Chapter 7

Mobilising financing for the transition

Meeting the objectives of the Paris Agreement will require reallocation of investment away from carbon-intensive assets and rapid scale-up of private investment in low-emission, climate-resilient infrastructure and technologies. This chapter describes major trends in private financing for infrastructure and the roles of different private actors and sources of finance. It then explores what is needed to mobilise private finance for the transition, including how to address factors hindering private investment, and the types of instruments and transaction enablers governments have at their disposal. It considers the role of specialised development banks and development finance institutions, and how greater transparency and signaling in the global financial system might improve its capacity to respond to opportunities arising from the transition, while strengthening resilience to climate risks.

Establishing pathways to reach the goals of the Paris Agreement will require large-scale private investment in low-emission infrastructure and innovative technologies, and reallocation of investment away from carbon-intensive assets. Infrastructure, new or old, will also need to be made resilient to climate impacts. Investment in emerging economies and developing countries also needs to be aligned with the Sustainable Development Goals (SDGs). It is crucial to ensure that the global financial system is able to support the necessary rapid scaling up of such investment.

While infrastructure development is ultimately funded by taxpayers or users, it may be financed by public authorities (national and/or subnational governments, development banks, or other public financial institutions) and/or the private sector (corporate or project finance). The mix of financing will depend on the country and stage of development, and on the type of infrastructure and investment model. Despite low interest rates, in advanced economies fiscal constraints combined with concerns about the efficiency of public sector investment have led to a reduction in the share of public funds allocated to infrastructure to around 40% compared with 60-65% in developing countries (NCE, 2016; Ahmad, 2015).

This chapter describes what is needed to mobilise private finance for the transition in G20 countries and beyond. It describes the major trends in private financing for infrastructure, and the roles of different private actors and sources of finance that could support low-emission, climate-resilient infrastructure, including innovative clean technologies. It also examines the major factors hindering and helping private investment, and sets out a range of instruments and transaction enablers that can be deployed to mobilise private finance. The potential role of specialised development banks and development finance institutions in financing infrastructure and mobilising private investment is also explored. Finally, the chapter discusses potential misalignments in the global financial system and shows how transparency and signalling can improve its capacity to respond to opportunities arising from the transition, while strengthening the system's resilience to climate risks.

The shifting global landscape of private finance for low-emission infrastructure

Despite the favourable investment environment in global capital markets, access to long-term finance remains constrained for some infrastructure projects, particularly those in developing countries. To scale up private investment in infrastructure, it is vital to reach a sound understanding of the changing roles of actors and sources of finance, and the differences between traditional actors such as utilities and commercial banks, and non-traditional ones such as institutional investors and capital markets. Understanding the appetites and needs of these actors in terms of risk and liquidity in investments, and their capacity to finance potentially complex and large-scale infrastructure assets, is key to delivering the financing required.

Trends in the private financing of infrastructure

Private financing of infrastructure has undergone a major shift towards low-emission energy sources in the last decade.[1, 2] Overall infrastructure financing levels remained stable between 2010 and 2016, supported by ample liquidity in financial markets and high demand from the private sector. This included project-based primary finance (i.e. financing associated with "greenfield projects" – new activity in new assets) and secondary market transactions. Out of total finance from 2010 to 2016 of about USD 2.6 trillion, the lion's share went to the energy sector and finance for renewables accounted for 50% (USD 1.3 trillion) (IEA, 2016). A further 25% consisted of non-renewable power generation and support for transmission and distribution, while 23% went to the transport sector. Water received more limited private

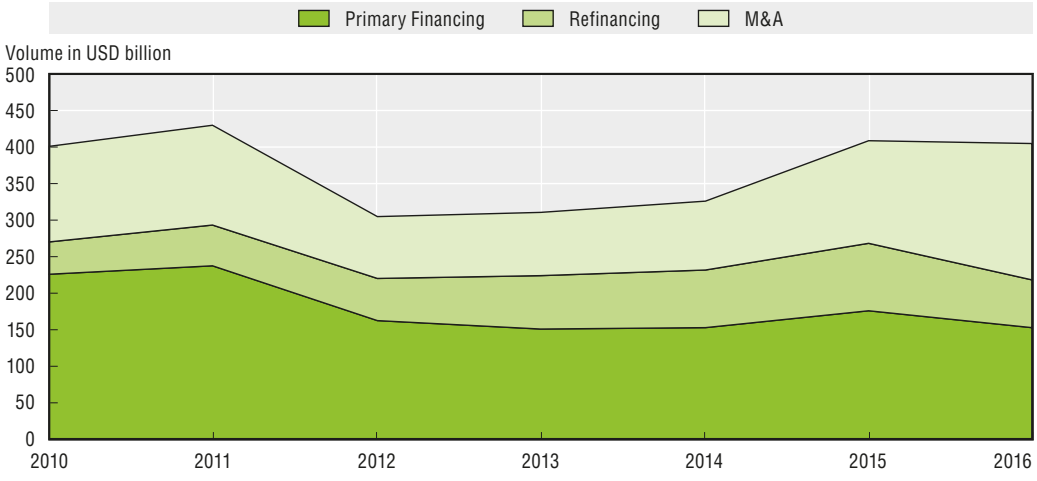
finance at 2% of the total, reflecting the predominant use of public financing in this sector. Europe accounted for 35% of the total, North America 25%, and Asia-Pacific 29%.

Despite the stable total volumes of financing for infrastructure, in recent years fewer new projects have secured primary financing. Primary financing for infrastructure declined for all regions from USD 226 billion in 2010 to USD 153 billion in 2016. For renewable energy projects, however, primary financing increased.

In contrast to the overall drop in primary financing, a large secondary market for infrastructure is developing, boosted by mergers and acquisitions (M&A) and refinancing activity (Figure 7.1). Global infrastructure M&A activity doubled from a low of USD 83 billion in 2012 to a record USD 179 billion in 2016, with the United States and China leading in terms of volumes.[3] Meanwhile, low interest rates and the abundance of liquidity in financial markets encouraged refinancing, which more than doubled from USD 43 billion in 2010 to USD 92 billion in 2015, before declining in 2016 due to a slow-down in activity, particularly in Asia.

While refinancing does not lead to additional investments, it can lower overall costs for users and governments, potentially freeing up fiscal space. Secondary markets also provide opportunities for investors, in particular for institutional investors, who represent a growing source of finance. For example, a project moving from construction to operation could refinance both debt and equity investments, accessing capital markets through bond issues, syndicated loans, and direct or indirect equity investment. In fact, much of this secondary market activity is fuelled by increased investor appetite for operational projects. For example, in the renewable energy sector, the increase of equity provision by institutional investors can be traced mainly to the acquisition of operational assets or portfolios for onshore wind deals (OECD, 2016a). Pension funds and insurers are less involved in greenfield onshore wind-power transactions, suggesting that institutional investors look to the onshore wind sector mainly for the acquisition of existing projects in the operational phase.

Figure 7.1. **Infrastructure finance by type, 2010-16**



Sources: IJGlobal Transactions and Bloomberg New Energy Finance. OECD calculations.

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Improving access to finance and lowering the costs of investment for infrastructure can make a substantial difference to the economic viability of projects and to the affordability of the services provided, in particular for the poor. Investors have a strong preference for operating assets in advanced countries; 76% of the secondary market transactions analysed is located in Europe and North America. This concentration of interest has contributed to competitive debt pricing and to a high valuation of operating assets located in developed economies.

In developing and emerging economies, however, infrastructure investments are often unable to attract long-term financing, as financing conditions such as shorter maturities and higher margins increase refinancing risks and make projects unviable. A recent IMF survey suggests funding and absorptive capacity constraints are a common impediment to scaling up infrastructure investment across low-income countries. Availability of external finance and administrative capacity were seen as key barriers in fragile states, while availability of domestic resources and concerns about debt accumulation were most important for low-income economies (IMF, 2017).

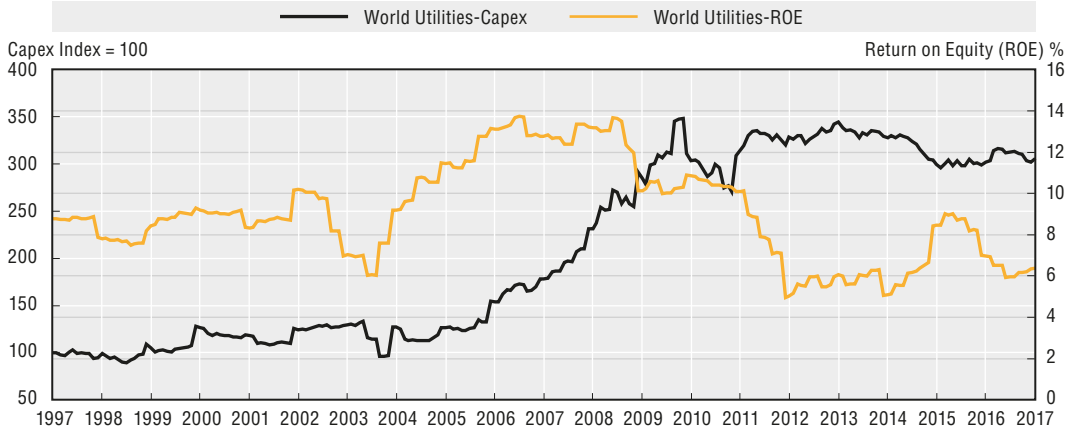
Key sources of finance for low-emission infrastructure

Utilities: pressure for new business models

Utilities, whether state-owned or private, have traditionally been an important source of finance for power generation, transmission and distribution through their balance sheets. Due to disruptions in energy markets, however, utilities' business models are facing challenges and may require adaptation. Across the G20, energy markets are not delivering the right price signals, while emissions markets and carbon-pricing mechanisms need significant adjustment (see Chapter 5). The growth of low marginal cost sources of energy (renewables), which tend to displace high variable cost energy generation (fossil fuels), combined with the rising share of decentralised generation in the electricity generation mix, are disrupting markets. As a result, wholesale electricity prices are flat or declining in Germany, the United Kingdom and the United States (IEA, 2016). In addition, "shadow costs" are mounting in the form of necessary power grid upgrades and mechanisms that balance demand and cope with intermittency.

As a result of these disruptions, the profitability of utilities in some countries and their ability to finance new capital expenditures are facing difficulties. Utility companies saw a global surge in investment in the mid-2000s until the global financial crisis.[4] This coincided with an increase in profitability as measured by return on equity (ROE). Since then, ROE has declined to below long-term averages for an extended period of time, while global capital expenditure (CAPEX) has levelled off. This trend was most acute in Europe, where CAPEX increased dramatically before the sovereign debt crisis and fell substantially afterwards, and where ROE has fallen below 5% for the past two years. CAPEX has increased steadily in North America over the past eight years and has surged in China over the past decade, particularly in the last two years. Given varying financial constraints, utilities may face challenges financing new power generation and transmission in certain markets.

Figure 7.2. **Global utility capital expenditures and return on equity**



Source: OECD calculations based on Thomson Reuters Datastream.

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The changing landscape of competition within electricity markets is driving a shift towards creative business models. Where the ability to self-finance new investment is limited, for example, utilities could act as construction companies, building projects through joint ventures or special purpose vehicles (SPVs) and project finance structures, benefiting from the trend in secondary markets that is opening new channels of finance for renewable energy projects.

Corporations: increasingly active in the transition

Corporations have provided finance in the renewables sector as off-takers through direct investments, power purchase agreements (PPAs), pure equity investments[5] and partnership models. Behind this flow of finance is a trend among large corporations to lower the emissions profile of their core business operations, or to promote renewable energy deployment more generally. Sixty-five global corporations have committed to 100% renewable energy for their future business operations (DLA Piper, 2016). Among firms investing for business reasons, criteria for investment consist mainly of the cost competitiveness of the energy source, but also its proximity to the end-use location and its contribution to the penetration rate of renewables.

In 2015, over 5 GW of renewable capacity was transacted through corporate PPAs in the global market, with the United States representing the largest share. Corporations such as Amazon, Google, Microsoft, Facebook, Norsk Hydro, and Wal-Mart were some of the biggest off-takers in 2016. This trend is also relevant in developing countries: by 2016, India had become the largest corporate procurement market in the Asia Pacific region (BNEF, 2016). As an example of a pure equity investment, Google, along with the Public Investment Corp (PIC) and the Development Bank of Southern Africa, financed the USD 230 million Jasper solar PV project in 2013 in South Africa. Regarding examples of partnerships, Google recently paired up with Eneco in the Netherlands and Duke Energy in the United States, both utilities; and Apple partnered with Goldwind in China, a maker of wind turbines.

Traditional oil and gas companies are also seeking to diversify their revenue sources away from fossil fuels and could be a growing source of finance for renewable energy. Statoil, the Norwegian oil and gas company, has applied its decades of expertise building offshore oil platforms to invest in floating wind turbines, which are cheaper than those fixed to the seafloor.

Banks are a crucial source of primary finance

Bank loans remain a critical source of finance for investment in new infrastructure projects and for the refinancing of operational assets, in both advanced and developing countries. In terms of overall volumes, bank lending remains the largest source of infrastructure finance in global markets. Whether through short-term corporate lending or non-recourse specialised lending, banks provide roughly 80% of green infrastructure finance, including for low-emission, climate-resilient infrastructure (UNEP, 2016a). In lower middle-income and low-income countries, state-owned banks and development banks play a bigger role due to the lack of well-developed commercial banking systems, and support the derisking of investment for greenfield projects.

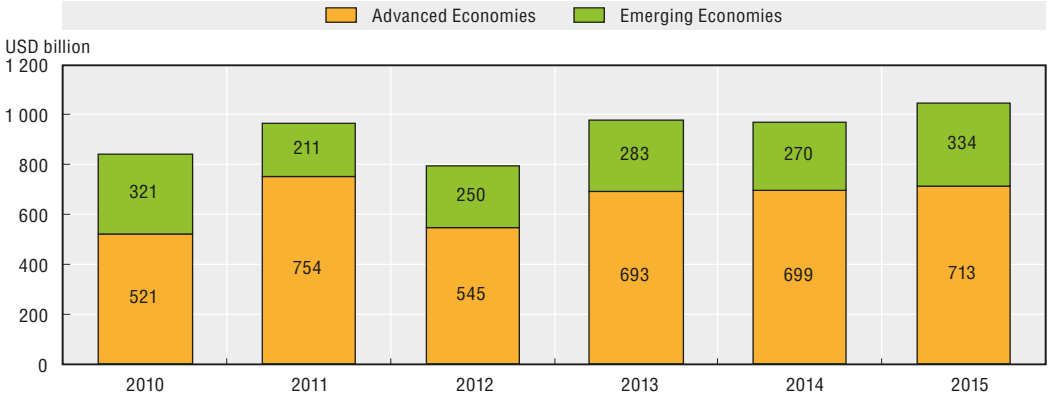
Loans are flexible in that they can be paired with many different project finance structures, including public and private sponsorship models. Bank financing covers the spectrum of low-emission and climate-resilient infrastructure. In the aftermath of the financial crisis, more stringent banking regulations have caused banks to become more focused in their evaluation of infrastructure projects, leading to projects with higher financial stability over the long run.

Bank lending may be constrained by sizeable exposures in one country, which requires an enhanced focus on country risk, the stability of the fiscal and regulatory framework, and the reliability of new technologies and revenue sources. Lending may also depend on the

business model of infrastructure projects; banks prefer models where costs are supported by end-users and stable tariff structures. From a policy perspective, facilitating cross-border transactions would strengthen infrastructure lending, allowing banks to diversify their portfolios and infrastructure projects to raise funds globally. Investing abroad is usually more complicated, however, as larger information asymmetries lead to higher risks, which may hinder cross-border lending.

One form of bank lending that is particularly important in infrastructure finance is the formation of loan syndications, which consist of a group of banks headed by one or more Mandated Lead Arranger that organises the financing package for a single borrower. Global syndicated loan volumes for infrastructure topped USD 1 trillion in 2015 (Figure 7.3), most of which originated in advanced economies; syndicated lending in emerging markets reached its highest level in 2015 in comparison with the earlier six years.

Figure 7.3. **Global syndicated infrastructure loan volumes, 2010-2015**



Source: OECD calculations based on Thomson OneBanker, IJGlobal Transactions.

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Banks are a particularly crucial source of finance for small-scale investments. For example, bank loans are essential for investment in energy efficiency and renewable energy (such as small-scale solar), both for consumer applications and larger-scale commercial projects. Policy reforms that make energy efficiency profitable and create demand will scale up lending through such channels. On the supply side, governments could work with the banking sector to create specialised financial products designed for energy efficiency and decentralised power generation projects.

Institutional investors: so far, low levels of investment, but immense potential sources of finance

As part of the overall trend to diversify investment portfolios, institutional investors – including pension funds and insurance companies – have been increasingly interested in infrastructure investments. With USD 56.6 trillion in assets under management at the end of 2014 just in pension funds and insurance company portfolios, institutional investors represent a large potential source of investment (OECD, 2015a).

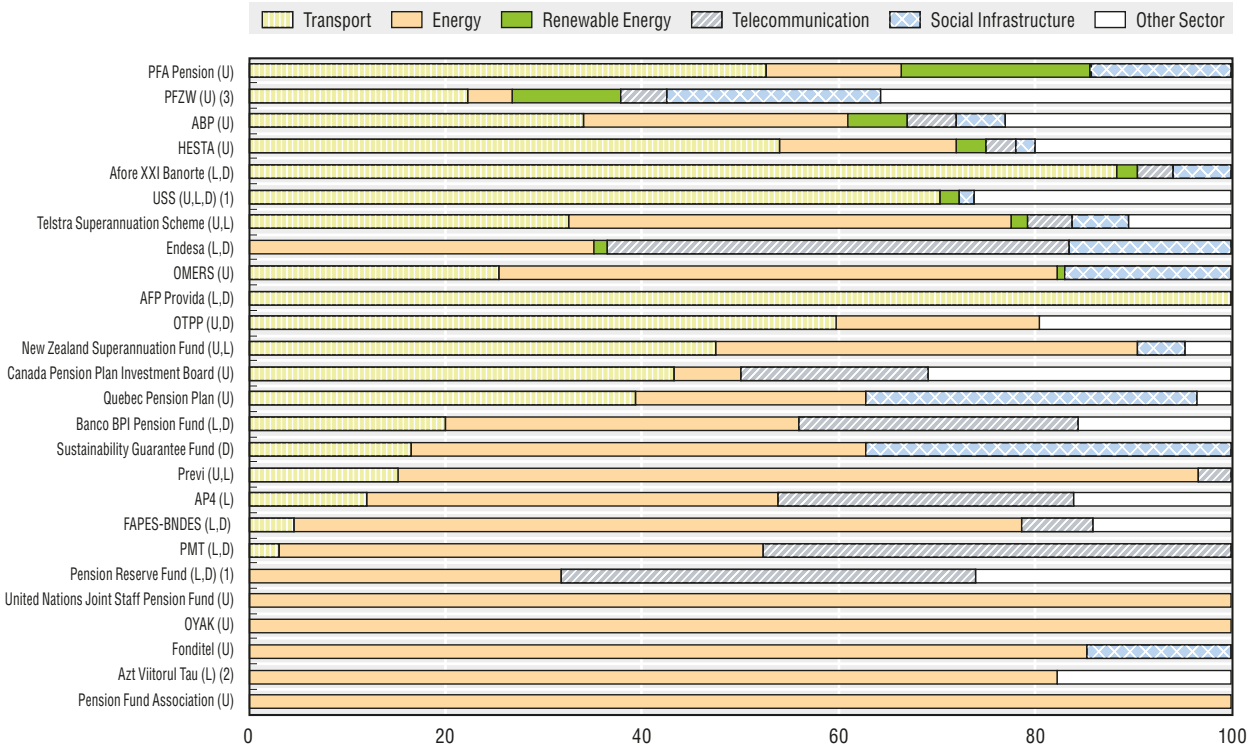
Pension funds and life insurance companies with long-dated liabilities – in particular defined benefit (DB) pension plans and life insurers offering long-term fixed guarantees – seek to match these liabilities with long-term assets, and are thus a potential source of long-term finance for low-emission infrastructure. Despite similar liability profiles, life insurers have less scope than DB pension funds to invest in illiquid assets because policy holders are able to withdraw funds, which can put pressures on insurer liquidity. By contrast, property and casualty insurers tend to have a short liability profile. The differing profiles of institutional investors highlight the need for expanded and diversified channels of financing for low-

carbon infrastructure, which can cater to different investment horizons, risk appetites, liquidity needs, and capacities to invest in potentially complex and large-scale projects.

Pension fund demand for investment in illiquid unlisted infrastructure equity markets has increased over the past five years. Despite this strong demand, the pension funds[6] that reported their unlisted infrastructure equity allocation in a recent OECD survey have only increased this allocation slowly, occupying around 3.5% of portfolios, on average, in 2014. At the same time, many funds reported that they were below their investment targets for infrastructure. This suggests that funds have some capacity to increase their investment in unlisted infrastructure equity, including in climate-relevant sectors. These figures only represent those funds that reported investments in infrastructure in the survey – a considerable number of pension funds globally do not currently invest in infrastructure, or do not treat it as an asset class. When considering assets invested in infrastructure across the whole survey population, just 1% is allocated to infrastructure.

By investing in infrastructure projects through funds that invest in infrastructure assets, or indirectly through public equity markets and debt instruments, some pension funds already have exposure to relevant infrastructure investments, depending upon the availability of financial instruments and channels of investment.[7] Notably, some funds reported exposure to renewable energy assets, and most funds reported high investment allocations in transportation and energy sectors (Figure 7.4). Of the 26 pension and reserve funds that reported sector allocations in their infrastructure portfolios, nine reported exposure to renewable electricity. Renewables investments were concentrated in pension funds based in Europe, while funds based in North America and Latin America had low or no reported investments in renewables. Based on these data, evidence is scant that investors have broadly lowered the carbon footprints of their infrastructure portfolios.

Figure 7.4. **Infrastructure allocations by sector at the end of 2014 (%)**



Source: OECD (2016b).

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Partnerships combine traditional finance with new business models and non-traditional sources of finance

Engaging institutional investors through the formation of partnerships is a key way for governments to mobilise finance for the transition to a low-carbon economy. As an example, in a recent financing partnership institutional investors invested (pari passu to the lead lender) in infrastructure through project finance loans along with commercial banks, acting as a sponsor and taking advantage of the bank's origination resources and experience. This approach represents an increasingly important financing model, as individual banks may not be able to finance the entire debt portion of a project. Using such a mechanism, construction risk is no longer a barrier for institutional investors in European assets and mature technologies, as investing alongside lead lenders with existing due diligence and monitoring capabilities builds a higher level of comfort.

The asset management industry is crucial to help finance the transition, as not all investors are able to make direct investments in, or perform due diligence on, infrastructure assets. For example, the proliferation of private debt and equity investment strategies geared toward institutional investors such as pension funds and insurers has opened the possibility for many different types of investors to make small allocations while building necessary diversification across a range of projects, geographies and asset risks. There are already examples where asset managers are investing in new projects during the construction phase, and partnering with traditional finance sources such as banks or utilities:

- The French utility EDF and the asset manager Amundi partnered in 2014 to create a joint asset management company that will finance energy-related projects. This partnership sought to raise financing for renewable electricity generation and energy efficiency projects.
- In Italy, the utilities EDF and Edison and the infrastructure fund F2i established the third-largest operator in the Italian renewable energy sector in 2014.

To facilitate these emerging business models, governments could encourage the formation of transparent and robust primary and secondary markets for infrastructure. For example, a pipeline of low-emission infrastructure assets would help investors assess investment opportunities (Chapter 3), and transparent bidding processes would support competition. This would help to reinforce partnership models and engage with institutional investors who may prefer to invest in operational assets, while using traditional sources of finance (such as utility balance sheets and bank loans) during the construction phase. Such initiatives, paired with reviews of regulatory environments (Chapter 5) and institutional investors' embrace of environmental, social and governance (ESG) factors in decision making processes (see the final section of this chapter) will help to re-orient investment portfolios for the transition.

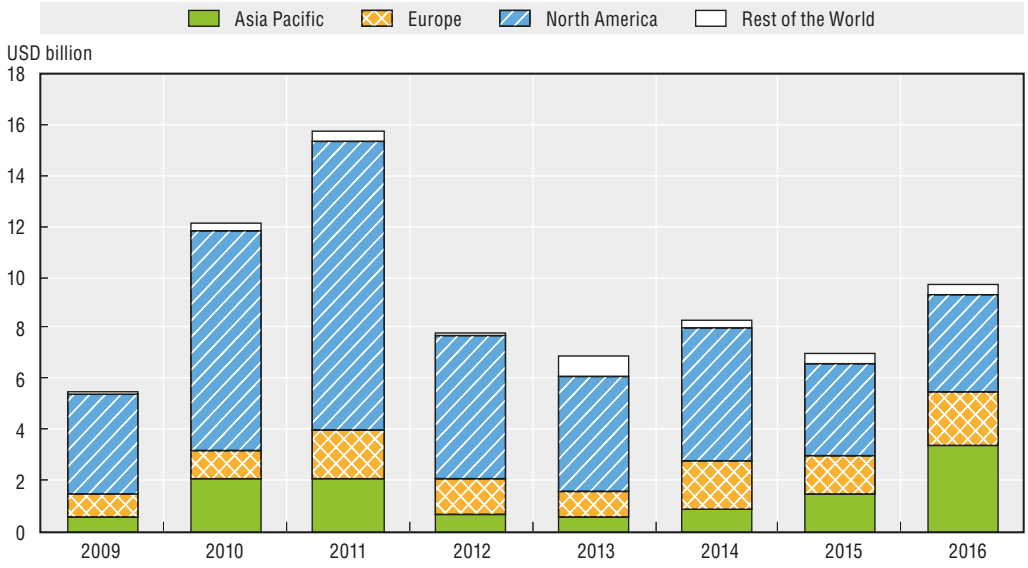
Financing for innovation in clean technologies has been declining

New venture capital (VC)[8] commitments in clean energy[9] have fallen from a peak in 2011 of almost USD 16 billion to just under USD 10 billion in 2016 (Figure 7.5). This decline, which was particularly evident in the United States was due in part to external economic factors such as the fall in energy commodity prices and in prices of solar panels, linked to manufacturing overcapacity in China. The decline was also due to investment models that are not always aligned with the capital intensity and the long development timelines required by clean technologies.

As a result, low volumes of capital are available and investment returns are historically volatile, in particular for companies that need early-stage financing to develop new materials or hardware for industrial or consumer applications,[10] or energy-related technologies such

as biofuels and batteries (Gaddy, Sivaram and O'Sullivan, 2016). Attracting financing for clean technology in developing countries can be even more challenging, given a scarcity of long-term capital and country-specific risks. However, USD 2.5 trillion in assets are under management in global private equity and venture capital markets,[11] so there is a significant amount of capital to unlock for the transition.

Figure 7.5. **Global clean energy venture capital and private equity volumes by region, 2009-16**



Source: CEP (2016).

As well as reducing their financing of clean technology, VCs have shifted investments from early-stage financing for hardware and materials to later-stage investments and less capital-intensive sectors such as software development and information technology, creating financing gaps within the clean technology value chain. For example, energy efficiency VC and private equity investment progressed from USD 1.2 billion in 2015 to USD 1.3 billion in 2016, whereas energy storage reached just USD 0.6 billion in 2016 (CEP, 2016). Energy storage is a critical area of investment that appears to be underserved by the VC model.

The problems in the existing VC model for the clean technology sector are reflected in the poor returns experienced by investors. Gaddy, Sivaram and O'Sullivan (2016) analysed the recent clean technology VC performance history, comparing the risk/return profile of clean technology investment with those of medical and software technologies. Clean technology companies were more likely to fail and yielded lower returns. Clean technology companies commercialising innovative science and engineering were especially unsuited to the VC investment model for four reasons. They were illiquid, tying up capital for longer than the three- to five-year time horizon preferred by VCs. They were expensive to scale up, often requiring hundreds of millions of dollars to build factories, even while the fundamental technology was still being developed. There was little room for error because these companies competed in commodity markets with thin margins – against cheap silicon solar panels or abundant oil and gas – making it difficult to invest in R&D while operating a lean manufacturing operation. Finally, the likely acquirers – utilities and industrial giants – were unlikely to acquire risky start-ups and were averse to paying a premium for future growth prospects.

New technologies beyond the clean energy sector have the potential to revolutionise the way that energy is generated and delivered to customers, as well as transform transportation (Box 7.1) and energy. In the future, innovative business models in the sharing and on-demand economy – based on services as opposed to hard assets – could make this change possible. In the transport sector, for example, the carbon footprint of urban road and other infrastructure could be much lower with a massive adoption of car-sharing models or driverless car technologies, while artificial intelligence could drastically lower the carbon intensity of the mining industry.

Box 7.1. **Innovation in financing low-carbon transportation**

The provision of transport services has historically relied on public funding and planning, resulting in a heavily regulated sector. However, recent research suggests that large-scale deployment of shared vehicle fleets, perhaps operated by private companies, could be viable. In a case study in Lisbon, Portugal, OECD/ITF (2016) assessed the large-scale deployment of a shared vehicle fleet that provides app-based and on-demand transport, replacing all other motorised transport modes while rail and subway services operate as today.

The results show that shared mobility would decrease congestion and reduce GHG emissions even with current internal combustion engines. At the same time, intensive per-vehicle use would accelerate fleet replacement and thus penetration of newer, cleaner technologies. This could provide an even quicker and more marked reduction of carbon emissions. Other benefits include a decrease in both pollution and the number of transfers, better accessibility and 95% less need for public parking.

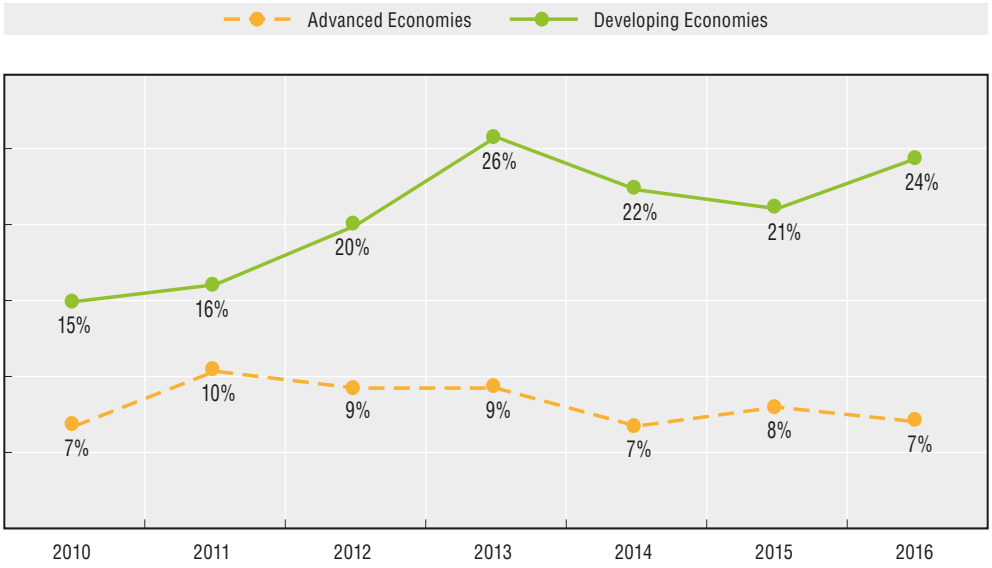
The challenges for policy-makers lie in creating the right market conditions and operational frameworks. While a sudden change to a completely shared mobility system is not conceivable, gradual installation is plausible and would yield large benefits from the start. In addition, this deployment scenario would free up significant amounts of space in a city that would need to be managed to ensure the benefits were fully reaped. Management strategies could include allocating space to specified commercial or recreational uses, such as delivery bays, bicycle tracks or enlarged footpaths. Freed-up space in off-street parking could be used for urban logistics purposes, such as distribution centres.

Source: OECD/ITF (2016).

The role of development banks and development finance institutions

Considering the scale of financing required, development banks and development finance institutions will be essential in helping countries to deliver on their Nationally Determined Contributions (NDCs), both within and outside the G20. As publicly owned or controlled institutions with a development mandate, these banks already play a role in infrastructure financing, especially in developing countries. Between 2010 and 2015, development and state-owned banks contributed around 21% of primary financing for privately financed infrastructure projects in developing economies (Figure 7.6). This role can be further strengthened to help countries shift investment for low-emission, climate-resilient infrastructure from "billions to trillions": by developing infrastructure pipelines, by investing in new greenfield projects and by de-risking infrastructure investment and mobilising private investors.

Figure 7.6. **Share of development banks and state-owned banks in privately financed infrastructure, power and transport sectors, 2010-16**



Note: This graph is based on figures for primary financing (i.e. financing associated with "greenfield projects" – new activity in new assets) in power (excluding renewables) and transport sectors.

Source: IJGlobal Transactions. OECD calculations, based on IMF categorisation of advanced and developing economies.

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Three types of development finance actors are worthy of attention: national development banks (NDBs), multilateral development banks (MDBs), and bilateral development banks and development finance institutions (DFIs).[12] Each type of institution has a complementary role to play, and their collective potential impact lies in their working collaboratively, building on the comparative advantages of each. Because NDBs work within a domestic context, they can be well integrated into national infrastructure policy and planning frameworks. They also have relationships with private companies operating in the local market and can supply adequate long-term financing in local currency. MDBs and bilateral DFIs are backed by strong credit ratings and the support of their shareholders. They can leverage significant capital and bring knowledge, expertise and innovation, based on broad experience elsewhere, to spur investment in climate-friendly infrastructure.[13]

To fulfil their potential, development banks and finance institutions – national, multilateral and bilateral – will need to scale up efforts to mobilise private capital, and ensure that infrastructure portfolios are aligned with low-emission, climate-resilient development pathways. Governments, which are the major shareholders and clients of development banks and finance institutions, need to encourage and enable them to fulfil this role.

National development banks

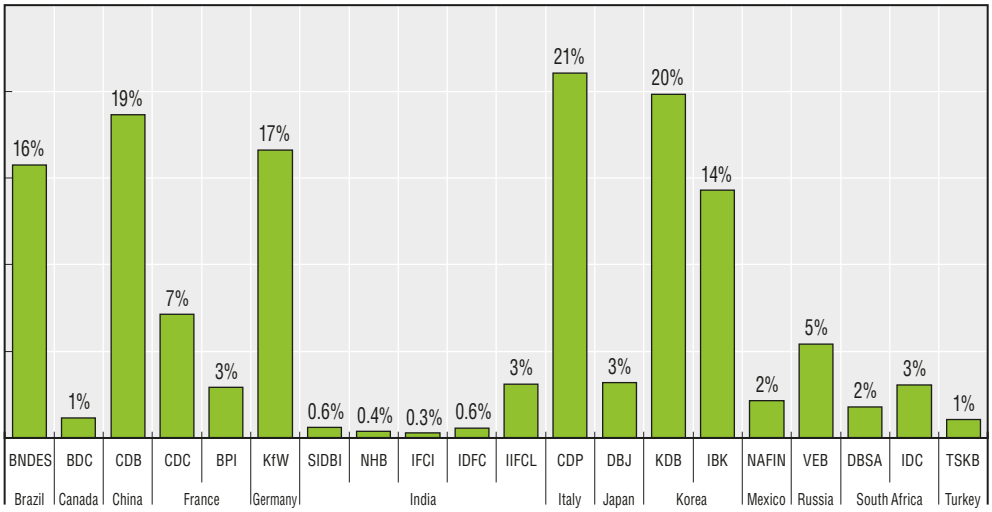
NDBs are important actors in financing public policy objectives in G20 countries

National development banks are prevalent across advanced and emerging economies alike. There are more than 250 NDBs worldwide, with assets of over USD 5 trillion, roughly three times the total assets of all major MDBs combined (Studart and Gallagher, 2016). As publicly owned domestic finance institutions with an overarching development mandate, NDBs support the policies and strategies of their governments. Among G20 countries,

while only a few NDBs have mandates that focus explicitly on infrastructure, there are at least 21 NDBs with relevance to infrastructure financing,[14] excluding agriculture-related and sub-national development banks.[15] While most NDBs are small, some have substantial operations within their domestic contexts and assets that make up as much as a fifth of national GDP, in countries such as Brazil, China, Germany, Italy and Korea (Figure 7.7).

The functions and mandates of NDBs in G20 countries vary. While most countries have established one NDB targeting different policy objectives and sectors, some have several NDBs targeting specific industries and/or market segments. In India, for example, five NDBs target small and medium-sized enterprises (SMEs), industry, agriculture, housing and infrastructure.[16] Some countries have also set up green investment banks (GIBs),[17] NDB-like entities that focus on facilitating private investment for environmentally sustainable projects. There are three GIBs in G20 countries (excluding sub-national banks): Australia's Clean Energy Finance Corporation, Japan's Green Fund and the UK Green Investment Bank.

Figure 7.7. **NDBs in the G20, total assets as percentage of GDP, 2015**



Note: Brazil Development Bank (BNDES); Business Development Bank of Canada (BDC); China Development Bank (CDB); Caisse des dépôts et consignations (CDC); Banque Publique d'Investissement (BPI); Kreditanstalt für Wiederaufbau (KfW); Small Industries Development Bank of India (SIDBI), National Housing Bank (NHB), Industrial Finance Corporation of India (IFCI); Infrastructure Development Finance Company (IDFC); India Infrastructure Finance Company Ltd (IIFCL); Cassa Depositi e Prestiti (CDP), Development Bank of Japan (DBJ); Korea Development Bank (KDB); Industrial Development Bank of Korea (IBK); Nacional Financiera (NAFIN); Vnesheconombank (VEB); Development Bank of Southern Africa (DBSA); South African Industrial Development Corporation (IDC); Industrial Development Bank of Turkey (TSKB). BANOBRAS (Mexico) has been excluded from this figure due to lack of data.

Source: Authors, based on data from 2015 annual reports (from institutions listed) and World Bank data on GDP in current prices and local currency.

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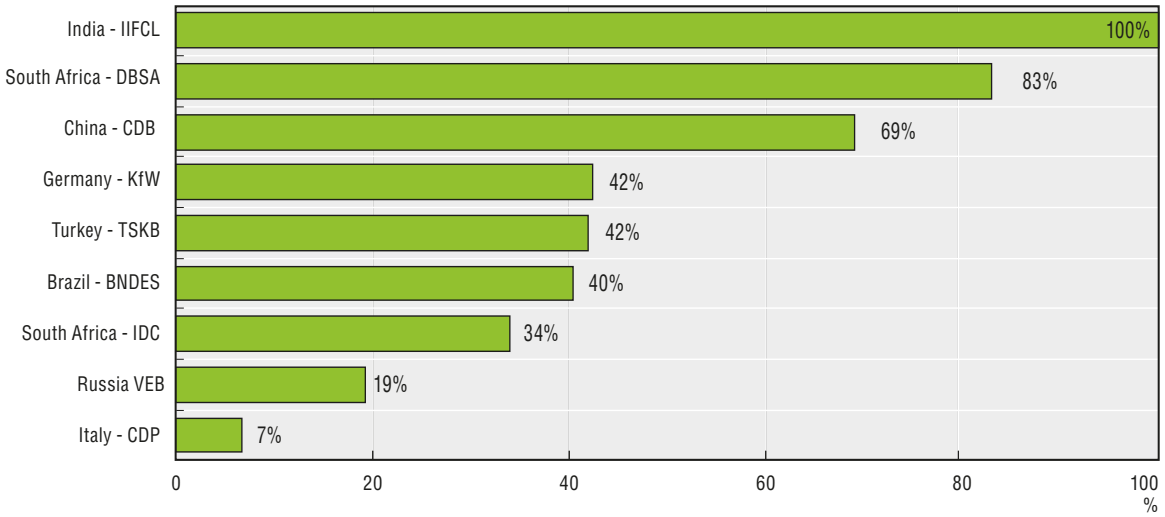
It is difficult to determine the share of NDBs' portfolios that targets infrastructure due to the lack of data and information on what these institutions finance. Out of the NDBs in G20 countries that publish sectoral breakdowns of their portfolios, the share of infrastructure financing varies from over 50% to only a minor share. NDBs with larger shares of infrastructure in their portfolios include China Development Bank (CDB), Development Bank of South Africa (DBSA) and India Infrastructure Finance Company Limited (IIFCL). Green investment banks such as Australia's Clean Energy Finance Corporation and the UK Green Investment Bank also focus on financing infrastructure.

Figure 7.8. **Percentage of NDBs' portfolio in infrastructure, selected NDBs (2015)**



Notes: Comparing the sectoral distribution of NDBs' portfolio is not an exact science, as categories to describe sectors differ from one NDB to another. However, it gives a general sense of priorities. In this figure, portfolio can mean loan portfolio year-to-date, outstanding loan portfolio or disbursements. The following assumptions were used to approximate the infrastructure share of the loan portfolio. For CDB, infrastructure includes railways, public highways, electric power, public infrastructure, petroleum and petrochemical and urban renewal. For TSKB, infrastructure includes electricity production and electricity-gas transmission, but not logistics. For KfW, infrastructure includes housing investment and infrastructure. Finally, for DBSA, infrastructure includes energy, roads and water and sanitation.

Source: Authors, based on data from annual reports of the institutions in 2015.

The extent to which NDBs finance low-emission, climate-resilient infrastructure varies

Some NDBs have made efforts to organise and track climate-related activities through the International Development Finance Club (IDFC), which includes several NDBs, both within and outside G20 countries, as well as some bilateral development finance providers.[18] There is no widely adopted standard for reporting climate-related activities, however, particularly in NDBs' annual and sustainability reports, so it is difficult to assess how much of each NDB's support for infrastructure is low-emission and climate resilient. IDFC members committed USD 98 billion in green finance[19] in 2014, and across members, the shares of green finance among total new commitments ranged from 100% (in one case) to under 5% or even 0% in a few cases (IDFC, 2014).

Several NDBs are taking a leading role, with substantial shares of their portfolios targeting this area. While lack of consistent data limits the extent to which comparisons can be made, a review of annual reports reveals examples of NDB activity related to climate change more broadly, and infrastructure more specifically.[20] Over half of Brazil Development Bank's (BNDES) disbursements for infrastructure in 2015 went to "green" infrastructure, including 27% to renewable energy (excluding hydro) and energy efficiency, and 24% for large hydro plants (above 30MW) (BNDES, 2016). In Germany, just under 40% of KfW's domestic commitments went towards environmental and climate-related goals in 2015, including support for the construction of energy-efficient housing as well as credit lines to help SMEs scale up activities related to environmental protection, renewable energy and energy efficiency (KfW, 2015a).[21]

Many NDBs also support financing for more carbon-intensive infrastructure, in line with national energy policies and priorities that may not yet be aligned with NDCs or the objectives of the Paris Agreement. For example, CDB, TSKB and DBSA support coal power generation. CDB has recently increased its focus on greening its portfolio: in 2014, total

outstanding "green credits" were around five times larger than CDB's outstanding loans for coal-related power projects (CDB, 2014).[22] Similarly, DBSA and Industrial Development Bank of Turkey (TSKB) support coal and gas power plants as well as renewables. Nevertheless, sustainability-themed loans make up 50% of TSKB's loan portfolio, excluding loans to the financial sector (TSKB, 2015). As of the end to 2015, TSKB had disbursed USD 487.7 million to renewable energy and energy efficiency, 14% of its total loan portfolio. Some NDBs have started putting in place policies to favour investment in low-emission infrastructure over fossil fuel technologies. For example, BNDES's new strategy for the power sector prioritises renewable energy over coal- and oil-based power, and includes greater subsidies for renewable sources (Climate Home, 2016).

NDBs could play a greater role

The role of NDBs in supporting the transition requires further attention from policy makers. In many countries, these institutions' role in financing national infrastructure could be harnessed for supporting the implementation of NDCs. In South Africa, for example, the Industrial Development Corporation (IDC) and DBSA are financing the development of renewable energy projects as part of the Department of Energy's Renewable Energy Independent Power Producer Procurement Programme.

In addition, partly due to their ability to borrow and lend in local currency, NDBs can mobilise and crowd-in local private finance based on their special status within their countries (Smallridge et al., 2013). In India, for instance, NDBs not only have access to soft funds from the Reserve Bank of India, the country's central bank, they can also mobilise additional capital by issuing securities that qualify as reserves under India's Statutory Liquidity Ratio (Kumar, 2016).

For NDBs to deliver on their potential, governments need to strengthen their mandates to specifically support low-emission infrastructure. As a first step, NDBs should put in place strategies and targets for climate action, including support for low-emission, climate-resilient infrastructure, in line with national low-carbon strategies. Where such cases have occurred, the focus has been on greening existing NDB portfolios and practices (e.g. project screening and preparation), creating green infrastructure windows within NDBs and/or establishing new specialised institutions, such as separate green investment banks (OECD, 2017b). Governments could ensure that NDBs play a role in NDC implementation, and create frameworks to facilitate dialogue and exchange on policy issues between NDBs and government agencies.

To scale up NDBs' role, better reporting and disclosure of information about what NDBs finance is vital. IDFC members use a common methodology to report on "green finance" and efforts have been made to harmonise the tracking methodology with the approach used by MDBs. Despite this, individual NDB annual reports present information in a variety of formats, and there is no standard practice on reporting or disclosure across NDBs more broadly. Governments could encourage the use of comparable and consistent data as well as greater transparency among NDBs and support more detailed disclosure about what they finance, including their support for climate-friendly infrastructure.

Some NDBs have been found to suffer from performance-related problems, which need to be rectified for them to make a full contribution to mobilising investment. These include the risk of market distortions arising from picking winners or from crowding-out effects, as well as corruption, the potentially high opportunity costs associated with subsidised loans, and a lack of efficiency due to the small scale of projects undertaken (Torres and Zeidan, 2016).

International collaboration will enable NDBs to scale up support

The major barriers that NDBs face in scaling up financing for low-emission, climate-resilient infrastructure, particularly in developing countries, include a lack of capacity to mainstream climate objectives into their portfolios, as well as a lack of "readiness" to access international concessional climate finance. In recognition of their potential as well as the challenges, MDBs and bilateral providers work with NDBs to develop and deploy green financing, and support these efforts with capacity building and technical assistance. In Russia, support for "environmental stewardship and energy efficiency" made up 34% of Vnesheconombank's (VEB) portfolio in 2014, and VEB has partnered with the World Bank and the International Finance Corporation (IFC) to support energy efficiency activities. Similarly, many of TSKB's green finance activities have been initiated and continue in partnership with KfW, Agence Française de Développement (AFD), European Bank for Reconstruction and Development (EBRD) and European Investment Bank (EIB). Governments and development partners could encourage further partnerships and collaboration between NDBs, MDBs, and bilateral development banks and DFIs in the financing of low-carbon infrastructure, as well as supporting efforts to shore up institutional and staff capacity. Initiatives such as the NDC Partnership can encourage collaboration aimed at concrete action at national and sub-national levels.

Multilateral development banks

MDBs have made ambitious commitments to increase climate finance and support infrastructure

MDBs are widely recognised as critical providers of financial and technical assistance to developing countries to promote economic and social development. They already play a noteworthy role in mobilising international climate finance, and this role is likely to continue. Within the context of the UNFCCC and the commitment of developed countries to mobilise USD 100 billion to support climate action in developing countries, MDBs supported over a third of estimated flows of public climate finance in 2013-14, on average,[23] and are also estimated to have mobilised roughly 50% of private climate finance (OECD, 2015b). MDBs deliver climate finance by using their own resources and by managing climate finance trust funds for donor governments.

In the run up to COP21 in 2015, MDBs also made ambitious commitments to scale up climate financing in their portfolios (Table 7.1). Based on these commitments, MDBs will provide over 40% of international public climate finance flows in 2020 (OECD, 2016c). Several MDBs have also made efforts to co-ordinate action on climate change, ranging from jointly tracking and reporting climate finance to harmonising measurement of projects' GHG emissions impacts.

Table 7.1. **Climate finance from MDBs to developing countries: Current status and future targets**

	MDB targets to scale up climate action	Climate finance in 2015 (USD '000)	Share of climate finance in MDB portfolios in 2015[24]
AsDB	Double climate finance to USD 6 billion annually by 2020	2 917	15.3%
AfDB	Triple climate financing to reach 40 percent of investments by 2020	1 359	15.6%
EBRD	40% of annual business investment in green finance by 2020	3 217	25.5%
EIB	Global target of greater than 25 percent of all lending. Increased target of 35% of lending in developing countries by 2020	5 137	26.2%
IDB	Double climate finance to 30% of operational approvals by 2020, to an average USD 4 billion per annum	1 744	16.1%
WBG	Increase climate financing by one-third, from 21 percent to 28 percent of annual commitments by 2020.	10 722	17.9%

Note: AsDB: Asian Development Bank; AfDB: African Development bank; EBRD: European Bank for Reconstruction and Development; EIB: European Investment Bank; IDB: Inter-American Development Bank; WBG: World Bank Group.
Source: Adapted from 2015 Joint Report on Multilateral Development Banks.

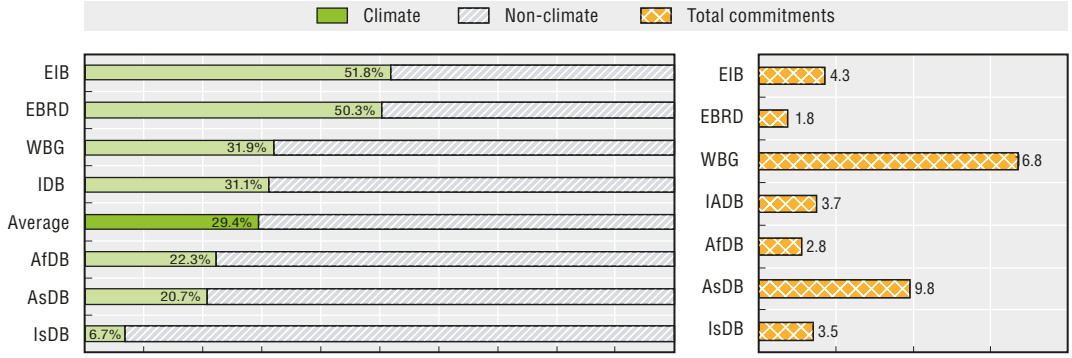
Alongside climate finance commitments, MDBs have stated in the context of the G20[25] that they intend to increase infrastructure financing, in many cases at scales far greater than the targets shown in Table 7.1. It is important to ensure that infrastructure financing – in the MDB portfolios and more generally across all public finance – aligns with the Paris Agreement by helping developing countries to make the transition; otherwise, there will be a "lock in" of high-carbon development pathways. While it will take time for policy reforms to take hold that mobilise private financing, public financing should be shifted as soon as possible to uphold the legal commitments and long-term goals that countries adopted in the Paris Agreement. Governments – as shareholders and clients of MDBs – can call on MDBs to prepare roadmaps and climate action plans to support implementation of the banks' climate change targets, including support for low-carbon infrastructure. Many MDBs already have climate change strategies that can form the basis of road maps and action plans. The World Bank, for example, prepared an action plan in 2016 for how it will deliver on its climate change commitments.

MDBs could scale up efforts to mainstream low-carbon infrastructure support

While the importance of infrastructure in MDB portfolios has largely decreased since the 1950s[26] (Humphrey, 2015), infrastructure sectors – including energy, transport, water and communications – still remain a key aspect of MDB financing. From 2005 to 2014, MDB commitments to infrastructure doubled, growing at 10% per year on average (Miyamoto and Chiofalo, 2016). In 2014, MDBs' actual spending (i.e. disbursements) on infrastructure was around USD 31 billion. This was roughly half the support provided for infrastructure in developing countries by all bilateral and multilateral development partners reporting to the OECD Development Assistance Committee (OECD-DAC). Infrastructure is a substantial part of the overall portfolios of some MDBs, especially the Islamic Development Bank (IsDB) (85% in 2014), the African Development Bank (AfDB) (63%) and the Asian Development Bank (AsDB) (59%).

Roughly one-third of commitments by the largest MDBs[27] to infrastructure sectors in 2013-15 reported to OECD-DAC were climate-related, on average, ranging from 51.8% of EIB's infrastructure operations to 6.7% of IsDB's (Figure 7.9). Development finance for the energy sector shows the most alignment, while less mainstreaming is noticeable in the transport sector (Figure 7.10). This comparison is enabled by MDB efforts to harmonise their tracking and reporting on climate finance, both among MDBs and with other tracking systems, such as OECD-DAC.

Figure 7.9. **Share of MDB commitments for infrastructure which is climate-related and total MDB commitments for infrastructure, by institution (USD billion), 2013-15 average**

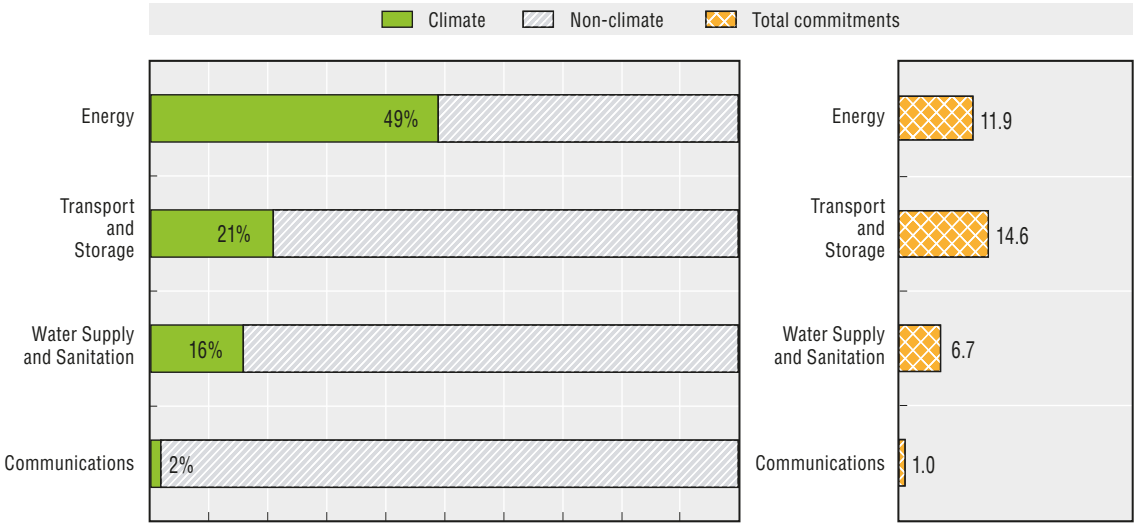


Notes: This graph is based on data reported to the OECD Development Assistance Committee by the following MDBs: the African Development Bank, the Asian Development Bank, the European Bank for Reconstruction and Development, the European Investment Bank, the Inter-American Development Bank, the Islamic Development Bank and the World Bank Group (WBG), which also includes the International Finance Corporation. Climate-related components of projects are those that target mitigation, adaptation, or both mitigation and adaptation, based on the joint MDB Climate Finance Tracking Methodology. MDB commitments include concessional and non-concessional support. Infrastructure sectors include transport, energy, water supply and sanitation, and communications.

Source: OECD-DAC statistical system.

StatLink http://dx.doi.org/10.1787/888933484367

Figure 7.10. **Share of MDB commitments for infrastructure which are climate-related and total MDB commitments for infrastructure, by sector (USD billion), 2013-15 average**



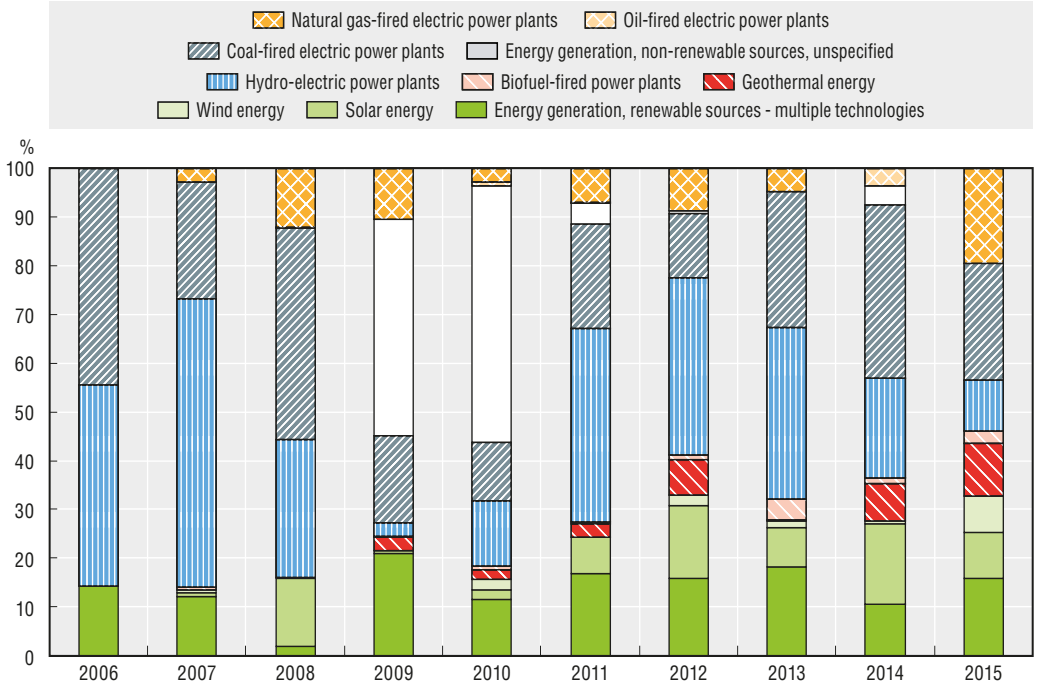
Notes: This graph is based on data reported to the OECD DAC by the following MDBs: African Development Bank (AfDB), the Asian Development Bank (AsDB), the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), the Inter-American Development Bank (IDB), the Islamic Development Bank (IsDB) and the World Bank Group (WBG), which also includes the International Finance Corporation (IFC). Climate-related components of projects are those that target mitigation, adaptation, or both mitigation and adaptation, based on the joint MDB Climate Finance Tracking Methodology. MDB commitments include concessional and non-concessional support.

Source: OECD-DAC statistical system.

StatLink http://dx.doi.org/10.1787/888933484375

Analysis of MDB support for the energy sector shows there is room to scale up financing for low-emission, climate-resilient technologies and scale down support for carbon-intensive technologies. While the share of MDB support for renewable energy technologies (excluding hydropower) in overall commitments to power generation has grown significantly over the last decade, at a compound annual growth rate of around 13%, the share of MDB support for fossil fuels has kept pace, with a compound annual growth rate of 15.7% (Figure 7.11). At the same time, MDBs have increased financing for transmission lines, which is critical to enable energy access and reduce losses. A detailed review of energy sector pipelines for the World Bank, IFC and AsDB in 2015-16 conducted by the World Resources Institute shows that while very few projects in the near future would be considered misaligned with the goals of the Paris Agreement, the major share of projects could have either a positive or negative impact on GHG emissions, depending on how they are designed and implemented (Christianson et al., 2016). In addition to financing infrastructure, MDBs provide technical assistance and advisory services, and support capacity building in the energy sector, which helps developing countries strengthen policies and regulations critical for attracting private investment into low-emission, climate-resilient technologies (Chapter 5).

Figure 7.11. **Trends in commitments to renewable and non-renewable power generation, selected MDBs, by sub-sector, 2006-15**



Notes: This graph is based on data reported to OECD-DAC by the following MDBs: African Development Bank (AfDB), the Asian Development Bank (AsDB), the Inter-American Development Bank (IDB), the Islamic Development Bank (IsDB) and the World Bank. Other MDBs are excluded from this analysis to avoid inconsistencies arising out of data gaps. MDB commitments include concessional and non-concessional support.

Source: OECD-DAC statistical system.

StatLink http://dx.doi.org/10.1787/888933484382

MDBs could mobilise additional investment for the transition

MDBs could scale up additional investment for low-emission, climate-resilient infrastructure by leveraging their shareholder base and mobilising more from capital markets. While MDB operations are limited by the capital allocated to them by shareholders, MDBs could make more efficient use of their existing capital, while retaining their existing credit ratings (Humphrey, 2015). In 2015, G20 governments initiated an action plan for MDBs to optimise their balance sheets so they can expand operations to meet the investment needs of delivering the SDGs.[28] The plan includes actions to improve capital efficiency, use concessional financing more innovatively (within prudential limits) and use risk mitigation more effectively to crowd-in private capital. Some banks have already taken steps in this direction. AsDB has combined its concessional and non-concessional windows, enabling greater leverage on its capital (Birdsall, Morris and Rueda-Sabater, 2015). As a result, AsDB could expand its operations by up to 50%, from USD 13 billion per year to USD 20 billion per year (AsDB, 2015). This additional financing is targeting low-income countries in the Asia Pacific region and could increasingly be targeted to low-emission, climate-resilient infrastructure. The Inter-American Development Bank (IDB) has taken similar steps, and the World Bank is introducing a new "private sector window" in its operations targeting low-income countries.[29]

MDBs could also scale up efforts to mobilise private capital by using well-designed, diversified risk mitigation instruments including guarantees, coverage of political and regulatory risks, credit enhancements, and more diversified insurance offerings (Table 7.3).

IFC, for example, has committed to a target of catalysing USD 13 billion of private sector support annually by 2020 by using de-risking and aggregation approaches in its climate change implementation plan (IFC, 2016). While private sector operations of the MDBs have focused significantly on renewable energy, as these technologies become commercially viable in many developing countries MDBs will need to focus on other areas in support of the transition.

Blended approaches – using MDB finance to mobilise private capital – can also be useful, especially to bridge viability gaps for investment, but should be governed by the standards and principles adhered to by development banks and DFIs to avoid crowding out the private sector. Such standards are in place among many institutions already; further harmonisation and co-ordination among these would be valuable. Better synergies between MDBs and the private sector would also be useful, including through co-financing facilities, insurance pools, a wider range of currency hedging tools, and investment platforms and partnerships where governments, local finance institutions and MDBs can co-invest alongside financial sponsors.

MDB support is influenced by country policy frameworks as well as access to targeted, concessional climate finance

MDBs could play a significant role in supporting countries to adopt low-carbon infrastructure choices, but this support is partly dependent on the availability of concessional climate finance. While the Paris Agreement has created momentum for countries to act on climate change, many countries have not yet centralised climate concerns within development policy and infrastructure planning, and it will take time for these enabling policy frameworks to take hold and have an impact. In the meantime, MDB support – especially efforts to mobilise private capital – is dependent on concessional support to bridge the viability gap for investments in low-carbon infrastructure and in climate-proofing infrastructure (Trabacchi et al., 2016). Concessional finance is particularly important where there are policies in place but technologies may not have enough of a track record to attract investment.

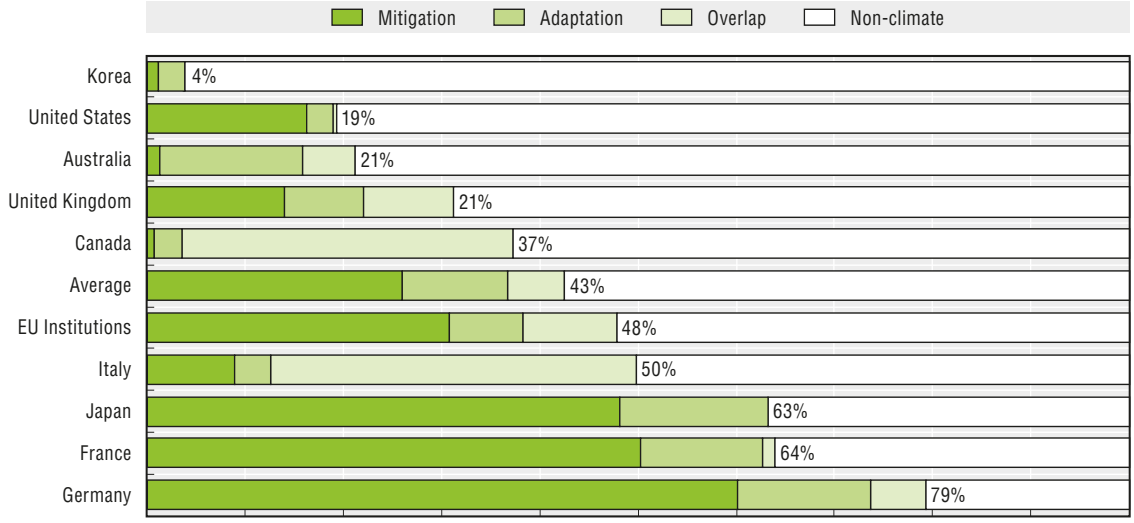
MDBs have increasingly been a channel of external concessional finance for climate change, for example through trust funds supported by bilateral donors. MDBs have also played the role of implementing entities for multilateral climate funds such as the Nordic Development Fund and Climate Investment Funds (CIFs), as well as the Global Environment Facility. Access to concessional finance has helped MDBs to gain experience and to begin climate-proofing their own investments, and could even be a pre-condition for MDBs to meet their climate targets. The World Bank's climate target, for example, is conditional in part on access to concessional finance (World Bank, 2016). Changes in the global climate finance architecture, including the scaling down of the CIFs[30] and the initiation of the newer Green Climate Fund, will have implications for how MDBs can scale up operations and meet their ambitious commitments to provide climate finance support for developing countries.

MDBs are facing demands to help countries cope with a wide range of other global challenges in addition to climate action. The World Bank, for example, identifies competition for support on social protection and budget support (for other issues) as a key risk to demand for climate support (World Bank, 2016). Through technical assistance, knowledge sharing and advice, and demonstration and piloting, MDBs can help raise awareness of stakeholders in borrowing countries, particularly in infrastructure sector ministries, and highlight the win-win cases for climate and development. These can focus on projects that have clear mutual benefits for development and for climate action.

Bilateral development banks and development finance institutions

G20 countries play a significant global role in cross-border development finance, providing 77% of concessional development finance (ODA and ODA-like flows) between 2010 and 2014.[31] While aid supports only a small share of global infrastructure investment, it plays a critical role in low-income countries, where it is difficult to mobilise domestic and other external finance. If aligned with a low-emission pathway, such support can help developing countries – both middle and low-income countries – achieve their NDCs more rapidly and "leapfrog" the emissions-intensive pathways of developed countries. G20 countries that report to OECD-DAC are mainstreaming climate considerations into their support for infrastructure (Figure 7.12).

Figure 7.12. **Share of climate-related official development finance to infrastructure, commitments, 2013-15 average, G20 members reporting to OECD-DAC**



Note: This graph is based on Official Development Finance (Official Development Assistance and Other Official Finance) commitments data reported to the OECD-DAC Creditor Reporting System (CRS) database. Infrastructure sectors include transport, energy, water supply and sanitation, and communications. 'Overlap' refers to activities that simultaneously pursue mitigation and adaptation objectives.

Source: OECD-DAC Statistical System.

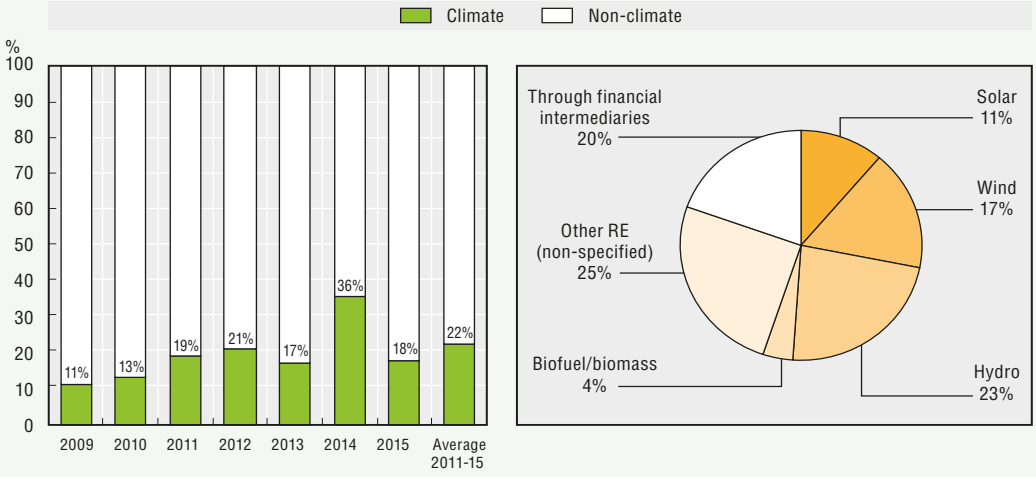
StatLink http://dx.doi.org/10.1787/888933484398

Bilateral support is often channelled through bilateral development banks, such as Germany's KfW and France's AFD; bilateral development finance institutions, such as CDC in the United Kingdom and the Overseas Private Investment Corporation (OPIC) in the United States; and through export-import agencies, such as China EXIM Bank, Japan Bank of International Cooperation (JBIC) and Korea EXIM Bank (KEXIM). Bilateral development banks work in a similar way to MDBs: they raise capital at attractive rates based on their governments' high credit ratings, and support both public and private sector projects in developing countries. Some bilateral development finance institutions specialise in engaging with businesses and mobilising private capital in support of development outcomes. These "private-sector focused" bilateral DFIs include those set up by various European countries (Box 7.2).

Box 7.2. **European development finance institutions and support for low-emission, climate-resilient infrastructure**

The European DFI Association (EDFI) brings together 15 bilateral DFIs from EU member countries. These institutions provide financing in the form of equity, loans and guarantees, on commercial terms, to international companies as well as businesses based in developing countries. Together, European DFIs represented EUR 6 billion in new commitments in 2015, equivalent to one-tenth of ODA from EU member states and the EU. The three largest European DFIs in terms of new commitments per year are FMO (Netherlands), DEG (Germany) and CDC (United Kingdom). The major focus areas of EDFI operations are infrastructure and the financial sector, which each make up roughly one-third of the overall portfolio of EDFI members in 2015. On average between 2011 and 2015, 22% of EDFI members' overall commitments were related to climate. Within the power sector, renewable energy (including hydro) made up 70% of power investments in 2015, and commitments to renewable energy have been increasing year on year. Support for adaptation is still at a nascent stage, making up 1% of climate-related finance flows from European DFIs in 2015.

Figure 7.13. **Climate-related annual commitments by EDFI members, as share of commitments and by sub-sector, 2011-15**



Source: OECD analysis based on data collected by EDFI.

Bilateral development banks need to scale up support for climate resilience

Climate finance targets and commitments among bilateral development banks and DFIs are driven by countries' commitments in the context of the UNFCCC negotiations, specifically the commitment to mobilise 100 billion USD per year by 2020. In recognition of this, some bilateral development banks are increasingly mainstreaming support for low-carbon infrastructure. On average between 2013 and 2015, 68% of AFD's, 58% of KfW's and 40% of JICA's financing for infrastructure targeted climate change directly.[32] Within this support, however, the major share went towards climate change mitigation, with only a minor share going towards increasing the climate resilience of infrastructure projects.

Across bilateral DFIs that target private sector operations through largely non-concessional financing, support for renewable energy has been increasing. Despite this the share of climate finance in their portfolios is lower, as is the share of climate finance going to adaptation, when compared with bilateral development banks that support both public and private sector projects.

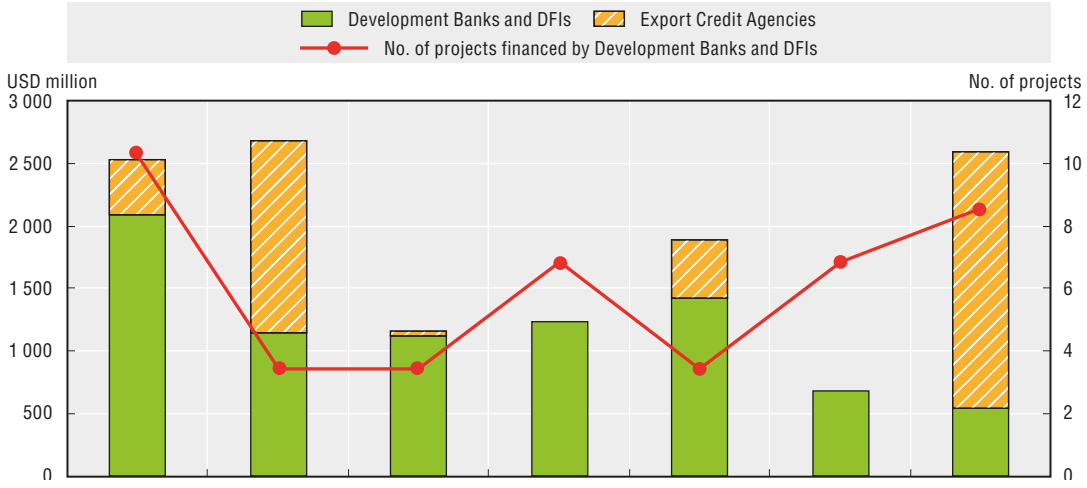
Bilateral providers also increasingly work together to co-finance projects related to climate change. Initiatives such as the Interact Climate Change Facility and the EU Electrification Financing Initiative (ElectriFI), for example, bring together EDFI members and other bilateral and multilateral development banks to source and support renewable energy and energy efficiency projects in low and middle-income countries.

Development banks, DFIs and export credit agencies also support carbon-intensive infrastructure

As well as supporting climate-friendly projects, some bilateral DFIs and export-credit agencies continue to support more carbon-intensive forms of energy in developing countries. Investment by development banks and finance institutions (national, multilateral and bilateral) and export credit agencies in privately financed coal projects ranged from USD 682 million to USD 2.6 billion per year in the last five years (Figure 7.14). Export credits in support of power generation from G20 countries that report to the OECD overwhelmingly supported fossil fuel technologies over the last decade (Chapter 3). In the future, any export credits provided by OECD member countries for coal power will support super-critical and ultra-supercritical coal technologies, which have lower emissions than traditional coal technologies but remain high-carbon relative to other power generation options. However, this agreement – the Sector Understanding on export credits for coal-fired power projects under the OECD's Arrangement on Export-Credits, which took effect in January 2017 – is only valid for OECD member countries, and will not apply to export credits provided by all G20 countries.

Overall, investment by development banks and finance institutions in privately financed coal-fired power has been declining since 2010, and development banks are moving away from financing coal-fired thermal power. Some MDBs – such as EBRD and EIB – have withdrawn support for coal, while others are limiting their support. The World Bank only supports new coal projects in "rare circumstances". KfW supports new coal power plants and retrofitting of existing plants on condition of eligibility and sustainability criteria being met, including minimum plant efficiencies, existence of national climate policy and commitment to renewables (World Bank, 2013; KfW, 2015b). Some banks – such as EIB – incorporate the economic cost of carbon into project appraisal.

Figure 7.14. **Investment in privately financed coal power projects by development banks and DFIs, 2010-16**



Source: IJGlobal. OECD Calculations.

StatLink http://dx.doi.org/10.1787/888933491515

Mobilising private investment for low-emission, climate-resilient infrastructure

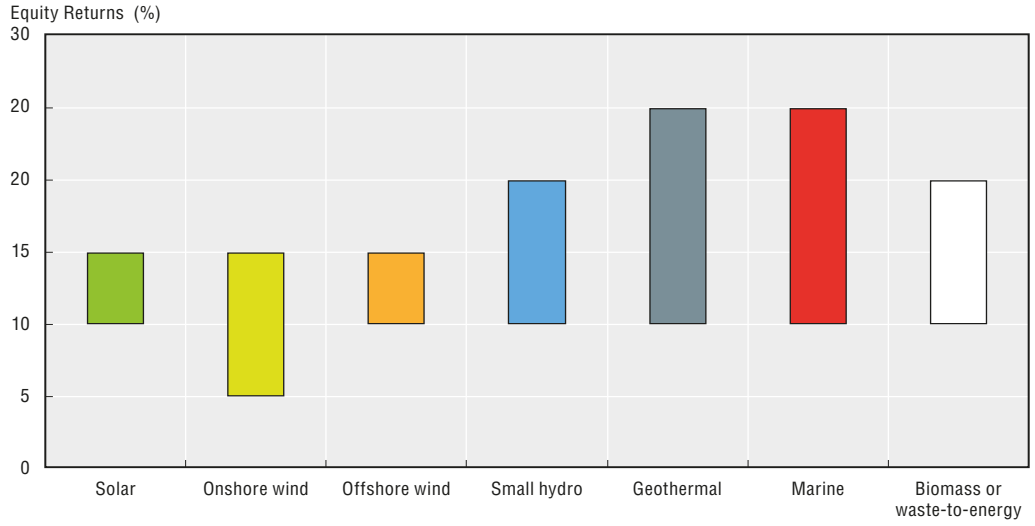
Impediments to private investment

Projects with clear revenue streams supported by end users, such as renewable energy projects, have a strong potential for private financing. Projects face difficulties attracting capital from private investors, however, where a revenue stream is not readily available (e.g. climate proofing of existing infrastructure, or climate resilience infrastructure such as flood protection), or where revenue streams are not predictable and dependable (e.g. basic infrastructure projects in countries with weak governance and regulation). Financing is also influenced by the general risks involved in infrastructure investment, due to the project stage and other risk factors, such as being located in less creditworthy countries, or facing market risks that are difficult to quantify and mitigate. Other barriers have been identified in this report, such as the absence of a steady pipeline of infrastructure investments (Chapter 3), and the absence of many of the investment-related policies needed (Chapter 5). This section discusses returns and risks related to infrastructure, and looks at the tools available to policy makers and regulators to help de-risk investment and facilitate the engagement of investors in infrastructure projects.

Risk and return drive investor demand

Most investors expect 10-15% net ROE for onshore and offshore wind, as well as solar, according to the results of a preliminary OECD survey on renewable energy finance.[33] Some investors have high return expectations for the offshore wind sector, perhaps reflecting higher technical risk and less experience than in onshore wind and solar energy projects. Onshore wind reported a greater range of return expectations, given the maturity of markets in some regions, notably northern Europe where returns on onshore wind have been pushed down to 6%-8%. Other renewable energy sectors with greater technology risks, such as marine, have higher return expectations, but also greater uncertainty reported by investors, as expected (Figure 7.15). Further analysis of return expectations for low-emission, climate-resilient infrastructure is needed, but the general principle remains true: the greater the perceived risks of a project, the higher the returns investors will demand, and the higher the costs passed onto end users and government sources of funding.

Figure 7.15. **Expected equity return, renewable energy finance, by sector (in %)**



Source: OECD calculations based on survey data collected by the OECD.

Several factors determine the risks – real and perceived – associated with infrastructure investments. These investments are typically long-term, involve high upfront costs, differ from project to project and thus cannot reach economies of scale, and usually involve different stakeholders and non-standardised financing structures (OECD 2015c). As a result, infrastructure investments are commonly associated with different types of risk (Table 7.2). Some of these are further exacerbated in the case of low-emission infrastructure projects (OECD, 2012; OECD, 2015d, OECD/World Bank, 2015, Frisari, 2013).

Table 7.2. **Risks linked to infrastructure assets over the project lifecycle (shaded cells can be linked to climate change risks)**

Risk Categories	Development Phase	Construction Phase	Operation Phase	Termination Phase
Political and regulatory	Environmental review, land acquisition	Cancellation of permits	Change in tariff regulation	Contract duration
	Rise in pre-construction costs (longer permitting process)	Contract renegotiation		Decommission
				Asset transfer
			Currency convertibility	
	Change in taxation			
	Social acceptance			
	Change in regulatory or legal environment			
	Changes in climate change policy and support schemes			
	Enforceability of contracts, collateral and security			
Macroeconomic and business	Prefunding	Default of counterparty		
	Financing availability		Refinancing risk	
			Liquidity	
			Volatility of demand/market risk	
			Liability risks - compensation from victims of climate change	
	Inflation			
	Real interest rates			
	Exchange rate fluctuation			
	Long pay-back period for climate change mitigation investment			
Technical	Governance of the project			Termination value different from expected / stranded assets
	Environmental			
	Project feasibility and inclusion in investments plan*	Reliability of forecasts for construction costs and delivery time	Qualitative deficit of the physical structure/ service	
	Archaeological			
	Obsolescence			
	Force Majeure			

Source: Adapted from OECD (2015c), p. 48.

Political and regulatory risks are the most significant when considering investment in infrastructure projects in the construction or operations phases. These risks are usually greater for low-emission projects because such projects depend strongly on the public sector for support. In addition, a general lack of clear political commitment to act on climate change can undermine a long-term investment horizon, and specific technologies can face social resistance. Based on the survey results of investors in renewable energy, the most significant risks in this category are related to retroactive changes to remuneration schemes, subsidies (taxes) and tariffs. Permitting (administrative risk) is another top concern, along with land acquisition, which can be critical for the deployment of wind and solar generation facilities. Investments in operational infrastructure projects similarly face risks from potential retroactive changes to regulation, subsidies and remuneration schemes. For these reasons, commitments by policy makers remain the key concern for investors in infrastructure.

Macroeconomic and business risks are also of concern to investors. According to the OECD survey, the interest rate environment, state of the economy and (global) energy prices are the risks most often cited by investors in energy sector projects in the construction phase. Counterparty, sovereign default and currency convertibility risk were also mentioned. With respect to investment in the operations phase of infrastructure projects with commercial risk, a decline in prices and demand are the macroeconomic and business risks that most concern investors.

Technical risks are also relevant for investors. During construction, the most important relate to the reliability of cost and time forecasts, as well as uncertainties about the deployment of new technologies. For renewable generation projects in the operating phase, technical risks include connectivity problems (grid, offshore transmission), technical failure and reliability issues. The current value and future performance of an infrastructure asset can also be reduced if climate change increases the frequency and intensity of natural disasters. For this reason, it is vital to question the extent to which access to climate risk insurance influences the cost of capital for infrastructure projects.

Matching expected returns with acceptable levels of risk

Private sector investment in infrastructure is based on matching the expected risks and returns of infrastructure assets with the investor's own tolerances for returns and risks. The involvement of the private sector can also help to increase operational efficiency, thus providing support beyond mere financing. Projects that are clearly commercially viable are typically able to attract private sector finance. When projects face financing shortfalls, governments can use risk mitigation techniques and incentives to reduce risks to match a suitable level of return, or increase return to match a given level of risk, facilitating the pricing of investment. Lowering costs can also improve the economic viability of some projects and improve the overall efficiency of public capital for low-emission infrastructure. Reducing the cost of finance, both for debt and equity, can dramatically improve the ability of renewable energy technologies to compete with fossil fuels, especially in developing countries (UNDP, 2015).

Risk mitigation instruments and blended finance can facilitate private investment

Enabling a pipeline of bankable low-emission infrastructure projects will require efforts to mitigate the risks that investors face, and crowd in private capital. Governments, development banks and DFIs utilise a range of tools to achieve these aims, including guarantees, insurance and hedging, as well as syndication and debt subordination (Table 7.3). Each tool mitigates different types of risk. Guarantees can be useful in protecting investors from the risk of governments not honouring their obligations, for example, while currency hedging can reduce exposure to fluctuations in foreign currencies.

Many such approaches are supported by "blended finance" – the strategic use of public capital, concessional or non-concessional, to mobilise additional investment. For example, in some subordinated debt approaches, transactions can be structured so that public capital can take a "first loss" position to attract private capital to the project. While such tools are useful in engaging private capital, particularly for technologies that are yet to mature or in countries where the perceived risk of investment is high, there is a need to balance blended finance interventions – and risk mitigation tools more broadly – against issues of moral hazard[34] and market distortions.[35] MDBs are increasingly working together to develop common guidelines in the use of concessional finance in private sector operations. Similar efforts are under way among OECD-DAC members.

Public support for project preparation and development also plays an important role in promoting low-emission infrastructure. Dedicated project preparation and development facilities can support different stages of the project cycle, such as advisory support for design and conceptualisation, prefeasibility and feasibility studies, and help identifying potential investors (Nassiry et al., 2016). Such facilities also provide broader support such as technical assistance and capacity building, which are major barriers to project development in developing countries. Such approaches should be scaled up, and facilities with a multi-country or regional focus should be better co-ordinated to maximise their impact and avoid duplication or overlap.

Table 7.3. **Approaches and instruments used to mitigate risks and mobilise private capital**

Instrument / approach	Usage	Example
Guarantees	Political risk guarantees can enable investment in higher risk countries.	The Multilateral Investment Guarantee Agency (MIGA) provided a guarantee against risks related to expropriation, war and civil disobedience to a Dutch solar company (SunE Solar) to cover investment in the development of three solar power plants in Honduras.
	Credit guarantees can incentivise institutional investment.	MIGA provided a guarantee to cover the non-honouring of financial obligations issued to back a USD 361 million loan by Banco Santander S.A. of Spain to the state of São Paulo, Brazil, to improve the sustainability of São Paulo's transport system.
Currency hedging	Currency hedging mitigates the risk of currency fluctuations for foreign investors, important for infrastructure investment in developing countries.	The Currency Exchange Fund (TCX), supported by the German and Dutch governments, is a currency hedging fund. When the private fund manager ResponsAbility Investments provided local currency-indexed loans to M-Kopa, a Kenya-based solar home system company that provides decentralised solar solutions in Kenya, Tanzania and Uganda, it used a hedging contract with a specialist currency hedging provider, that either passes on the currency risks to commercial counterparties or to TCX, if the former do not exist.
Loan syndication	Loan syndication mitigates business risks for private investors and builds on due diligence capacity of development banks	MDBs usually take the role of lead arrangers, and the private sector steps in to provide additional capital. The division of the loan amount leads to risk diversification, and it builds on the due diligence capabilities and reputation of the public sector (MDB) arrangers. By doing this, the MDBs boost investor confidence and reduce transaction costs.
Debt subordination	Debt subordination diversifies risks through structuring and facilitates private investment.	The Green for Growth fund was launched by KfW and the EIB with the financial support of the European Commission, the German Federal Ministry for Economic Co-operation and Development (BMZ), and the EBRD.[36] The fund invests in energy efficiency projects as well as projects increasing renewable energy sources in Southeast Europe. The public donors are invested in the most junior tranche, while private institutional investors invest in the most senior tranches, thereby benefiting from the risk cushion provided by the public (donor) investment.
Co-investment platforms and funds	Co-investment vehicles pool investor capital to deploy directly in infrastructure projects, bypassing intermediaries.	The Marguerite/2020 European Fund for Energy, Climate Change and Infrastructure brings together several NDBs and financing institutions, including CDC, CDP, EIB, KfW and PKO Banco Polski, to co-invest in renewable energy and sustainable transport infrastructure in Europe, with a focus on greenfield projects (minimum 65% of the fund) (Della Croce and Sharma, 2014).
	Blended finance funds pool public and private capital to mobilise additional capital	Climate Investor One, launched by FMO and Phoenix InfraWorks and supported by funding from the government of the Netherlands, is a new fund of funds structure designed to invest at the development, construction and refinancing stage of large-scale solar, wind and hydro projects, with initial projects financed in Rwanda and Zambia.
Project development facilities and technical assistance	Supports the development of bankable infrastructure projects.	The Asia Pacific Project Preparation Facility, funded by Australia, Canada and Japan, supports AsDB member country governments and their public-sector agencies in preparing and structuring PPP transactions for infrastructure, prioritising infrastructure with climate change and sustainable development elements. AsDB will provide the technical assistance.[37]

Facilitating investment using diversified financial instruments and techniques

This section presents a range of financial instruments that mobilise investment through capital markets channels, and that benefit from pooling smaller projects, from partnerships, and from engaging corporate and institutional investors, while taking advantage of the expertise of established players such as utilities and banks.

These instruments build on previous recommendations endorsed by the G20 in the *G20/OECD Guidance Note on Diversification of Financial Instruments for Infrastructure and SMEs*.[38] For developing countries, the formation and deepening of local capital markets – debt

and equity – is essential to attract domestic and foreign investors. The Guidance Note presents other important pre-conditions that can strengthen the financing environment for infrastructure.[39]

Diverse equity instruments for financing low-emission infrastructure

Private market instruments such as private equity-style funds have played a major role in regions where institutional investment has been taking place in infrastructure. For example, CNP Assurances (an insurance company) and Meridiam (asset manager), jointly launched the Meridiam Transition Fund, an unlisted equity fund targeting green infrastructure investment. This is just one example from a spectrum of investment strategies, levels of fees, and terms and conditions that exist. Asset management industries, combined with a competitive bidding process for assets and a project pipeline, are conducive to investment funds raising capital for deployment in low-emission infrastructure projects.

Box 7.3. **Financing sustainable transportation infrastructure**

The financing of passenger rail and metros is often constrained by higher upfront capital costs, lower returns and longer development and payback periods, compared with toll highways. In addition, direct user fares are often set too low to cover operational costs, due to social affordability concerns. Several financial tools and risk-sharing mechanisms are available to improve the relative risk-return profile of sustainable transport infrastructure projects.

Public-private partnerships (PPPs), which allow for private sector participation and risk sharing, have often been used for bus rapid transit systems, highly used and specific rail links, and shared-use vehicle and bicycle systems. However, the right institutional capacities and processes must be in place (see Chapter 5).

Land value capture tools secure revenues from the indirect and proximity benefits generated by transport infrastructure (e.g. increased real estate value) to help fund transport projects. Examples of land value capture tools include tax increment financing (TIF) districts, development charges, development rights and joint development. To date, these tools have been applied mainly to roads, metros and rail. New York City (NYC) is financing Hudson Yards subway line extension and station through the issuance of bonds by a special purpose vehicle (SPV), the Hudson Yards Infrastructure Corporation, with debt service guaranteed by innovative sources of revenues, including: tax equivalency payments, provided by NYC in anticipation of future tax revenues from land value increases; payments in lieu of taxes, which offer land tax exemptions to project developers in a specific area; and transferable development rights from the transfer of public property land and building rights. Effective land-use planning is instrumental in promoting value creation through new infrastructure (see Chapter 5).

Source: OECD (n.d.).

Since many funds invest in public-private partnerships (PPPs), a supportive project finance environment, coupled with liquidity in local debt markets, is conducive to investment, since private equity investors also seek to secure debt financing for investment. Private market funds and direct equity investment can support new, greenfield investments; however, most investors prefer the risk/return profile of operational assets that generate attractive cash yields. Countries could review the availability of unlisted equity funds in local markets, for both domestic and foreign investors, taking note of product diversity and fund activity in renewable energy markets, as well as direct equity investments by institutional investors and the secondary market conditions that can support such investment.

Listed equity instruments also have potential to channel investment for the transition, particularly through retail channels or in defined contribution pension systems. Closed-end funds, real estate investment trusts and master limited partnerships (MLPs) are designed principally as holding companies to pass through income to shareholders, with some structures offering potential tax advantages for investors. Low-emission and climate-resilient infrastructure assets could be included, where rules permit them as qualifying assets. Countries could, where appropriate, review the rules for qualifying assets for listed equity vehicles for renewable energy assets and other relevant infrastructure.

Over the past few years, yieldcos have emerged in North America as an equity-based financing model for clean energy projects such as wind and solar. Although this market has been volatile recently, this model of finance represents an innovative channel for investors to gain exposure to clean energy assets.[40] Some closed-end funds have also been launched specifically to finance renewable energy, particularly in the United Kingdom, such as Greencoat Capital.

Bond issuances such as green bonds facilitate private investment

Bond issuances have become increasingly important in recent years as a means to mobilise private finance for low-emission infrastructure projects. Project bonds can provide long-term debt capital to such projects by directly financing or refinancing specific assets through the capital markets. Such issues may be designated "green bonds", although green bonds are not specifically defined, and both officially labelled and unlabelled types exist (OECD 2017b).[41] The major issuers of green bonds are corporations and development banks (Box 7.4) (OECD, 2017b). "Climate-aligned bonds" is another label for bonds that are specifically linked to the financing of low-emission investments. As of 2016, outstanding climate-aligned bonds amounted to USD 694 billion (CBI, 2016). From 2015 to 2016, the share of climate-aligned bonds that are officially labelled rose from 11% to 17%, reflecting the growing demand for transparency in the sector (CBI, 2016).

Governments could encourage diverse channels of debt financing for relevant infrastructure projects, in particular through non-bank channels, including syndication of bank loans through capital markets, the development of a robust project finance market, revival or innovative use of infrastructure project bonds and sub-sovereign bonds, and linking to trends in green bond markets. In 2017, the French government issued its first green bond, raising EUR 7 billion. The issue is the largest and longest-dated benchmark green bond in the world, and was launched to encourage the development of a robust green bond market. In developing countries, the expansion of local currency debt markets is crucial for infrastructure projects to secure large amounts of debt financing, while minimising currency mismatches and over-reliance on external sources of debt finance (G20/OECD, 2016).

Securitisation supports the bundling of small-scale loans, tapping capital markets' liquidity

Securitisation mobilises capital markets' liquidity through the issuance of rated bonds, and diversifies risks by aggregating small-scale assets, which is particularly important for investment in energy efficiency or decentralised energy. The pooling of assets also facilitates access to infrastructure investment by institutional investors, who may have minimum investment thresholds but who may also not have the capacity or expertise to provide financing on a project-by-project basis. Some recent examples of securitisation include:

- Up to March 2016, SolarCity (a corporation that produces, installs, finances, and services solar energy installations in the United States) has raised over USD 680 million over a series of six securitisations in the past three years (Marathon, 2016).

- Loan warehouse facilities for securitisations have also taken place. In the United States, the Warehouse for Energy Efficiency Loans (WHEEL) purchases and aggregates home energy efficiency loans on a national scale, and issued its first asset-backed security in June 2015, totalling USD 12.6 million, comprising unsecured home energy efficiency loans up to USD 20 000.

Securitisation could lower the cost of finance for solar PV installations by enhancing liquidity and pooling issues across geographies, though there are challenges to overcome. As a collateral type, cash flows generated through long-term contracts on decentralised power (leases, loans, or PPAs) have a short history, and such collateral is usually unsecured in that the asset has little or low resale value, which can lead to higher losses given default. Backing energy efficiency loans with adequate collateral can sometimes be challenging. In developing countries, a lack of credit scoring, credit history and insufficient data are impediments to overcome. Standardising contracts for small-scale financing at the domestic level would be beneficial for securitisation transactions, along with mitigating certain policy risks such as net metering rules (utility buy-back of surplus generation) (Marathon, 2016), and credit guarantees. Strong growth prospects for the rooftop solar industry, driven by falling technology costs, regulatory and policy support for solar power, and acceptance of the asset class by institutional investors, are the key drivers of the sector's expansion in developed economies (Moody's, 2015).

Box 7.4. **Tapping the debt capital market by issuing green bonds**

EDF's green bond programme: The state-owned French utility EDF launched a green bond programme in 2013 with a EUR 1.4 billion bond issuance of eight-year tenure, at a 2.25% fixed rate. A second issuance of USD 1.25 billion took place in 2015, maturing in 2025, and a third issuance of EUR 1.75 billion in October 2016. EDF uses the debt financing to invest in greenfield renewable power generation projects as well as renovation and upgrade of existing hydropower facilities in France; that is, collected funds are directed to 13 projects (first issuance, as of December 2015) and 3 projects (second issuance, as of December 2015). The EDF example shows how investors can invest in tradable corporate fixed-income securities directed to low-emission, climate-resilient projects, thereby achieving an attractive risk-return relationship: the first note offered a competitive return at low risk – S&P rated it investment grade (A+).

IDB's securitised green bonds for energy efficiency: In 2014, IDB and the Clean Technology Fund (CTF) set up a USD 125 million financing project for energy efficiency projects developed by Mexican energy service companies (ESCOs). As a first step, the IDB engaged in warehousing receivables of two Mexican ESCOs of USD 50 million, which will be issued via securitisation in green bonds and sold in local debt capital markets, thereby enabling institutional investors to increase their exposure to the energy efficiency sector. This transaction will enable the ESCOs to access long-term funding to implement small-scale energy efficiency projects. The portfolio of these projects is backed by a partial credit guarantee provided by the CTF.

Using municipal and resilience bonds to finance climate resilience and adaptation

Adapting to the expected impacts of climate change, such as more frequent inland and coastal flooding, will require investment in structural protection infrastructure such as flood barriers and sea walls. However, the potential for private investment in such projects is limited because unlike toll roads or airports, structural mitigation projects

do not generate revenue with which to repay investors. An emerging bond type, known as "resilience bonds" or "municipal adaptation bonds", is similar to the concept of green bonds whereby the issuer commits to use the funds for specific adaptation purposes. For example, such bonds have been issued by Nederlandse Waterschapsbank (NWB Bank) to finance loans to Dutch water authorities for water management measures, including flood protection measures. The finance of urban resilience infrastructure, of which there is great need (see Chapter 3), may be particularly suited for resilience bonds, although capacities to finance may be limited by the creditworthiness of local municipalities.

The non-life insurance companies that would face reduced claims in a better-protected municipality could have incentives to provide a portion of the financing for resilience bonds that are structured to provide a return to investors. One approach could be to monetise the expected reduction in insurance premiums that would accompany investments in resilience as a means to generate returns for investors. For example, Vajjhala and Rhodes (2015) have outlined an approach to linking investments in resilience to pre-defined rebates (insurance savings) on catastrophe bonds that could be used to fund the project costs. A significant increase in interest in catastrophe bond issuance by public agencies would be a prerequisite, as this risk transfer instrument is rarely used by public entities.

Tax equity financing models for renewable energy projects

In the United States, tax credit mechanisms initially targeted at project developers have attracted third-party tax equity providers. Project developers could not easily use the tax credits due to their small size, lack of profitability and lack of tax exposure (Sharif, et al., 2011). Third-party tax equity investors comprise banks and corporates, receiving remuneration in the form of tax credits instead of cash. Tax equity investors can also access accelerated depreciation of investments, providing further tax benefits and cost recovery for investment. Tax equity partners have expanded the amount of capital available for investment in renewable energy projects in the United States.

Although banks dominate the market, new actors are entering, including other institutional investors and corporates. In June 2011, Google invested USD 280 million in a tax equity fund with the US solar power company SolarCity to finance residential solar projects. In 2015, primary tax equity financing for renewables reached nearly USD 1 billion (IJ Global). Other sources cite much larger numbers: Renewable Energy World reported that USD 11.5 billion in tax equity financing was secured in 2015 for new wind and solar projects.[42]

Limitations to the tax equity model include scheduled phase-outs of supportive legislation that creates such incentives, political risk, and cyclical demand (tax credits only have value to investors when they have profits to offset). This model is also unique to the United States.

Emerging finance models for energy efficiency, decentralised power generation, and carbon markets

The availability of finance often determines the uptake of new technologies in energy efficiency and decentralised power generation; for example, many homeowners at first eschewed investing in solar panels due to the upfront costs and limited access to finance. As more financing models are emerging, however, there are more ways for policy makers to foster technology uptake. In developing countries, governments can enable investment in decentralised power generation by promoting innovative financing models for solar PV, small scale loans or leases for households and businesses deploying technologies, and

securitisation to recycle capital into new lending. In advanced economies, governments can help to offset the costs of installing decentralised power by supporting net metering policies, with fair economics.

There is massive potential to achieve energy efficiency in buildings, infrastructure and industry (Chapter 3). It can be difficult to monetise returns in the necessary investments, however, so financing for energy efficiency has not been happening at the scale needed. To change this situation, effective investment policies are crucial (Chapter 5).

Nonetheless, new business models and financing techniques have emerged in some countries in response to specific tax policies. This includes accounting standards, such as accelerated depreciation, which can shorten the payback period on investments. Some innovative financing models include:

- With the advent of technologies such as off-grid solar coupled with mobile payment solutions, several new pay-as-you-go (PAYG) solar companies have emerged with significant potential to improve access to renewable energy in low-income countries. Companies such as M-Kopa and PEG have expanded access to solar electricity to off-grid communities and households in Africa, based on low-level weekly or month payments.
- SunFunder launched its Structured Asset Finance Instrument (SAFI) in May 2016, with a first USD 2 million deal with SolarNow in Uganda. Sunfunder has also launched a fund, initially seeded by OPIC with USD 15 million, to provide project finance loans and short-term inventory loans to solar companies deploying off-grid projects in Africa, India, Pakistan and the Philippines.
- Touting an "infrastructure-as-a-service" business model, Generate Capital, a balance-sheet corporation, raises capital through issuing shares or debt, and deploys flexible financing options for innovative solutions in energy, agriculture and water infrastructure. It focuses on sustainability and small-scale downstream opportunities with a high development impact. Generate owns the infrastructure asset, and collects usage payments.
- Using tax finance for energy efficiency, the U.S. Property Assessed Clean Energy (PACE) comprises a loan to a building owner to retrofit a building. The loan is attached to the property and reimbursed through local taxes by the occupant. The fact that payments are integrated in local taxes enhances their creditworthiness, since taxes have almost zero non-payment rates in the United States and are senior to any other debt.

Specialised loan products have been developed that focus increasingly on renewable energy and energy efficiency, such as green credit lines. In Germany, KfW provides loans and grants for energy efficiency, which are distributed through local banks. Several bilateral and multilateral providers use a similar approach to finance energy efficiency in developing countries, by working through NDBs. For example, EBRD's Turkish Sustainable Energy Financing Facility, a USD 260 million credit line facility, works with several local banks to help Turkish SMEs finance energy efficiency improvements. In the United States, energy efficient mortgages for qualifying buyers reduce borrowing costs when the mortgage takes into consideration lower utility costs, which could help support a slightly larger mortgage payment.

To scale up emerging and innovative financing, governments should implement policies that support investment in energy efficiency (such as standards and labelling for equipment, and building codes), while encouraging the private sector to develop financing tools such as long-term loans, leases, securitisation, "green mortgages", PAYG, and other products to create a competitive financing landscape. The development of standardised measurement and verification frameworks, including energy efficiency audits, has helped to create a framework for energy efficiency investment in the United States and other advanced economies:

- In April 2016, the California utility PG&E submitted plans for a residential pay-for performance pilot programme that measures results at the meter and rewards customers for savings.
- The International Renewable Energy Agency (IRENA) and Terrawatt Initiative launched the Solar Energy Standardization Initiative in June 2016 to work with 15 law firms and over 20 financial institutions worldwide to develop streamlined and standardised contract documentation for solar PV.

Other financing models are evolving that mobilise third-party investment from institutional investors and capital markets by using closer links to carbon markets. Emissions trading schemes directly engage companies and organisations, moving capital around to unlock investments in energy efficiency, renewable energy, or other low-carbon investments (Jones, 2016). Among institutional investors, carbon pricing could also affect asset allocation decisions, potentially unlocking further investment through capital markets. In this way, new instruments could compensate investors through the receipt of carbon credits, which could be used to offset their own emissions, or the credits could be sold in carbon markets. Such an innovative concept could unlock investment for carbon capture and storage assets that themselves generate carbon credits, renewable energy, energy efficiency, or carbon sequestration like forests and wetlands.

Forest bonds for the support of forest conservation

As well as being essential for the absorption of atmospheric carbon dioxide, forests have a strong mitigating effect on the extremes of climate change weather. An innovative forest bond issued in October 2016, backed by the IFC and BHP Billiton, raised money from institutional investors to combat deforestation in Kenya. This is an innovative instrument because investors can opt to be paid in carbon credits, which they can use to cover emissions or sell in the carbon credit market for cash. This model could be particularly attractive for entities that have large carbon footprints and emissions to offset and is an innovative example of attracting third-party investment through capital markets.

The role of the public sector and the need for improved business models

To improve the flow of finance to climate-friendly technologies, collaboration between the public and private sectors is needed. This could be led by the G20 or by individual country initiatives, and could focus on crowding-in investment at key points along the value chain and catalysing investment. Such initiatives are especially important in early stage financing, where there are shortages of capital for innovation, and in capital-intensive technologies or technologies with long development periods. For example, in innovation financing for climate change adaptation, where revenues are not always available, the public sector could take a stronger lead by awarding grants to promising solutions, or launching clean technology incubators. Another example is Smart City initiatives in numerous countries where local authorities work closely with innovators, financiers and the public to identify innovative solutions to urban challenges and climate change. A number of global initiatives have recently been launched with climate change as a central theme. Examples include:

- Mission Innovation, with 23 members (including Australia, Brazil, Chile, China, the European Union, India, Indonesia, Japan, Mexico, the United Kingdom and the United States) has committed to doubling public investments in clean energy research and development by 2020 while encouraging greater levels of private sector investment in transformative clean energy technologies.
- The Global Innovation Lab for Climate Finance, which brings together governments, project developers and development banks and finance institutions, supports the

identification and piloting of cutting-edge climate finance instruments that can drive investment and unlock new opportunities for renewable energy, energy efficiency, and adaptation efforts in developing countries.

- Infuse Ventures is an India-based technology fund seeded through public funds that invests in seed and early stage venture capital focused on sustainability and clean energy. The government of India has a first-loss position, while private sector investors and other public investors have contributed capital.
- The US-India Joint Clean Energy R&D Centre promotes collaborative development. This idea could be scaled up to other multilateral settings to enhance north-south collaboration, the uptake of new technologies in developing countries, and the application and commercialisation of technologies (Patwardhan, 2016).

To mobilise further investment in clean technologies, innovation in business models and financing is needed. The venture and private equity capital model could be improved by extending fund investment horizons for base technologies. Corporations could be encouraged to commercialise technologies by strategically investing in or acquiring start-ups, as is the case in the biotechnology sector. Additionally, shifting investors' mind-sets away from finding a "breakthrough" technology (which can be very difficult), to focusing on information technology solutions and applications, can better fit the VC model. Technology can be used to enhance the performance of existing infrastructure and move into new markets, providing for a better alignment with the VC model, which seeks to exploit untapped markets or unleash disruptive technologies on incumbent industries.

A responsive and resilient financial system for the transition

The Paris Agreement has sent a strong signal to financial markets. Crossing the threshold for entry into force "brings the horizon forward" for climate action (Carney, 2016). The financial system needs to evolve and adapt to this new environment, so as to capture profitable opportunities arising from the transition while remaining resilient to related risks. Together with an effective investment policy framework, including long-term policies supported by strong government commitment (Chapter 5), enhanced transparency and signalling would improve the ability of the financial system to support investment and innovation as the economy undergoes transformation.

The key functions that the financial system performs in the real economy include mobilising capital and allocating resources, managing and transferring risks, and price discovery. The availability of reliable financial and non-financial information is essential for the system's smooth functioning and integrity. Data gaps related to opportunities and risks linked to the transition could lead to mispriced risks and a poor allocation of capital, which could undermine economic growth and productivity, and create stresses that could abruptly shift asset prices and impact financial stability.

Improved information about the environment (e.g., the value of natural assets and the environmental impacts of corporate sector operations and investments, including GHG emissions) and about the low-carbon transition (e.g., corporate strategies and risk management, project pipelines, policy frameworks and carbon taxes) could support the functioning of the financial system and enhance decision-making about policy interventions. A fundamental question for investors is how to benchmark climate change risk to allow for the measuring of global exposure and for risk management, either by investing in assets with low climate change risk exposure, hedging this risk at reasonable cost, or avoiding the assets with the greatest exposure. This would also aid in identifying opportunities to invest using climate change as an investment thesis, or reason to invest. For the time being, there is no straightforward answer.

Understanding of climate change risks is increasing, yet more research is needed

In 2015, Mark Carney, Governor of the Bank of England, emphasised the risks to the financial system, and in particular to financial stability, posed by the physical risks, liability risks and transition risks associated with climate change. Infrastructure projects face varying exposures to such risks. According to a recent OECD survey, investors' top concerns are exposure to changes related to policies and regulations of GHG emissions, and changes related to government support schemes and incentives for low-carbon investing (broadly, the transition risks).[43] The materiality of climate change risks on business valuation and operations was also important. Social risks such as acceptance and securing land-use for infrastructure projects also ranked high. Physical risks (force majeure) and future liability risks, though important, did not concern investors as much as the other risks.

Regarding the materiality of climate change risks, there is increasing evidence that incorporating sustainability criteria in investments can improve financial performance, supported by a growing body of academic research. This academic research is summarised in a forthcoming OECD publication on investor governance and the integration of environment, social and governance (ESG) factors. Not all academic research points to such positive relationships between ESG factors and long-term returns, however. Several surveys – especially those published between 2000 and 2010 – find that the data is inconclusive. More empirical research on the effects of climate change risks and opportunities on corporate performance is needed.

Several organisations, from industry-led associations to subscription services, aim to help asset owners advance their ESG analysis and practices. Policy makers need to align such initiatives and collaborate where possible to reduce redundancies, eliminate frictions and achieve global standards on climate change risk, ESG practices and disclosure of risks. There is also a need to develop the tools necessary to analyse climate change risk, which can be a complex undertaking requiring large amounts of data and long-term analysis. Such tools could be used by all parts of the financial sector, making climate change stress testing and scenario analysis a part of due diligence and long-term financial analysis processes for banks and corporations. For institutional investors, the modelling of asset allocation, including climate change risks, and assumptions on carbon pricing could have important implications, underlining the need for quality information.

Efforts are under way to assess the exposure to climate change risk of the financial system (banking, pension and insurance, capital markets).[44] Individual countries or the G20 itself could prioritise such assessments, evaluating potential impacts on financial stability and the ability of markets to price climate change risk, ensuring the efficient allocation of capital, and supporting industry-led efforts to describe the significance of climate change risk. Climate change risks "can be part of a broader approach to prudential risk management and supervision".[45]

Emerging awareness of climate change within the banking system

Generally, environmental considerations are fully embedded in project appraisal processes as part of the integration of the Equator Principles,[46] yet bank lending models are evolving to further integrate sustainability factors in all types of infrastructure assets, and across their entire loan portfolios. Indeed, sustainable banking implies integrating ESG and risk management considerations into bank operations, financing, and capital raising activities, and mainstreaming practices in key bank functions such as credit and lending, savings products, and capital markets (UNEP, 2016a). Banks are a primary pillar of the financial system, yet green banking practices are at different stages of evolution across the G20, reflecting broader national financial and economic circumstances.

At the institutional level, perceptions and priorities also seem to vary, along with levels of adherence. For example, Société Générale divested from coal investments and has extended sustainable banking beyond renewables to other key infrastructure sectors such as transportation, water and telecommunications. Industrial and Commercial Bank of China has curtailed lending to certain industries that present a high risk of hazardous emissions (UNEP, 2016a). Deutsche Bank recently announced that it would no longer finance greenfield thermal coal power plants and coal mining. Regarding clean technologies, a shift is necessary in the banking sector's mind set. The dominant risk-averse posture of banks' risk management departments is limiting their ability to support innovative low-carbon technologies, which bear a higher risk but ultimately a higher potential return.

Banks are increasingly recognising the link between climate change and financial performance of assets, and are evolving credit and due diligence processes on loan origination to take into account ESG risks. For example, a tool developed by the Natural Capital Finance Alliance (NCFA)[47] and other sponsors GIZ and VfU enables users to integrate financial risk exposure to water scarcity into standard financial models used to assess credit risks to entities with high exposures to the water sector (NCFA, 2015). Uptake of such practices by banks varies, and there are no generally accepted definitions of sustainable investments or standards across the G20. In countries where universal banking is practiced, capital markets activities and investment banking services such as underwriting green public market equity issuance and green bonds are other banking activities aligned with sustainable banking strategies. Banking associations can also play an important role in implementing voluntary efforts to mainstream sustainable banking: market-led initiatives in Brazil, France, India, Mexico, the Netherlands, Singapore and Turkey all provide examples (UNEP, 2016a).

Regarding regulatory requirements and climate change risks, most G20 countries have been hesitant to require banks to incorporate environmental and social risk factors into risk management models, and G20 countries generally do not require banks to consider environmental risks as material risks for the calculation of regulatory capital requirements – although Brazil and China have formally incorporated environmental risk and governance standards into prudential bank regulation (UNEP, 2016b). Within the Basel III framework, there is no recognition that regulatory risk capital weights should incorporate the financial risks associated with environment sustainability risks, although G20 countries require banks to disclose all material risks regarding the firm's economic viability, through financial reporting, which could include climate change risks (ibid).

Box 7.5. **OECD empirical research on Basel III and bank capacities to lend to low-carbon infrastructure**

Financial stability rules and banking regulations implemented to pursue other objectives than climate objectives can have unintended consequences on the infrastructure investment required for the transition. The critically important Basel III framework for bank regulation was introduced after the 2008 financial crisis to strengthen the resilience of the banking sector and provide an international framework for measuring and monitoring liquidity risk.

The different components of Basel III banking rules have been introduced gradually, starting as early as 2011 for some countries, and are expected to be fully implemented by 2019. In particular, Basel III introduced a simple, transparent, non-risk based leverage ratio to act as a credible supplementary measure to the risk-based capital requirements. Results from a new OECD econometric study suggest that until 2014 (the last year of the study), the implementation of Basel III leverage ratio has hindered investment flows in renewable power generation across OECD and G20 countries (Ang, Röttgers and Burli, 2017).

Box 7.5. **OECD empirical research on Basel III and bank capacities to lend to low-carbon infrastructure** *(cont.)*

This result is in line with public comments from several financial stakeholders that Basel III may have unintentionally constrained the ability of banks to provide long-term debt financing for capital-intensive renewable infrastructure projects. To exclude the possibility that the result on Basel III is driven by banks' capitalisation levels and financial stability across countries, the econometric study has included a variable on regulatory capital to risk-weighted asset ratio. Still, there are important caveats on the interpretation of the Basel III result. Additional empirical research is needed to assess the impacts of Basel III on investment in low-carbon infrastructure.

Source: Ang, Röttgers and Burli (2017).

Integrating ESG factors into the governance of institutional investment

Regulation of institutional investment is increasingly focused on governance, as it moves away from quantitative constraints and towards risk-based controls and prudential standards (OECD forthcoming). Understanding ESG issues and the potential impact of ESG[48] factors on their investment strategy and the broader operating environment can be part of governance for institutional investors; in this context, climate change factors are increasingly being included in ESG investment practices. However, there is a wide range of definitions of ESG, so individual investors' circumstances and belief systems affect the uptake of ESG practices.

An OECD review found that regulatory frameworks in OECD and non-OECD countries rarely make explicit reference to ESG factors, although this is beginning to change.[49] Therefore it is up to institutional investors to decide whether and to what extent ESG integration is consistent with prudential standards, risk controls, legal requirements and any other obligations they may have towards their beneficiaries (OECD, 2017a). Similarly, risk-based controls generally do not explicitly refer to ESG or climate change factors. The focus is on solvency: pension funds and insurance companies are expected to identify, measure, and manage long-term risks and these are understood by both regulators and investors to be financial risks.

Box 7.6. **Some countries have clarified the role of ESG in regulatory frameworks**

In the United States, the Department of Labor confirmed that fiduciaries may legitimately consider ESG factors if they have a bearing on financial analysis and recognised that there has been an evolution in the data and methodologies that can be used in financial analysis. It also confirmed that fiduciaries may invest in "Economically Targeted Investments" (i.e. investments whose purpose is not purely financial) as long as the investment is otherwise appropriate for the plan and is financially and economically equivalent to competing investment choices.

In the United Kingdom, the Pensions Regulator published a new Defined Contribution Code and trustee guides in July 2016; these reflect the findings of the Law Commission's study of trustees' duties that there is no legal obstacle to taking ESG into account and they encourage trustees to take into account risks that affect the long-term sustainability of investments.

In South Africa, the 2011 Amendment to the Pension Funds Act states that "Prudent investing should give appropriate consideration to any factor which may materially affect the sustainable long-term performance of a fund's assets, including factors of an environmental, social and governance character."

Box 7.6. **Some countries have clarified the role of ESG in regulatory frameworks** *(cont.)*

The proposed revisions to the European Union's IORP (Institutions for Occupational Retirement Provision) Directive, which is expected to be passed by early 2019, go further: IORPII would make ESG integration a requirement of pension fund governance. The relevant articles of the proposed revisions are noteworthy for the extent to which they support the "ESG investor" interpretation of prudential standards, and for the influence of civil society in this aspect of the revision process.

Source: OECD (2017a).

Momentum is gathering to encourage institutional investors to clarify and disclose climate change risks in regard to investment portfolios, which is leading investors to seek more information on climate-related risks and opportunities, including through enhanced corporate disclosures. Disclosure also includes actions that investors are taking to mitigate climate change risk. Recent recommendations from the FSB's Task Force on Climate-Related Financial Disclosures (FSB-TCFD) provide a voluntary framework (FSB, 2016).

Taking stock of such initiatives, some countries have already put into place reporting requirements or voluntary disclosure of ESG practices by institutional investors. Australia requires pension funds, insurance companies and asset managers to disclose their ESG practices. France has introduced the most far-reaching requirements in terms of ESG reporting by institutional investors. Under Article 173-VI of the Energy Transition Act, asset managers, pension funds and insurance companies must provide information not only on how they integrate ESG factors in their investment and voting decisions but also on the climate risks they face and how their portfolio construction contributes to the transition to a low-carbon economy (OECD, 2017a). More countries had in place reporting requirements for pension funds, while insurance companies had fewer requirements.

In some countries, sub-national governments or regulatory bodies have passed laws that govern institutional investors' behaviour. The Canadian provinces of Alberta and Ontario have enacted regulations regarding the disclosure of climate change risks by pension funds. In 2015, California passed Senate Bill 185, which required the two largest state pension funds (also the largest public funds in the United States), CalPERS and CalSTRS, to divest holdings in publicly listed companies that generate more than 50% of their revenue from the mining of thermal coal. The legislation in California was designed to stem investment in industries particularly exposed to transition risks or "stranded assets". While funds worldwide are increasingly disclosing and reporting their ESG practices, few funds are measuring their stranded asset risk exposure or the overall carbon emissions (carbon footprint) of their portfolios. Policy makers could clarify that prudent investors may consider ESG criteria and climate change risk factors as part of their investment decision-making, especially investors with long-term liabilities and investment horizons.

Integrating environment and climate change considerations into operations of development banks

Approaches within development banks can be placed on a spectrum, ranging from establishing socio-environmental standards for risk management and decision-making to more holistic approaches that integrate socio-environmental criteria into performance management. Most bilateral development banks and finance institutions have adopted and/or developed ESG standards; however, banks vary widely in the ways they monitor, report and disclose climate risk and impact.

MDBs are the most advanced, having introduced and piloted climate risk screening tools to build climate resilience into the planning, design and implementation of projects. For example, AsDB projects are screened through a checklist, "at risk" projects are further screened using an online tool, and medium- and high-risk projects are subject to a more thorough Climate Risk and Vulnerability Assessment. The mid-term evaluation of AsDB's corporate strategy noted that the climate risk screening approach adopted by the bank is "well placed" but will need continued support, financial and technical, to ensure it is effective (AsDB, 2014a; AsDB, 2014b). Similarly, all country partnership frameworks and projects under the World Bank's concessional arm, the International Development Association (IDA), are subject to climate risk screening, with plans for this practice to be extended across the bank's non-concessional operations in 2017.

Nine international finance institutions – including major MDBs, bilateral DFIs and climate funds – have reached a framework agreement to harmonise their measuring and disclosing of their carbon impact at a project level, supported by sector-specific guidance.[50] While this is an important step in the right direction, it was developed to support the monitoring of mitigation projects – that is, to quantify GHG reductions. It requires that "at a minimum" banks report the emissions from "screened in" mitigation projects, but disclosure of "portfolio-wide net emissions" remains voluntary. Despite this, some banks are disclosing their carbon footprints. EBRD and IDB report on their portfolio-wide emissions as part of annual sustainability reports.

There is less harmonisation on disclosure of climate risks and impacts among NDBs. Most NDBs report environmental performance on a variety of metrics such as GHG emissions reduced and tonnes of coal consumption avoided. Besides the specialised green investment banks, few disclose metrics on the environmental impact of their portfolio or their portfolio's exposure to climate-related risks. BNDES (Brazil) stands out in this context, disclosing the environmental risk profile of its portfolio in amounts as well as number of projects (BNDES, 2016).

In December 2015, 26 development banks with total assets over USD 11 trillion, including five NDBs – TSKB (Turkey), IDBI Bank (India), KfW Group (Germany), DBSA (South Africa) and Caisse des Dépôts (France) – as well as some private sector finance institutions, adopted five voluntary mainstreaming principles to incorporate climate more holistically across their portfolios (EIB, 2015). While comprehensive and ambitious, the principles are voluntary and the extent to which they will be adopted is unclear.

Monitoring, reporting and verification of progress by development banks and DFIs to align their portfolios with efforts to keep average global warming to 2°C or below could be expected to help governments achieve their NDCs. Governments could call for more transparent disclosure of climate risks and impacts by development banks and DFIs, including efforts to monitor, disclose and report the climate impact/footprint of their overall portfolios, and in particular to what extent climate risks in the portfolio are being considered and addressed. A first step could be for organisations such as IDFC and EDFI to lead the way by helping their members to work collectively with other development banks and finance institutions to build on and tailor for their own purposes recommendations from the FSB-TCFD.

Disclosure of climate change risks of infrastructure assets and promoting infrastructure as an asset class

To improve transparency about the exposure of infrastructure assets to climate change-related risks, countries could promote or require embedding ESG criteria into reporting disclosures for infrastructure assets, including carbon emissions, potential contribution to

country decarbonisation strategies, level of alignment to NDCs, potential contribution to the SDGs, energy and water use, social impacts and governance of infrastructure assets. Furthermore, countries could support initiatives to create infrastructure benchmarks that will in turn help to describe infrastructure as an asset class. This includes setting benchmarks that can measure climate change risk and the carbon intensity of assets. Promoting data collection could also include the consideration of a template for a preferred set of information to be collected and quantitative data on historical cash flows and performance at the project level.[51]

This fits more broadly with G20 work on long-term investment finance, which has repeated that there is a shortage of readily accessible, consistent and comparable data on investments (Chapter 3), and on the supply of and demand for long-term finance, on which to base policy analysis and conclusions. Promoting the development of infrastructure as an asset class and improving data and information could support more diversified and innovative financing of low-emission infrastructure. A potential outcome could be opening new channels of funds to low-emission, climate-resilient infrastructure. The findings may also support regulators in determining fair prices by appropriately including risk charges in the costs of capital. The same need to create new knowledge on the risks of long-term investment is also patent on the regulatory side. More accurate risk measures may require the adjustment of capital charges, and the more effective and efficient intermediation of long-term capital.

Box 7.7. **Sustainability and ratings agencies**

Increasingly, ratings agencies are recognising the importance of including climate change risks in long-term scenario analysis of rated debt instruments such as loans and bonds, in both infrastructure-related issuance and corporate issuance. Ratings agencies could take a pivotal role in recognising the materiality of climate change risks as financial risks, since firms with high perceived exposure would receive lower ratings on debt or be placed on watch lists, raising their cost of debt finance and incentivising businesses to address the effects of climate change on their business profile and profitability.

The signing and ratification of the Paris Agreement has facilitated the ability of the ratings agencies to model the risks of climate change, providing baseline scenarios and a benchmark to consider carbon transition risk in rated entities. Moody's, for instance, using a traditional credit process, focuses on the carbon regulatory impact on indicators such as business profile, leverage, liquidity, interest coverage, profitability and efficiency. Credit processes also consider the direct impact of climate change hazards on businesses, although such findings do not yet indicate a material impact on credit ratings, for the most part (Moody's, 2016).

Dagong's credit rating process regards environmental and social sustainability as fundamental to the construction and operational sustainability of infrastructure projects, which in turn determines the ability of a project to service its debt payments, and feeds in directly to ratings categories (Dagong, 2016).

Notes

1. The analysis of trends in this section draws on both project-based and mergers and acquisitions (M&A) data from commercial databases to provide evidence of finance trends in low-emission infrastructure sectors at disaggregated levels. Results should be interpreted with caution due to data-related gaps and challenges (see Annex 7.A1 for a detailed description of data used). Individual assets may not be labelled low-emission. The ability to track financing in energy efficiency is limited by a lack of data. The terms "investment" and "finance" of infrastructure are used interchangeably to reflect total capital value (stocks) of the projects and do not reflect gross fixed capital formation per se.
2. For the figures in this section, infrastructure sectors include power (including fossil fuel generation, transmission and distribution, and renewables), transport and water.
3. M&A refers to balance sheet and project finance transactions for corporate and individual asset acquisitions in all sectors.
4. As measured by the Thomson Reuters World Datastream Utilities Index.
5. "Pure equity investment" refers to capital invested in a renewable energy project where the output is not purchased or consumed by the financing entity. Some corporations have used this model to "offset" their conventional electricity use in other locations, reducing their emissions profile.
6. Data presented is from the 2015 OECD Survey of Large Pension Funds and Public Pension Reserve Funds. Funds from 36 countries were surveyed, including OECD countries, G20 countries, and beyond.
7. The composition of private pension markets – principally whether systems are predominately defined benefit or defined contribution, can influence the types of finance available within local markets. For example, defined benefit funds are able to invest in illiquid assets such as direct infrastructure, while defined contribution plans may have certain liquidity requirements that make it difficult to invest in illiquid assets.
8. Defined as early-stage equity investment in clean technologies and businesses that carry a substantial element of risk, as commercialisation and development of technologies may not be well proven.
9. For the purposes of this section, clean energy includes solar, wind, energy efficiency, green transportation, and advanced material and technologies.
10. Within the clean technology space, hardware may refer to, inter alia, electronics, solar panels and small-scale power stations; materials may refer to, inter alia, nanotechnologies, chemicals, biological materials and membranes.
11. Preqin 2017 Global Private Equity and Venture Capital Report.
12. In this chapter, development banks and finance institutions refer to publicly owned finance institutions with a development/policy-related mandate. National development banks refer to those that primarily work in a domestic context. Bilateral development banks support the development co-operation policy of a country and work in developing countries (supporting both public and private sector activities), and bilateral development finance institutions (DFIs) are agencies set up specifically to work with the private sector in developing countries.
13. MDBs, for example, maintain strong credit ratings due to the support of their shareholders, which allows them to borrow resources from private capital markets at attractive rates and on-lend these resources to developing countries with enough margin to cover administrative costs (Humphrey, 2015).
14. This includes NDBs with a specific infrastructure mandate, as well as those with broader industrial and other development mandates (which also cover some infrastructure financing).
15. Examples of sub-national development banks include NRW Bank in Germany, Banco do Nordeste and Banco de Desenvolvimento de Minas Gervais (BDMG) in Brazil. Examples of agriculture related national development banks include the Agricultural Bank of China, the National Bank for Agriculture and Rural Development in India, Financiera Rural in Mexico, Russian Agricultural Bank and the Land and Agricultural Development Bank of South Africa.
16. The Small Industries Development Bank of India (SIDBI), which targets SMEs; the Industrial Finance Corporation of India (IFCI), which caters to the long-term finance needs of the industrial sector, the India Infrastructure Finance Company Limited (IIFCL) and Infrastructure Development Finance Company, whose focus is on infrastructure, the National Housing Bank (NHB), which promotes and finances housing and the National Bank for Agriculture and Rural Development (NABARD) which focuses on agriculture.
17. OECD (2017) defines green investment banks (GIBs) as "publicly capitalised entities established specifically to facilitate private investment into domestic low-carbon, climate-resilient infrastructure and other green sectors such as water and waste management".

18. IDFC is a network of development banks. As of 2017 its membership includes 23 banks, including: national development banks: Brazil (BNDES), Chile (BE), Peru (COFIDE), Columbia (Bancoldex), Mexico (NAFIN), Morocco (CDG), South Africa (DBSA), Burundi (PTA), China (CDB), India (SIDBI), Indonesia (Eximbank), Korea (KDB), Croatia (HBOR), Germany (KfW), Russia (VEB) and Turkey (TSKB); regional development banks: Central American Bank for Economic Integration (BCIE), Development Bank of Latin America (CAF), Banque Ouest Africaine de Développement (BOAD), Black Sea Trade and Development Bank (BSTD), Islamic Corporation for the Development of the Private Sector (ICD); and bilateral development finance providers: France (AFD), Japan (JICA).
19. According to the IDFC methodology, "green finance" includes climate finance as well as finance for "other environmental objectives", such as environmental protection, remediation and biodiversity.
20. The definitions of "green" and "environmental" vary from bank to bank, making it difficult to compare banks. For instance, for TSKB "sustainability-themed" includes renewable energy, energy and resource efficiency, sustainable tourism and APEX loans.
21. KfW Group's domestic activities are broken down into SME banking and municipal development. The KfW SME banking dedicated 45% of its financing in 2014 to environmentally friendly activities such as environmental protection, renewable energy and energy efficiency. This included two lines of credits for demonstration projects in green finance: the KfW-BMUB Green Innovation Programme and the KfW-EU NER 300 funding programme. With regard to KfW's municipal banking activities, 64% of financing for housing development goes towards energy-efficient construction and refurbishment, while only 6.2% of infrastructure financing is considered environmentally friendly.
22. By the end of 2014, CDB's outstanding green credit loans – which include loans to environmental protection, energy conservation and emissions reduction ¬– were RMB 958.5 billion, whereas total loans to coal-related projects were RMB 174.5 billion (CDB, 2014).
23. Public climate finance for 2013-14 (on average) included USD 22.8 billion from bilateral sources, USD 17.9 billion from multilateral sources (of which USD 15.5 billion was from the MDBs) and USD 1.6 billion from export credits (OECD, 2015b).
24. MDB climate finance includes own resources and MDB-managed external resources. The share represents MDB Climate Finance as a percentage of total MDB operations (i.e. MDB internal resources and MDB-managed external resources) as reported in the joint MDB report (2015 Joint Report on Multilateral Development Banks).
25. MDBs' Joint Declaration of Aspirations on Actions to Support Infrastructure Investment, available at www.g20chn.org/English/Documents/Current/201608/P020160815360318908738.pdf
26. Most MDBs were originally set up to deliver infrastructure financing as a way of supporting social and economic development, and delivering poverty reduction.
27. This includes EIB, EBRD, WBG (including IFC), AsDB, AfDB, IDB and IsDB.
28. MDB Response to the G20 Action Plan for MDB Balance Sheet Optimisation July 2016, available at www.g20chn.org/English/Documents/Current/201608/P020160815361155807206.pdf.
29. The private sector window will be introduced in the funding envelope for International Development Association (IDA) which provides grants and low interest loans to low-income countries.
30. Within this context, the CIFs have played a particularly influential role in the MDBs' support for climate action. Initiated in 2008, the CIFs are a multilateral climate fund with a budget of approximately USD 8 billion. A key feature of the CIFs is that their support is programmed and implemented by MDBs, in contrast to other climate funds which are implemented by a range of different entities e.g. UN agencies, governments, local financing institutions as well as MDBs and other DFIs (Nakhooda et al., 2016). The CIFs accounted for just under half the external concessional climate finance implemented by the MDBs in 2013-14 (Trabacchi et al., 2016).
31. The analysis is based on OECD-DAC data reported by DAC members as well as several non-DAC members along with estimates of ODA-like flows from other countries, including Brazil, Chile, China, Colombia, Costa Rica, India, Indonesia, Mexico, Qatar and South Africa. For a full list of DAC and non-DAC member countries that report to the OECD, please see http://www.oecd.org/development/stats/non-dac-reporting.htm.
32. To ensure conservative estimates, this includes AFD, KfW and JICA support for infrastructure for which climate was the principal objective of the project only. If activities where climate change is a significant objective of the project are considered, the shares of infrastructure financing in 2013-15 that could be considered climate-related are much higher: 68% of AFD, 89% for KfW and 67% for JICA. Bilateral development providers report on climate-related development finance to OECD-DAC using the Rio markers approach, through which each activity is marked as to whether climate change mitigation and/or adaptation is the "principal" or "significant" objective.

33. The OECD issued a survey in 2016 on renewable energy finance, with institutional investors, asset managers, and corporations responding to questions regarding the financing environment of renewable energy.
34. Instances where certain risks are transferred from the private sector to the public sector that dis-incentivises the private sector to manage risks. For example, a public guarantee on project debts may dis-incentivise debt holders to monitor the project entity.
35. Any risk mitigation instruments, particularly examples where concessional financing is provided, should try to limit potential distortionary effects on market competition.
36. Please see www.ggf.lu/about-green-for-growth-fund/institutional-structure/.
37. See https://www.adb.org/site/funds/funds/asia-pacific-project-preparation-facility.
38. For detailed recommendations delivered to the G20 in 2016 on diversifying financial instruments for the financing of infrastructure, refer to the Guidance Note.
39. Refer also to the G20/OECD High-level Principles of Long-term Investment Financing by Institutional Investors for greater details on the enabling environment for infrastructure finance.
40. For more on yieldcos, refer to Chapter 5 of the OECD Business and Finance Outlook 2016
41. The Climate Bond Initiative (CBI) is working towards labelling green bonds, and also tracks the development of unlabelled bonds which are climate-aligned.
42. http://www.renewableenergyworld.com/articles/2016/01/wind-solar-secure-11-5-billion-in-tax-equity-deals-in-2015.html.
43. A 2016 OECD survey put questions to institutional investors, asset managers and corporations about the financing environment of renewable energy.
44. For example, a scientific advisory committee to the European Systematic Risk Board recently recommended that future stress tests of the pensions sector include climate-related risks.
45. Geoff Summerhayes, Executive Board Member of the Australian Prudential Regulation Authority, 17 February 2017, "Australia's New Horizon: Climate Change Challenges and Prudential Risk"
46. As of December 2016, 86 financial institutions have officially adopted the Equator Principles covering project finance debt, which reportedly covers 70% of international project finance debt in emerging markets
47. The NCFA consists of 30 signatories (financial institutions).
48. ESG integration is defined as: the recognition in the institutional investor's investment policy or principles that ESG factors (of which climate change may be included) may impact portfolio performance and so affect the investor's ability to meet its obligations; and using analysis of those impacts to inform asset allocation decisions and securities valuation models (or employing third parties to do so) (OECD, 2017a).
49. See OECD publication "Investment Governance and the Integration of ESG Factors" for the full study.
50. International Financial Institution Framework for a Harmonized Approach to Greenhouse Gas Accounting (2015), available at https://www.thegef.org/sites/default/files/file_attach/IFI-Harmonisation-Framework-GHG%20Accounting-2015.pdf.
51. Building on current work developed by Global infrastructure Hub (GIH), EDHEC (Ecole des Hautes Etudes Commerciales) and the OECD, and on note circulated to the G20 in 2015 on Addressing Data Gaps in Long-term Investment.

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Annex 7.A1

About the Database

The main source for the trends analysis is the IJGlobal transaction database. Between 2010 and 2016, 4 596 projects were included across the transport, power, renewables, oil and gas, water and telecoms sectors, for a total volume of USD 2.4 trillion. Deals in which the SPV or the sponsor is 100% state-owned are not eligible for project or corporate finance ranking. The figures presented refer to financing activity and not to capital expenditure.

The study included the use of two different databases: IJGlobal Transactions and Bloomberg New Energy Finance. IJGlobal Transactions data was used to study financing trends in the transport, power and water sectors. The transport sector refers to roads, ports, transit infrastructure, tunnels, maritime transport infrastructure, heavy rail, bridges and airports. The power sector refers to transmission and distribution, coal-fired power plants, gas-fired power plants, oil-fired power plants, independent water and power projects, hydro, carbon capture and storage, and co-generation. The water sector refers to water treatment, distribution and desalination.

For the renewable energy sector, the study of financing trends relied on the Bloomberg New Energy Finance database. The sectors included are wind, small hydro, solar, biomass, biofuels, geothermal, digital energy, energy storage, fuel cells, efficiency, carbon markets, hydrogen, and energy retail and supply.

The study only included **private sector related** transactions reaching financial closure; therefore, the dates refer to the financial close date.

Some transactions' proceeds target several regions. When it was impossible to identify the main region the financing targeted, the transaction was not included in the analysis of the regional infrastructure trends.

The study only included **transactions with a reported transaction amount**; no estimates have been performed for transactions with unknown amounts.

Only transactions with a clear capital structure description (debt vs. equity) were included; tracking and spotting trends in the transactions financing mix was among the main objectives of the analysis. The study deliberately excluded transactions with a reported amount but an unreported capital structure.

For the analysis of the infrastructure-related syndicated loans trends, the Thomson Reuters syndicated loans database was used. The study included the following sectors: alternative energy sources, power, water, waste water, and waste management, internet infrastructure and transport infrastructure.

Thomson Reuters was also used to show trends in terms of cost of financing for infrastructure-related syndicated loans. The margins over the benchmark presented for each region were weighted by transactions' sizes.

Table A7.1. **Categories included in the financing types for each database**

	IJGlobal Transactions	Bloomberg New Energy Finance
Primary Financing	Project Finance – Primary Financing	New Built
	Corporate Finance– Primary Financing	
Refinancing	Project Finance – Primary Financing	Refinancing
	Corporate Finance– Primary Financing	
M&A	Project Finance – Asset Acquisition / Corporate Acquisition	Corporate M&A
	Corporate Finance – Asset Acquisition / Corporate Acquisition	Asset Finance - Acquisition

Data include the roll-out phase on **primary financing** (financing of primary assets/projects) and **secondary market activities** not associated with new activity, including investment projects that do not contribute directly to new assets or company financing, such as corporate mergers and acquisitions (M&As) and asset refinancing and acquisitions. Main categories used are:

- **Project Finance:** a single-purpose infrastructure asset or portfolio financed with commercial debt on a non-recourse or limited recourse basis. The transaction is secured on the project's long-term future cash flows and assets of the project or target company (SPV). Acquisitions financed with this structure and associated with new and existing infrastructure assets – such as the transfer or sale of assets or an asset-based holding company – will be included in project finance.
- **Corporate Infrastructure Finance:** transactions related to the general development of infrastructure and not classified as non-recourse and limited recourse project finance. This includes hybrid finance with recourse to corporate balance sheets and corporate loans made to companies that own and/or operate assets. Corporate Infrastructure Finance also includes mergers and acquisitions of companies that own and/or operate assets such as vertically integrated utilities with retail businesses and other companies that cannot be valued on assets alone. Mergers and acquisitions can be financed on-balance sheet or with commercial debt guaranteed by the sponsor.