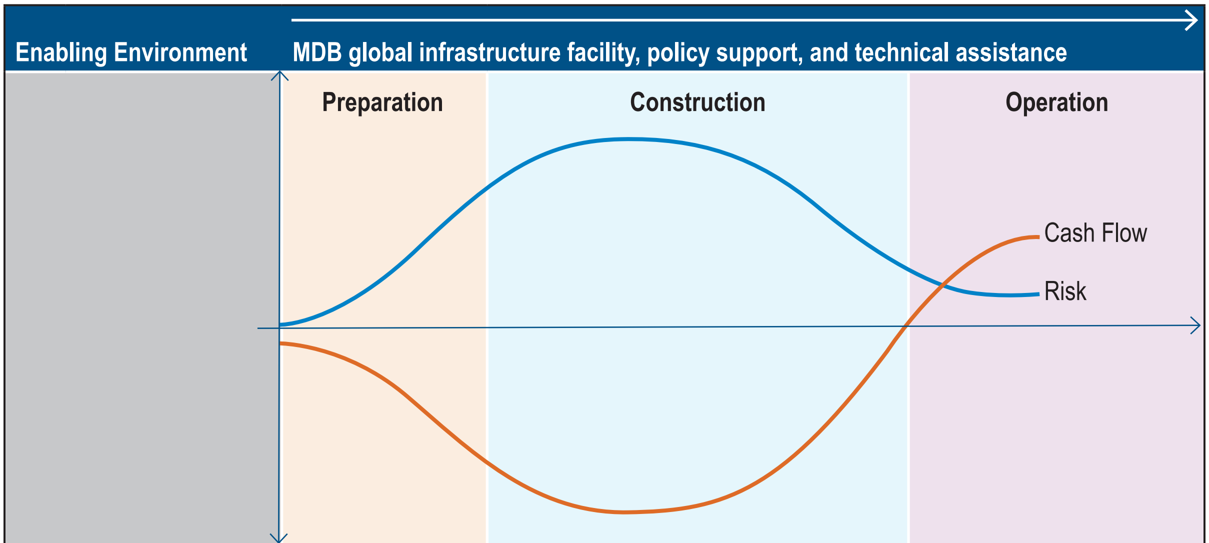
[61] Giulia Christianson et al., “Financing the Energy Transition: Are World Bank, IFC, and ADB Energy Supply Investments Supporting a Low Carbon Future?”
[62] “Global Infrastructure Facility (GIF) Opens for Business.”
[63] Kaori Miyamoto and Emilio Chiofalo, “Official Development Finance for Infrastructure: With a Special Focus on Multilateral Development Banks.”

Figure 4.1: Changes in Risk and Cash Flow During LCR Infrastructure Project Cycle



Sources of finance		Preparation	Construction	Operation
	Private finance	Mainly sponsor equity Some bank loans	Scope for debt finance, such as bank loans, syndicated loans, corporate bonds, and project bonds	Opportunities for institutional investors
	Multilateral Development Banks	Technical assistance Grants Risk mitigation instruments Concessional loans	Finance to reduce risk using junior/subordinated debt, guarantees/risk sharing, concessional loans, and grants.	Capital market development Build green bond market
	Multilateral Climate Funds	Technical assistance Grants Highly concessional loans	Highly concessional loans First loss guarantees	

At the project preparation stage, **Figure 4.1** shows that financing largely depends on sponsor equity, with some opportunities also to access short-term bank loans. For LCR projects in developing countries, however, the risks and other gaps can make project preparation cost-prohibitive. MDBs and the MCF can support project preparation through technical assistance, and efforts to more broadly improve the enabling environment should help by building local capacity. In addition, grants and other concessional finance is often needed to reduce the cost of finance.

An additional role for the MCF at the project preparation stage is to incentivize consideration of best available technology to reduce emissions. Climate finance can be used here to build into the project preparation stage consideration of the below 2-degree Celsius climate goal. For instance, this could include support to determine whether a proposed project, such as a gas-fired plant, would be consistent with the types of emissions reductions a country should make over the 30-40 year project lifespan.[64]

Larger amounts of finance are needed at the project construction phase and it is at this point that high costs of capital can render infrastructure projects financially unfeasible. Blending MDB and MCF can reduce risks sufficiently to attract private sector capital into LCR infrastructure (see Section 4).

The following section assesses the blending of MDB and climate finance to reduce risks and crowd-in private capital into LCR infrastructure projects.

[64] Giulia Christianson et al., "Financing the Energy Transition: Are World Bank, IFC, and ADB Energy Supply Investments Supporting a Low Carbon Future?"

SECTION 5: ASSESSING THE CLEAN TECHNOLOGY FUND

The CTF is the largest provider of blended financing amongst the MCFs to date. Outcomes from CTF blending with the MDBs and private capital provides important insights into the success of blending to achieve climate and development goals.

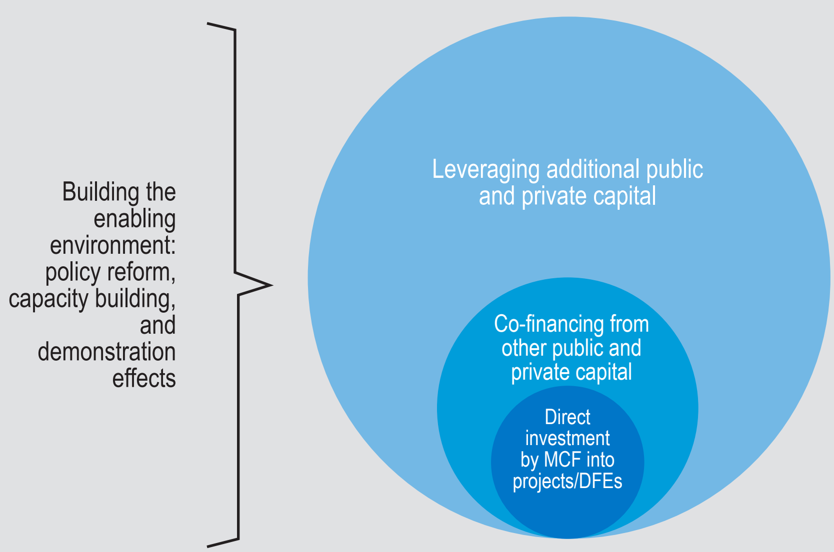
Distinguishing between co-financing and leverage

Within the broader notion of blending are two separate concepts—co-finance and leverage. Co-financing refers to the use of MCF resources alongside other sources of finance, either public or private.[65]

Levels of co-finance occur at the project level as well as the fund or facility level.[66] For instance, the CTF invests directly in LCR infrastructure projects. As mentioned earlier, the CTF also invests in domestic financial entities (DFEs), which can then on-lend to other LCR infrastructure projects which can further attract blended public and private finance.[67]

The notion of leverage captures a larger financing envelope that includes additional resources committed, either as a result of the infrastructure project or due to policy reforms that strengthen the enabling environ-

Figure 5.1: From Co-financing to Leveraging Other Sources of Finance



[65] "The World Bank Operations Manuel: Operational Policies on Co-financing"; Stacy Swann, "Blending Donor Funds for Impact."
[66] "The State of Blended Finance," 4.
[67] "The State of Blended Finance."

ment.[68] For instance, this could include a renewable energy project built as a result of investment in T&D.

Figure 5.1 captures the differences between co-financing and leverage from a MCF perspective.

Blending CTF Finance

The CTF aims to blend its own highly concessional finance with MDB finance (concessional and non-concessional) in order to "increase the concessionality of the overall financing for the project."[69] In doing so, blending should unlock private sector demand to finance projects.

When determining the appropriate amount of concessional finance, the key CTF aim is to support investment in scaling-up the deployment of low-carbon technologies. The description by the CTF of when to provide hard and soft loans outlines the range of circumstances under which such concessional finance should be deployed. This includes soft loans for projects with negative rates of return, which would include the risks in **Table 4.1** such as the absence of a carbon price or the presence of fossil fuel subsidies. The following figures in Section 5 provide co-financing ratios between the CTF, other public (including MDBs) and private finance.

Data on the broader notion of leverage is not available. However, leverage achieved from CTF finance will likely be an important outcome of the use of CTF finance to meet LCR infrastructure needs and should be taken into account in assessing whether CTF finance (and MCF more broadly) is 'transformative'.

Each of the MCF report different levels of co-financing. For instance, GEF reports a co-financing ratio of 1:13, although this includes China, which produces higher co-financing ratios on average. This figure is also skewed by some large projects.[70] The CTF has reported co-financing of around 1:9.5 (1:3.3 for private; 1:2.6 for MDBs and 1:2.4 for bilateral/other sources).[71] The ratios for the limited number of GCF projects is 1:2.5 and includes GCF support for mitigation and adaptation.

CTF investment by risk

This section assesses the use of CTF finance in mobilizing MDB and private finance across project risks.

The following conclusions that link allocation of finance and investment risk levels are tentative, as the allocation of a risk level to a given investment takes into account local and project specific factors that limit the ability to compare risk levels across investments.

This analysis utilizes data provided by the Climate Investment Funds Administrative unit and desk research. The data encompasses 126 projects with CTF financing of $5.25 billion. This is broken down into 70 private projects with CTF financing of $1.89 billion and 56 public projects with CTF financing of $3.63 billion.

For the CTF in particular, the public projects are those where the CTF funds are allocated to public sector

[68] "Joint Report on Mobilization of Private Finance by Multilateral Development Banks."
[69] "CTF: Financing Products, Terms, and Review Procedures for Public Sector Operations," para 8.
[70] Independent Evaluation Group 2015.
[71] ICF International 2014; CIF 2017. Our data analysis shows overall co-financing rations of 1:9.3; private sector co-financing of 1:3.1, MDB co-financing of 1:2.7 and co-financing with bilateral/other sources of 1:2.3. The differences with CTF figures are due to rounding and some data we are missing, particular for private sector financing.

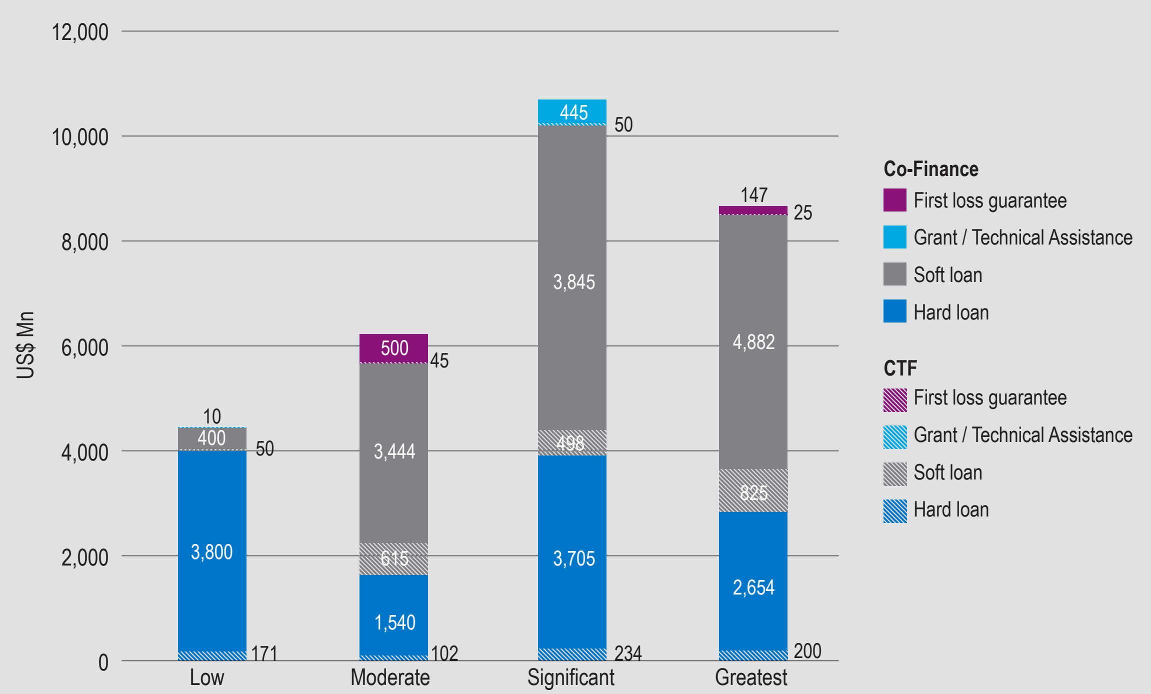
sponsors. Small amounts of CTF funds may also go towards the activities that support the preparation or construction phases of the projects. These activities include preparation grants, MDB-implementation services, technical assistance, and similar activities.

Figure 5.2 shows the distribution by risk levels of total finance for public projects. As can be seen, investments with the significant and greatest risk represent the bulk of total finance. In addition, the largest amounts of CTF finance ($1.05 billion) was allocated to significant and greatest risk investments.

Moreover, CTF share of total investment was higher for projects with moderate (12.2 percent) and greatest (12 percent) risk levels. Examples of projects with moderate risk level were investments in solar rooftop energy in India, geothermal clean energy in Indonesia, efficient lighting in Mexico, urban transport in Vietnam, and distribution efficiency in the Philippines. The highest risk projects include a smart grid in Ukraine to phase out a single-buyer energy market, wind power in South Africa to promote independent producers, and hydropower in India that relies on improved institutional action.

Figure 5.2 shows the various financial instruments used by the CTF and the other sources of finance. For significant and greatest risk projects, the majority of CTF finance was in the form of soft loans. In contrast,

Figure 5.2: Composition of Total Public Project Investments Including CTF Share



the lowest-risk projects have the smallest amount of soft loans, both in absolute terms and as a share of total CTF finance. This should be the case, as CTF soft loans are needed most to address the high risks of investing in low-carbon technologies.

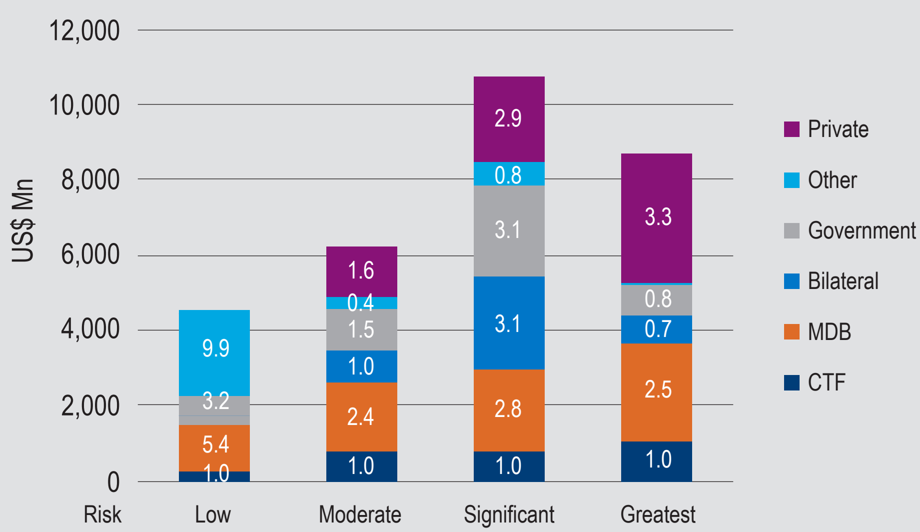
Co-financing and private sector mobilization

As project risk increases, larger amounts of multilateral climate financing may be required to reduce risk and crowd-in private capital. Indeed, for particularly high-risk projects using new climate technologies or when developing new markets, zero or very little private sector capital can be expected.[72] Similarly, for lower-risk projects, a given amount of concessional climate finance should crowd-in larger amounts of private capital.

Figure 5.3 shows the composition of finance from the CTF for each risk level as well as other sources of public and private finance. The table beneath the figure shows the composition of financial sources converted into co-financing ratios.

There are a couple of trends here worth noting. One is that public/private co-finance ratios increase as project risk increases. CTF, and public finance more broadly, has been increasingly successful at mobilizing private capital as risk levels increase. In other words, there was lower CTF financing in lower-risk projects and more CTF financing for higher-risk projects. **Figure 5.3** also shows that MDB financing in absolute amounts

Figure 5.3: CTF Public Sector Projects Co-financing Ratios



Risk	Low	Moderate	Significant	Greatest
CTF: Other Public: Private	1:18.5:0	1:5.3:1.8	1:9.8:2.9	1:4:3.3
Public: Private	NA	1:0.3	1:0.3	1:0.6

[72] Stacy Swann, "Blending Donor Funds for Impact."

and as a share of total finance was higher for low risk projects. This points to some complementarity between CTF and MDB financing, with MDB finance being used for lower-risk projects and the more concessional CTF finance being reserved for riskier projects.

One explanation for the increase in private finance for riskier projects may be in the "other finance" category, which is the largest share of low-risk projects. The "other finance" category includes public-private partnerships, which could raise private sector ratios for low risk projects (the data do not allow us to state whether in fact there are such partnerships in this category or their value).

There are other gaps in the data that explain some of the lower private sector investment in lower risk investments. For instance, CTF data for a low risk project in Turkey did not include private sector co-financing, yet the project's implementation completion and results report shows that the $1.051 billion financing ($950.66 million IBRD and $100 million CTF) leveraged other financing of $2.049 billion from IFIs (including IFC), private sector banks and owners' equity, indicating a co-finance ratio of about 1:1.95.[73]

As noted above, there are also some investments in LCR infrastructure, such as T&D, that can enable additional LCR infrastructure into renewable energy. This reflects the co-finance/leverage distinction outlined above. For example, one of the four low risk projects is a T&D project in India which itself could enable investment for renewable energy projects.

Yet the high private sector co-financing of greatest-risk projects suggests that the CTF should consider expanding its financing of even riskier LCR infrastructure projects.

One challenge here for the CTF of moving into riskier projects could be limits on its capacity as a minority partner in a blended finance structure to attract private capital and also push projects into higher-risk, transformational climate technologies.

Another challenge to financing even riskier projects could arise from the CTF's underlying capital structure. In particular, the terms under which donors fund the CTF requires that CTF concessional finance to be no more concessional than that finance provided by its donors.[74] As a result, CTF ability to take on risk is limited by its donor's risk tolerance.

Co-finance for public and private projects

Figure 5.4 expands the analysis to all CTF projects, public and private. However, the absence of risk data for private projects limits the analysis to co-financing rates.

From the perspective of mobilizing private finance, CTF support for private investments have produced high private capital ratios than CTF finance of public investments. This is the case looking at both the ratio of CTF to private capital as well as the overall public/private ratio. However, this is to be expected, given that the mandate of the private sector arms of the MDBs is to mobilize private capital. In addition and as discussed, some CTF finance of public projects such as T&D will leverage additional private sector investment.

[73] "Implementation Completion and Results Report."
[74] "Report on the Financial Status of the CTF."

Figure 5.4: Project Co-financing Ratios

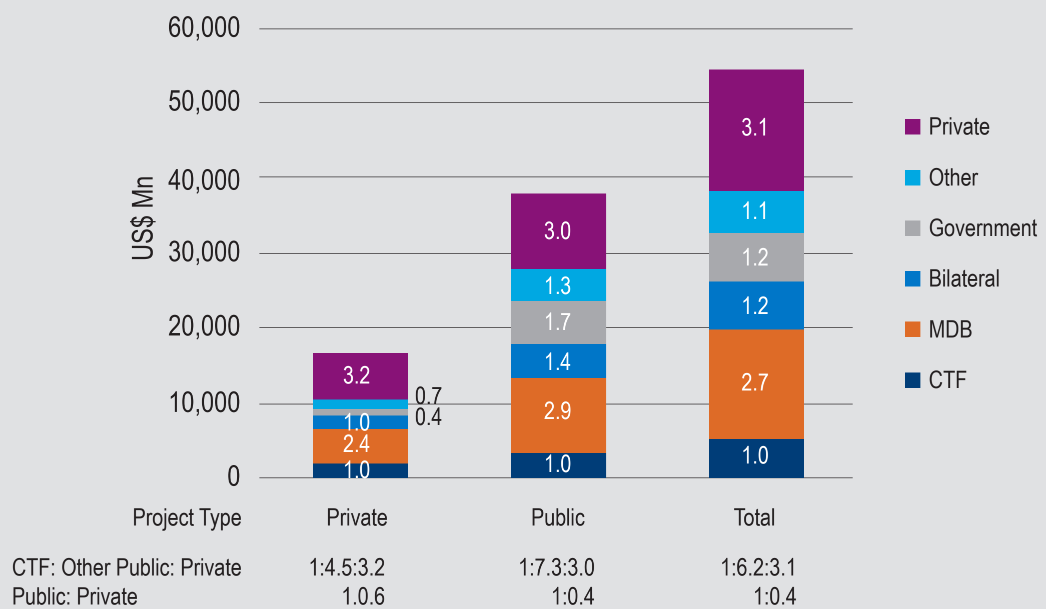
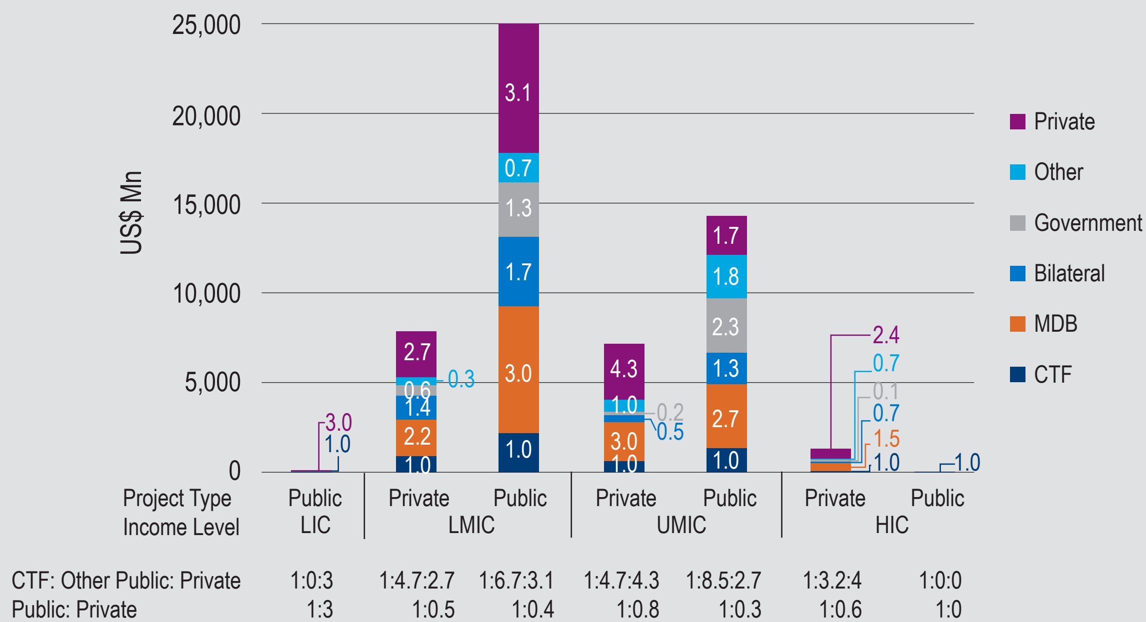


Figure 5.5: Project Co-financing Ratios Across Private/Public and Country Income Levels



The co-financing ratios also reveal the role played by bilateral funds and national governments and, while not the subject of this paper, is worth further analysis. **Figure 5.5** breaks out the private and public projects by income group.

The bulk of CTF finance was deployed in lower-middle-income (LMIC) and upper-middle-income (UMIC) countries. Private projects had higher ratios of private sector co-financing, particularly in UMICs. However, private sector co-finance in public projects in UMICs could be significantly higher depending on the composition of the "other" category.

Figure 5.5 also shows a focus on public projects in LMICs. This includes renewable energy in India, wind power in Morocco, market transformation through electric vehicles in the Philippines, energy efficient district heating in Ukraine, and urban transport in the Vietnam.

Meanwhile, in the case of private projects in LMICs, a greater mix of direct financing and on-lending has resulted in more even leverage among the sources of finance. The private projects feature more high-cost geothermal, concentrated solar, and energy efficiency projects.

Working through domestic financial intermediaries

The following considers CTF success in attracting co-finance by distinguishing between two broad types of investments outlined in **Figure 5.6**—direct investments in projects and indirect investments that develop the capacity of DFEs to on-lend to LCR projects. Such indirect investments often include capacity building as well as a loan or guarantee to the DFE.

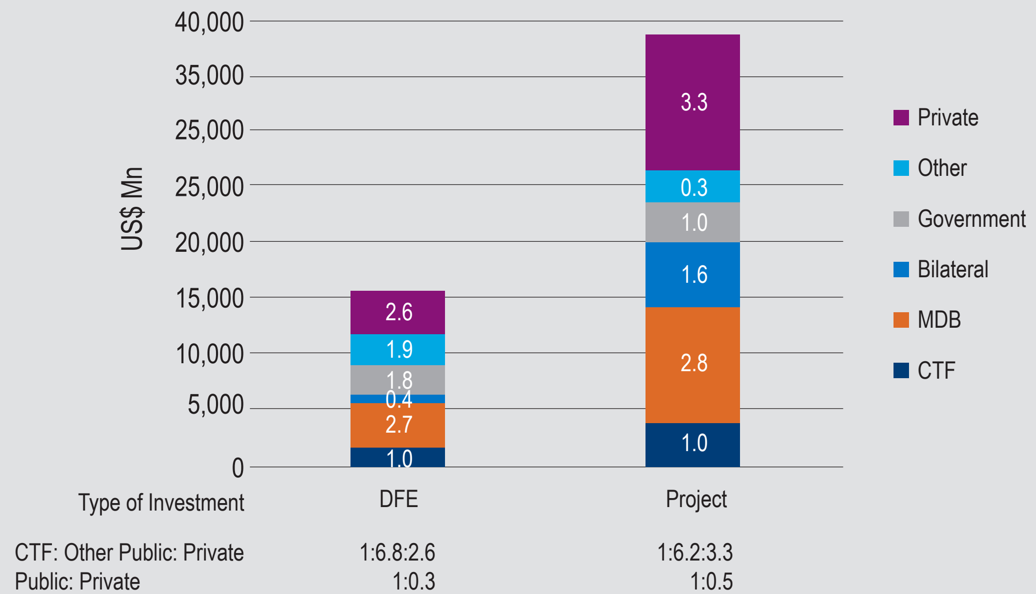
For instance, CTF finance helped build the capacity of national development banks in Mexico to evaluate large-scale wind power projects. In Turkey, it financed the development by financial intermediaries of financing for energy efficiency. It also financed Colombia's sustainable energy finance program. Success here can attract other local banks into the sector.

As can be seen in **Figure 5.6**, the majority of CTF finance has been direct support for projects. This reflects the types of projects that receive direct finance from the CTF and MDBs, which tend to be larger renewable energy or transportation projects. In contrast, the end-use projects from DFEs are generally smaller projects between $100,000-$2 million for energy efficiency upgrades (new equipment, building management systems, etc.) and small-scale renewable energy (rooftop solar, small distributed generation).

Direct projects also mobilize more private sector capital than investments in DFE—though this conclusion could change depending on the composition of the 'other category'. Moreover, through on-lending, DFEs leverage additional public and private resources. Take the example of the IFC China Utility-Based Energy Efficiency Program (CHUEE). With support from the GEF and China's Finance Ministry, the program supports energy efficiency measures in the country. It extends an IFC grant to local banks that then lend to market participants, such as utilities and businesses to implement energy efficiency measures.[75] While the IFC estimates that its grants have directly mobilized approximately 1.5 times that amount of private capital, the CHUEE program estimates that other elements of the program, including building the understanding and capacity of banks to engage in energy efficiency

[75] "Terminal Evaluation of China Utility Based Energy Efficiency Program (CHUEE)" (International Finance Corporation, 2014), https://www.ifc.org/wps/wcm/connect/0083ab004602caacade5bd9916182e35/Terminal+Evaluation+of+CHUEE.pdf?MOD=AJPERES.

Figure 5.6: CTF Finance According to Project



financing and building an energy efficiency market, have mobilized an addition $1.8 billion,[76] or three times the IFC investment.

[76] "IFC China Utility-Based Energy Efficiency (CHUEE) Program" (UN Framework Convention on Climate Change, n.d.), https://unfccc.int/climate-action/momentum-for-change/activity-database/momentum-for-change-ifc-china-utility-based-energy-efficiency-chuee-program.

SECTION 6. CONCLUSION

Multilateral climate finance will remain a small part of the finance requirements for LCR infrastructure. As discussed, blending MCF with MDB finance needs to be done in a complimentary structure to reduce LCR infrastructure risk and crowd-in private sector finance. This will require using MCF as a source of highly concessional finance with a high-risk tolerance that can support projects with the potential to demonstrate new climate technologies or create new markets.

The CTF is well positioned to fulfill this role. However, now that a new financial architecture under the UNFCCC is effective,[77] the CTF governing board will have to decide either to extend the CTF or sunset it in June 2019. This paper does not address the future of the CTF However, this paper does demonstrate that the CTF has played a key role in mobilizing MDB and private capital for LCR infrastructure.

How can multilateral climate financing enhance its impact?

For one, the MCF should continue to push into high risk climate projects that would not otherwise be viable (i.e. those projects that the MDBs alone would be unable to support). Here, the CTF already has a good track record. For example, the Noor Ouarzazate solar complex in Morocco is a concentrated solar power plant that, unlike with photovoltaic panels, allows for energy storage. The complex has been operational since 2016, and when fully completed will be the world's largest multi-technology solar power plant with 580 MW of installed capacity and an overall investment of over $2 billion.

How to most effectively deploy MCF capital is a moving target. As the MDBs ramp-up their climate financing and emphasize risk mitigation before direct loans—in line with the cascade approach—then the MCF should adapt accordingly and evolve to address remaining financing gaps.

As discussed, the emphasis on blending and use of the MCF to mobilize private capital to address LCR infrastructure investment needs has led to a focus on co-finance as a metric of success.

There are, however, limits to using high co-financing ratios as a key metric for determining successful use of MCF and also MDB finance. High private co-financing can signal a lack of risk taking by multilateral lenders, and could even indicate some crowding-out of private sector investment. Indeed, high private co-financing rates increase the likelihood that a project would proceed even without public financial support.

The World Bank cascade approach in principle should avoid this—only providing public finance to the extent needed to attract private capital. However, in practice, this calibration is difficult, in part due to information asymmetries between private and public actors, which make it difficult for MDBs and the MCF to assess what risks the private sector is able to tolerate.[78]

Co-financing ratios are also often project-specific, which suggests that care is needed in interpreting them. For instance, co-financing can be high for larger

[77] Climate Investment Funds, Governance Framework for the Clean Technology Funds, Adopted November 2008 and amended June 2014, section L.
[78] Paddy Carter, "Why subsidise the private sector? What donors are trying to achieve, and what success looks like", ODI Report, November 2015.

projects that require a consortium of lenders in which MDB and MCF financing represents only a small part.[79]

There also is no inherent link between high private co-financing and climate outcomes. In fact, lower co-finance ratios have been associated with higher levels of environmental benefits.[80] This suggests that there are projects with higher risks where private sector appetite is limited but in which environmental payoffs are significant. For MCF, support for transformative climate technologies may not always correspond to achieving high private sector co-financing.

The capacity for public finance to mobilize private capital will also depend crucially on the availability of bankable projects. In fact, the claim that low amounts of public capital can produce high mobilization rates assumes that there is a pipeline of projects which a small public investment can make viable.[81] Yet, a lack of bankable projects continues to be identified as a key barrier to increasing investment in LCR infrastructure.[82] Where there is a lack of bankable LCR projects, even higher amounts of public finance will be required to make second and third tier projects attractive to private investors.

There is also a role for an expanded consideration of co-financing to include leverage ratios. Such ratios are harder to measure, but are likely to be an important channel by which MCF will scale the financing needed for LCR infrastructure. This also underscores the importance of addressing the enabling environment for LCR infrastructure. Strengthening the enabling environment should reduce LCR infrastructure risk across the project cycle, creating additional opportunities for private capital to finance such projects. This should free up MCF to invest in even higher risk and transformational LCR infrastructure projects.

Blending public and private capital can also create tension in terms of goals. Generally speaking, private sector capital seeks a financial return, while the MCF balances financial returns and having a climate impact.[83] Moreover, the MCF often take only minority stakes in blended projects. This is often a risk management technique and regarded as a careful use of scarce resources. Yet, having a small stake can also limit the capacity of the MCF to attract private capital investment into even higher risk transformative climate technologies.

However, this tension between achieving financial returns and having a positive climate impact may be less intense than it appears.

One reason is that a number of LCR projects may have better than expected risk-adjusted returns. Indeed, a Brookings analysis of investments by the IFC found no causal link between better environmental, social, and governance (ESG) performance and worse financial performance; nor did it find evidence that better ESG performance causes better financial performance.[84] If in fact the trade-offs are less than expected, this would suggest that greater financing of LCR infrastructure in frontier markets could be more successful than anticipated in mobilizing private capital.[85]

[79] Javier Pereira, "Blended Finance: What It Is, How It Works, and How It Is Used."
[80] GEF Evaluation Office 2010.
[81] Samuel Munzele Maimbo and Simon Zadek, "Roadmap for a Sustainable Financial System"
[82] Aaron Bielenberg et al., "Financing Change: How to Mobilize Private Sector Financing for Sustainable Infrastructure."
[83] Javier Pereira, "Blended Finance: What It Is, How It Works, and How It Is Used."
[84] Raj M. Desai, Homi Kharas, and Magdi Amin, "Combining Good Business and Good Development: Evidence from IFC Operations."
[85] Nancy Lee, "Billions to Trillions? Issues on the Role of Development Banks in Mobilizing Private Finance."

Another reason is that private capital is diverse and itself comes with different investment mandates. For example, private capital such as from sovereign wealth funds, impact investors, and some philanthropic capital have development or sustainability mandates.

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