



PROGRESS REPORT ON APPROACHES TO MOBILISING INSTITUTIONAL INVESTMENT FOR GREEN INFRASTRUCTURE

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Executive Summary

Objectives and contents

This Progress Report updates analysis in the OECD's 2015 Report for G20 Finance Ministers and Central Bank Governors “Mapping Channels to Mobilise Institutional Investment in Sustainable Energy” (OECD, 2015a). It is also provided as a contribution to the “Greening Institutional Investors” sub-group of the G20 Green Finance Study Group, co-chaired by the People’s Bank of China and the Bank of England.

The introduction provides the necessary context for the report and is followed by a review of institutional investment in green infrastructure (focused on renewable energy) that is occurring “organically”, where government sets an “investment-grade” enabling environment but does not deploy any further intervention to mobilise institutional investors. A “stock-taking” section follows, focused on institutional investment in green infrastructure where the public or official sector has deployed a “risk mitigant” or “transaction enabler” to open up the supply of investment. This section is accompanied by a research database to be made available on the OECD website. A summary section with implications for further research concludes the main body of the report. Finally, a fifth, self-contained section of the report, prepared by the World Bank Group as an input to the report, is provided in Annex A. This section provides a preliminary description of the role of sovereign wealth funds (SWFs) and strategic investment funds (SIFs) in green finance.

Context

According to the New Climate Economy (NCE), investment demand for sustainable infrastructure is estimated to be around USD 6 trillion annually over the next 15 years, up from some USD 3 trillion invested in all types of infrastructure today. The scale of this investment is so large that it will, inevitably, have to rely in large part on mobilising private capital. Public finance can and does play a critical role to “jump start”, leverage and guide investment, but transformational change will require large-scale private sector engagement and shifting of capital flows to meet the green infrastructure demand. However, traditional sources of financing for green infrastructure – governments, corporate actors and the banking sector – have faced significant financial, regulatory and structural constraints since the global financial crisis. The ability of traditional financiers to expand their activities to meet the USD 3 trillion investment gap is modest and constrained by these factors and other factors specific to green infrastructure such as heightened risk perceptions and transaction costs.

The role of institutional investors

Institutional investors (e.g., pension funds, insurance companies, investment funds, sovereign wealth funds, and others) manage over USD 100 trillion of assets globally. In this context, much attention has been focused on the potential for these investors to significantly increase their investments in green infrastructure. While there are expanding pockets of “direct” institutional investment activity in green infrastructure projects (as opposed to more routine “indirect” investments made in corporate stocks and bonds), investments have been minimal compared to the scale of institutional investors’ assets and the magnitude of the investment gap. Looking just at large pension funds surveyed by the OECD, direct equity investment in unlisted infrastructure projects of all types accounted for only 1% of their asset allocation in 2015, and green infrastructure accounted for a tiny fraction of that (1%).

Yet green infrastructure projects have a number of unique cash flow characteristics which can appeal to investors with long-dated liabilities. For example, sustainable energy assets can provide steady, long-term, inflation-linked, income streams with low correlations to the returns of other investments. In a low interest rate environment, and if governments provide an enabling environment for green infrastructure

investment, green infrastructure projects could in principle be attractive to institutional investors, and these investors should be able to play a much greater role especially as “recyclers of capital”.

OECD (2015a) proposed a list of nine high-level policy recommendations for governments to address the range of barriers and to facilitate institutional investors’ investment in sustainable energy infrastructure (a subset of green infrastructure), building on findings from previous G20/OECD reports. The regulatory environment in which institutional investors operate and the risk-return profile of investments will determine whether institutional capital can be mobilised to support infrastructure development – and whether the infrastructure in question is “green”. Policymakers can take actions to create an investment environment in which investors have lower risk perceptions and there are significant reductions in the cost of capital, which is fundamental to reducing the costs of green infrastructure.

Institutional investors’ decision-making process for allocating capital among different types of instruments and asset classes is complex and varies significantly. There are diverse risk appetites, regulatory restrictions, liability profiles, investment preferences, illiquidity tolerances and other constraints which will determine the extent to which they will seriously consider investments in green infrastructure. Moreover, institutional investors will not make an investment just because it is “green”. Their primary concern is the risk-adjusted financial performance of the asset. Their willingness to invest in any given country will be heavily influenced by perceptions of the country’s sovereign risk, investment climate, policy settings, and institutions.

At the same time, investors can be expected to perceive increasing risks around unabated fossil-related investments and the potential for lower returns from such investments. Such changes in perceptions may be triggered by the expectation of increasingly stringent carbon pricing and climate change mitigation policy, and by an evolving investor governance and disclosure landscape.

Strengthening the demand for green institutional investment

A fundamental pre-condition for investing in green infrastructure is the establishment of appropriate domestic framework conditions, which provide the clear price signals, predictability and policy coherence that investors need. While simple enough in principle, such a framework often proves difficult to achieve in practice. Retroactive policy changes; weak carbon pricing, fossil fuel subsidies and the unintended effects of non-climate-related regulations can undermine policies that are otherwise supportive of the low-carbon transition.

In some locations where an adequate enabling environment, which may include public support measures, creates demand-side circumstances in which investment demand is generated “organically”, investment will be more likely. For instance, focusing just on renewable energy in the EU, which has been supported via a range of mechanisms including some that create revenue stability (e.g. Feed-in-Tariffs), institutional investors have allocated over EUR 25 billion in equity since 2004. The number of active institutional investors in this space has increased from fewer than 10 in 2004 to over 75 in 2016.

In the UK and Germany, with perceived stable regulatory regimes, institutional investor equity has increased as a percentage of total equity investment in EU renewables from 1% in 2007 to 17.5% by the end of 2015. The fastest growing investment channel for these investors – pension funds, insurance companies and listed “Yieldco” or investment trust funds -- is direct investment, as opposed to investment through funds. An enduring low interest rate environment with low-yielding government bonds has led some pension funds to invest in renewable energy, citing their fiduciary obligation to identify stable attractive returns with low correlations to other asset classes (e.g. PensionDanmark which has allocated EUR 2.5 billion to renewables and Allianz owns 63 wind farms and seven solar parks worth EUR 3 billion).

Data provided by HgCapital (a private equity firm that maintains a database of over 600 EU renewable energy deals) describe an emerging ecosystem of investment in EU renewables. Early stage risks in developing, building and de-risking projects are the territory of private equity operators with renewable energy expertise, and corporate on-balance sheet financing from project developers and utilities. Once de-risked, such projects become attractive investments for “financial investors” including pension funds, insurance companies, Yieldcos and generalist infrastructure funds seeking stable but lower yields. These operating projects (i.e. post construction phase) are overwhelmingly favoured by institutional investors, accounting for nearly 80% of all institutional equity capital tracked by HgCapital that was invested in renewable energy projects in the EU since 2011.

However, as is shown in the results of the stock-taking research (which examined a sample of deals collected where the public or official sector was present somehow in the deal structure itself), the majority of case studies in the sample focused on construction stage project investment. This finding is at odds with others showing that the vast majority of “organic” institutional investment in renewable energy (i.e. investments occurring without direct specific public intervention) is centred on lower-risk operational assets. Based on this trend, governments appear to be targeting their public intervention at the construction stage, perhaps to address a perceived financing gap specific to the construction stage.

An increase in instruments and funds to access renewable energy has coincided with rapidly falling costs of renewables since 2008. For example, an 80% decline in the costs of solar PV modules since 2008, along with a 50% decline in the cost of onshore wind since 2009, have coincided with a rapidly growing market for green labelled bonds, with annual issuance surging to USD 42 billion in 2015 (and with proceeds flowing to renewables including solar and wind projects). In response, a dozen institutional investors have made commitments or targets for green bond investments in excess of USD 15 billion to date, and 14 dedicated green bond funds are now operational.

Taking a wider view beyond renewable energy, investment demand for green and sustainable infrastructure is strong and growing. For instance, the Asset Owners Disclosure Project estimates that the stock of “low-carbon investments” by institutional investors across all asset classes was valued at USD 138 billion in 2016. Some institutional investors are poised to significantly increase investment in this area. For example, a coalition of insurance companies committed its participants to doubling their USD 42 billion of “green, climate-smart investments” in 2012 to USD 84 billion by 2015 and USD 420 billion by 2020. By July 2015 the figure had already reached USD 109 billion, well in excess of the 2015 target. In 2014, a coalition of three pension funds pledged to increase low-carbon investments across all asset classes to USD 31 billion by 2020, and had already reached USD 29 billion by the end of 2015. A host of other institutional investor initiatives geared at sustainable finance were showcased in the margins of the UNFCCC Conference of the parties in December 2015 (COP 21) including, inter alia, the Portfolio Decarbonisation Coalition, the Montreal Carbon Disclosure Pledge, the Divest-Invest Pledge, and the Aligned Intermediary.

Yet while some of these investment figures and pledges may seem large on an absolute basis, they are minute compared to the scale of institutional assets under management, and the scale of the investment demand and financing gap for green and sustainable infrastructure. Further, the individual allocations and pledge levels cited are largely exceptions to the rule that institutional investment in green infrastructure projects have been limited to a very small percentage of the portfolio.

Catalysing the supply of institutional capital: a stock-taking of approaches

Another element of a strong domestic policy framework is the creation of the supply-side conditions for scaling up green infrastructure investment by institutional investors. These actions are centred on the establishment of specific policies, instruments, funds, risk mitigants and transaction enablers for mobilising

institutional investment. There is an important role for governments in both reducing barriers to investment and supporting the development of investment channels, such as green bonds, funds and direct investment, which can hold the key to scaling-up institutional investment in green infrastructure.

Focusing on investment that occurred through the use of these tools and techniques, the stock-taking research conducted for this progress report examines a sample of 33 case studies collected. In total, the case studies feature 67 examples of the use of risk mitigants and transaction enablers. G20 countries hosted the majority of investments observed including multiple deals in Australia, Canada, China, France, India, Italy, Mexico, South Africa, the UK, and the USA. Examples of institutional investment outside of the G20 were also found, for instance in wind projects in Kenya and Uruguay, a water utility plant project in Peru, a geothermal project in the Philippines, a pan-Asian fund, a pan-African fund, and a fund targeting countries eligible for Official Development Assistance.

Over half of the deals were in the sustainable energy sector. Within the other half of the sample, six deals involved energy efficiency and green enabling infrastructure such as off-shore wind interconnectors (three each) and two involved low-carbon mobility. Four deals featured multiple types of green infrastructure.

Results of the stock-taking

The results of the research suggest that there are many ways in which governments are already working to help mobilise institutional investment in green infrastructure, using a multitude of approaches. Tables 1 and 2 classify the different types of approaches into a typology of risk mitigants and transaction enablers, and lay them alongside the channels for investment in different types of green infrastructure.

Table 1. A typology and summary of risk mitigants deployed

Risk Mitigant	Description of public or official sector intervention	Deal Example (Name)	Sector	Financing Channel	Actor that deployed risk mitigant	Institutional investor involved
Credit enhancement	<i>A credit enhancement is any intervention that improves the chances that financing will be repaid. It is a form of public investment that results in a contingent liability.</i>					
Layered fund subordination	Taking a subordinated position in a fund to give priority to private investors with regard to claims on assets.	GIB Offshore Wind Fund	Sustainable energy	Intermediated unlisted project equity	UK Green Investment Bank	Strathclyde Pension Fund, undisclosed SWF
		Africa Agriculture and Trade Investment Fund	Sustainable agriculture	Intermediated private equity fund	KfW & German BMZ	Undisclosed institutional investors, Deutsche Bank
Partial credit guarantee	Guaranteeing payments for the principal and interest on debt issuance up to certain percentage.	Hindustan Solar	Sustainable energy	Listed project bond	IFCL, ADB	Yes Bank and other institutional investors
		Energy Efficiency Securitization	Energy efficiency	ABS	IADB	Undisclosed institutional investors
		Greater Gabbard offshore transmission link	Sustainable energy	Listed project bond	EIB, EC	Numerous undisclosed institutional investors
Loan guarantee	Legally binding agreement under which the guarantor agrees to pay any amount due on a loan in the event of non-payment by the borrower.	Crescent Dunes Solar CSP	Sustainable energy	Direct investment in unlisted equity of a project developer	US Department of Energy	Public Sector Pension Investment Board (Canada) and Ontario Teachers' Pension Plan

Revenue guarantee	Guaranteeing certain cash flows for a project	Consortio Agua Azul	Sustainable water	Direct investment in listed project bonds	Government of Peru	Undisclosed local pension funds
		Cestas Solar	Sustainable energy	Direct equity co-investment in asset	French Treasury	Mirova, KKB, ACof, Omnes
Public Investment	<i>Any form of direct public investment or presence in any deal structure.</i>					
Cornerstone stake	Investment in an offering that occurs early in the investment process so as to increase chances of success and to play a demonstration role to attract other investors.	Lake Turkana wind farm	Sustainable energy	Intermediated unlisted equity investment in project	Danish government, DCIF (a government-owned fund)	DCIF, Danish pension funds
		Cheltenham General Hospital	Energy efficiency	intermediated unlisted equity investment in project	UK Green Investment Bank	Aviva Investors
		Hines Poland Sustainable Income Fund	Green buildings	Intermediated private equity fund	EBRD	Undisclosed "foreign institutional investor"
Blending	Strategic mixing of concessional, non-concessional and for profit financing to attract risk-capital	Albion Community Power	Sustainable energy	Direct investment in unlisted equity of a pure-play corporate	UK Green Investment Bank	The Greater Manchester Pension Fund, Strathclyde Pension Fund
Grant	Concessional funds allocation	Off grid electric Tanzania	Sustainable energy	Unlisted debt investment for intermediated through a debt vehicle	U.S. Agency for International Development	Packard Foundation, Ceniath, Calvert Foundation.
Fund seeding	Public investment to help establish private equity funds that specialise in green projects.	GEEREF	Sustainable energy and energy efficiency	Equity: unlisted intermediated fund of funds	EIB	At least 8 private equity funds with institutional investor limited partners

Table 2. A typology and summary of transaction enablers

Transaction Enabler Type	Short description	Deal Example (Name)	Sector	Financing channel	Actor that deployed transaction enabler	Institutional investor involved
Securitisation	A technique whereby illiquid or small-scale assets are transformed into securitised products.	Energy efficiency securitisation in Mexico	Energy efficiency	Unlisted debt investment, intermediated	IADB	Numerous institutional investors
Warehousing, pooling	Bundle together smaller projects to get them to a commercial scale that is attractive for institutional investors.	Off Grid Electric	Sustainable energy	Unlisted debt investment, intermediated	Off Grid Electric set up a debt investment vehicle	Packard Foundation and other family offices
		Greencoat UK Wind	Sustainable energy	Intermediated listed project equity	Greencoat UK Wind (a listed infrastructure fund)	Numerous institutional investors
Co-investment, joint-ventures, partnerships, consortiums and loan syndication	Institutional investors partner up with other investors to invest in an asset.	Ararat Australia Wind	Sustainable energy	Unlisted direct project debt financing (loan) project	Australia Clean Energy Finance Corporation	OPSEU Pension Trust
		NY WHEEL	Energy efficiency	Direct unlisted debt investment in project company structure	NY Green Bank	Undisclosed Institutional Investors, Citigroup

Co-operation and collaboration	Informal sharing of knowledge and resources between actors.	Electric public transport system in Québec	Low-carbon mobility	Unlisted equity investment	LISEA (a concession company created for this project), EIB	Caisse de dépôt et placement du Québec
Conduit aggregation	Leveraging a larger or more specialised public institution to access normally unavailable channels	Kommuninvest	Mixed green finance	Intermediated, listed SSA green bond	Kommuninvest (Swedish Local Funding Authority)	Ap3, AP4, CalSTRS, UN Joint Staff Pension Fund
		CT Green Bank C-PACE	Sustainable energy	Intermediated, unlisted non-rated pooled project bonds	Connecticut Green Bank	Undisclosed institutional investors

Source: OECD analysis (author)

A range of public or official sector actors were involved across the case studies, including government ministries, green investment banks, export credit agencies and multilateral development banks.

- Six deals featured more than one actor, with the *Gemini Wind* deal featuring four (EIB and three export credit agencies).
- Given the relatively recent establishment of public green investment banks, it is notable that five such institutions, located in three countries, were involved in one quarter of the deals (UK GIB, Australia CEFC, NY Green Bank, Connecticut Green Bank, Hawaii GEMS).
- Six multilateral development banks (ADB, AfDB, EBRD, EIB, IDB and the World Bank Group) were present in over a third of the deals. Another third of the deals featured actors related to nine governments and their agencies (in Canada, Denmark, France, Germany, Ireland, Japan, the UK and the US). Sub-sovereign governmental actors in Canada and the US were also involved in two deals (Government of Quebec and the Delaware Strategic Fund).
- Seven public financial institutions (including national development banks, export credit agencies and a local funding agency) worked on nine deals. These included actors from six countries: Belgium, Canada, Denmark, Germany, India, Italy and Sweden (ONDD, EDC, EKF, KfW, IIFCL, SACE, and Kommuninvest).
- Two government-sponsored “blended capital” funds made investments captured in the dataset (Danish Climate Investment Fund and the Africa Agriculture and Trade Investment Fund). The Green Climate Fund took part in a deal as well, despite only recently becoming operational. The research focused on pension funds, insurers, sovereign wealth funds, strategic investment funds and investment managers that predominantly manage institutional capital. Total institutional capital committed across the 33 case studies is approximately USD 8 billion.
- Pension funds were the most active type of institutional investor, with 17 different actors named out of a total of 27 institutional investors whose participation in the deals was disclosed publicly. Notably, five Canadian pension funds were involved transactions domestically as well as in Australia, the UK and the US. Other institutional investors identified in the sample were from Australia, Denmark, France, Germany, Japan, New Zealand, Sweden, the UK, and the US.

Across the 33 deals, 44 cases involving the use of risk mitigants were logged. By providing coverage for risks which are new and are not currently covered by financial actors, or are simply too costly for investors, risk-mitigating tools increase the attractiveness and acceptability of sustainable energy projects, including for institutional investors that are particularly risk-averse (e.g. pension funds). Credit enhancements were deployed 23 times across the sample. The most prevalent such technique is the partial

credit guarantee which accounted for over half of credit enhancements. Public investment as a form of risk mitigant was used 21 times, with cornerstone stakes being the most common.

Also quite common in the sample were transaction enablers. Transaction enablers facilitate institutional investment in green infrastructure projects by reducing the transaction costs associated with these investments, or creating new channels, and also mitigating risk in some cases. For example, warehousing involves systematically collecting smaller projects to get them to a commercial scale and in a format that allows for them to be bundled into securities that are attractive for institutional investors. There were six further examples of co-investment and syndication by public actors alongside institutional investors. The remainder of deals involving transaction enablers included the use of public-private partnerships, and conduit structures to leverage the capabilities of a larger or more specialised public institution.

Nearly a third of the deals made use of a risk mitigant as well as a transaction enabler. For example, the *Africa Agriculture and Trade Investment Fund* involved three risk mitigants including a credit enhancement (subordination) and two public investments (a cornerstone stake and blending), alongside a partnership transaction enabler.

Half of the deals involved equity investments. The most frequently used equity investment channels were unlisted investments in projects, made via intermediated funds, followed by unlisted investments made directly in projects. On the debt side, project bonds were by far the most frequently used channel, accounting for 41% of all 33 deals. There were 11 examples of investment in a listed, project bond structure, and a further two investments in unlisted, privately-placed project bonds. Of the project bonds, three quarters benefited from credit enhancement techniques, mainly through some form of partial credit guarantee.

Summary and implications for future research

Several areas lay beyond the scope of this report and could usefully be addressed in future research. While this report focuses for the most part on direct project investment, an analysis of the role of institutional investors in financing corporate investment would also be useful to understand how much of the financing gap these sources can realistically fill. Green corporate investment by institutional investors could be examined from several perspectives, from early stage venture capital and growth capital financing to passive listed equities strategies.

A deeper inspection of the role of institutional investors in partnering with corporates and public financial institutions on investments made at different stages of the project financing cycle, and their role in capital recycling, could similarly be useful. A related issue to explore could be the role for public risk mitigation approaches for the earlier stages of project development, and examining case studies in which initial public participation resulted in market creation or new channels, and subsequent activity occurred without the presence of public risk mitigation (e.g. the case of Greencoat UK Wind where the UK Government and the UK Green Investment Bank de-risked the Initial Public Offering for the fund leading to more such funds being launched without these government interventions).

Another area that was beyond the scope of this research was to assess and explain the paucity of examples in certain green infrastructure sectors. The stock-taking was not intended to be comprehensive and was supposed to be limited to selected examples to provide a picture of the range of approaches used. Nevertheless, an extensive if not exhaustive search of readily available public information was undertaken. The distribution of samples across the categories reflected the amount of identifiable (and publicly available) institutional investor activity in each sector, with very few examples to be found for some sectors. For instance, in the green buildings (beyond just energy efficiency), agriculture, forestry and water

and sanitation sectors, only one example could be identified per sector. Future research could more systematically examine these important sectors which also are in need of private capital, to understand the role of institutional investors and what barriers might be specific to their investment in these sectors.

Future analysis could examine some of the more innovative deals using a more comprehensive and methodical case study approach, to understand what factors were essential in mobilising institutional capital. Assessing empirically the efficiency and effectiveness of different types of risk mitigants and transaction enablers could also hold significant promise for future research, provided the data were of sufficient quality to undertake such a study. With respect to individual actors, future research could examine the specific and active role that new green investment banks are playing to “crowd-in” institutional capital. With respect to specific investment channels, given the prevalence of project bonds in the deals studied, future research could examine these deals in depth and options for scaling-up credit enhancement mechanisms for project bonds.

Given that institutional investment activity has increased during a low-interest rate environment, key macroeconomic drivers for demand could be important to explore in depth, especially in the context of the ongoing global “search for yield” by institutional investors. Such research could also be geared at improving the understanding on the prospects for long-term returns from green infrastructure investing by different types of institutional investor.

To date the majority of organic institutional investment in green infrastructure projects has occurred predominantly in OECD countries. A separate and very important question is how institutional investors approach green infrastructure investments in emerging markets and developing economies (EMDEs). A quarter of the deals identified in the stock-taking took place in EMDEs, and three further deals involved mandates that extend to EMDEs. Studying the elements that needed to come together to make these deals work and overcome barriers would be important to determine which interventions -- including those made by development banks -- hold the most promise for catalysing investment in EMDEs. It follows that it will be important to explore how institutional investors can interact with international climate finance mechanisms targeted at emerging economies and developing countries.

Included in the report is a preliminary description of the role of sovereign wealth funds (SWFs) and strategic investment funds (SIFs) in green finance undertaken by the World Bank Group. Above all, the note provides an argument for strengthening the classification and reporting of the green investments of these types of funds. The sheer size of the capital managed by SWFs and SIFs means that their green finance activities, which historically are marginal (and not to be confused with public climate finance), could expand significantly. But existing classification systems and data sources allow for only an approximate and superficial analysis of this impact. In the light of such limitations, existing classification systems and reporting standards used by SWFs and SIFs should be further developed. A unified global standard should allow for the aggregated reporting, assessment, and analysis of these funds’ involvement in the green finance space. These findings may equally be applicable to the larger body of institutional investors discussed in this report.

1. Introduction

1.1 Objective and Organising Framework

1. The objective of this Progress Report¹ is to identify relevant examples where the public sector has worked with institutional investors to support their involvement in green finance projects (hereafter “green infrastructure”), updating and extending analysis from the recent OECD report for G20 Finance Ministers and Central Bank Governors on “*Mapping Channels to Mobilise Institutional Investment for Sustainable Energy*” (the “Mapping Channels Report”, OECD, 2015a),² as well as related G20/OECD reports on institutional investors and long-term financing (G20/OECD, 2014; 2013) and green infrastructure (OECD, 2013; G20/OECD, 2012).³ The Report is also provided as input to the “Greening Institutional Investors” sub-group of the G20 Green Finance Study Group.

Following an introductory section (1), the main body of the report is divided into three sections:

- 2) A review of institutional investment in green infrastructure (focused on sustainable energy) that is occurring “organically”, where government sets an “investment-grade” enabling environment and creates the demand for investment, but does not deploy some form of a risk mitigant or transaction enabler to mobilise institutional investors;
- 3) A stock-taking of institutional investment in green infrastructure where the public or official sector has worked to increase the supply of capital through deploying a risk mitigant or transaction enabler, to facilitate an investment in green infrastructure. This section is accompanied by a research database which will be uploaded to the OECD website following publication of the report;
- 4) A summary with implications for further research.

A fifth, self-contained section of the report is given in Annex A, provided as input by the World Bank Group:

- 5) A preliminary description of the role of sovereign wealth funds (SWFs) and strategic investment funds (SIFs) in green finance.

¹ A draft report [[DAF/CMF/AS/WD\(2016\)16REV1](#)] as well as an earlier scoping note for this project [[DAF/CMF/AS/WD\(2016\)16](#)] both benefited from comments provided through circulation to the G20/OECD Task Force on Institutional Investors and Long-term Financing.

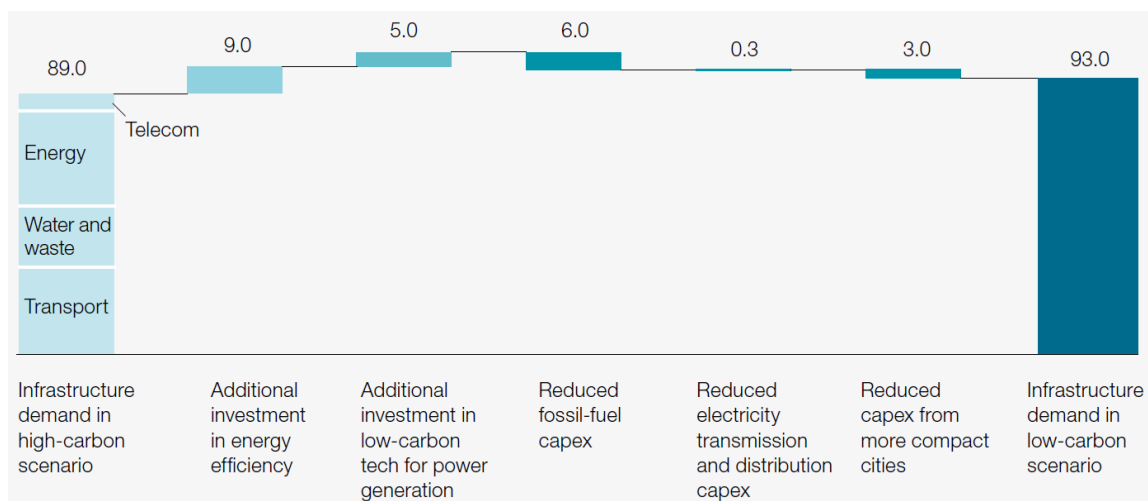
² Transmitted to G20 Finance Ministers and Central Bank Governors at their meeting on 9-10 February 2015 in Istanbul, welcomed and annexed in the communique. See Report: <https://g20.org/wp-content/uploads/2015/04/Mapping-Channels-to-Mobilize-Institutional-Investment-in-Sustainable-Energy1.pdf> and Communique: <http://www.g20.utoronto.ca/2015/150210-finance.html>

³ A previous OECD report examining this topic (*Institutional Investors and Green Infrastructure Investments: Selected Case Studies*) was annexed to the Communiqué of the G20 Finance Ministers and Central Bank Governors at their meeting of 10-11 October 2013. The report introduced approaches to mobilising institutional investment in “green infrastructure” including sustainable energy and elaborated policy conclusions based on four case studies. A previous G20/OECD policy note on Pension Fund Financing for Green Infrastructure and Initiatives was developed by the OECD at the initiative of the G20 Mexican Presidency.

1.2 Green infrastructure investment needs and related financing and investment sources

2. Recent estimates suggest that approximately USD 89 trillion in infrastructure investment across transport, energy and water systems will be needed in the next 15 years – or USD 5.93 trillion annually, on average (NCE, 2015) – in a “high-carbon” scenario (Figure 1). This is significantly higher than the approximately USD 3 trillion invested in all types of infrastructure today (McKinsey, 2016). However, the incremental costs of making infrastructure investments “low-carbon” rather than “high carbon” are estimated by NCE (2015) to be only 4.5% (i.e. USD 4 trillion over the next 15 years, or USD 0.27 trillion per year on average). Green infrastructure⁴ typically involves higher up-front investments than traditional infrastructure, but comes with a wider set of returns and benefits.⁵

Figure 1. Up-front capital costs to meet global infrastructure demand



Note: Global demand for infrastructure services, 2015–30, USD trillion (constant 2010 \$, indicative figures)

Source: NCE (2015)

⁴ For the purposes of this report, the term green infrastructure includes: 1) “low-carbon and climate-resilient” infrastructure projects, which either mitigate greenhouse gas emissions or support adaptation to climate change or both; 2) “sustainable energy infrastructure”, which as defined in OECD (2015a) includes the following sectors: power generation from solar, wind, small hydro, geothermal, marine, biomass and waste-to-energy, biofuels, carbon capture and sequestration and energy smart technologies (such as smart grids, interconnectors, energy efficiency, storage and electric vehicles); and 3) other investments, including sustainable agriculture, floodplain levees and coastal protection, waste management infrastructure and “green” water infrastructure (OECD, 2016b). Green water infrastructure may include wastewater treatment and infrastructure that requires less concrete, e.g. through rainwater harvesting, source control of surface water (such as sustainable urban drainage systems), green roofs, and local processing of grey or black water. The majority of institutional investment activity in green infrastructure tracked by the OECD is occurring within commercially scalable sustainable electricity generation technologies such as wind (on- and off-shore), solar (PV and CSP), small hydro (less than 50MW), biomass and geothermal.

⁵ Estimates of additional investment requirements typically do not consider returns on investment through lower operating costs due to energy savings from efficiency investments or lower fuel costs in the case of renewable energy replacing fossil energy. They also do not consider other benefits such as lower health costs. One study (Kennedy and Corfee-Morlot, 2012) estimates that shifting to low-carbon and climate-resilient (LCR) infrastructure could result in systemic change that raises only slightly, or even lowers, overall investment costs. Investing in sustainable energy also makes economic sense. The IEA (2014) presents evidence that the USD 44 trillion in additional investment needed to decarbonise the energy system in line with their “2 degree scenario” by 2050 is more than offset by over USD 115 trillion in fuel savings – resulting in net savings of USD 71 trillion.

3. These figures suggest that investment for green infrastructure will need to take place at a far greater scale over coming decades to achieve the aims of the Paris Agreement and the Sustainable Development Goals. The scale of this investment is so large that it will, inevitably, have to rely in large part on mobilising private capital. Public finance can and does play a critical role to “jump start”, mobilise and guide investment, but transformational change will require large-scale private sector engagement (OECD, 2015a). Examination of these issues so far has often been centred on the financing of climate change mitigation and adaptation, and how to close the financing gap to fund the needed low-carbon investments.

4. Strategies for closing the financing gap need to consider: a) A policy regime that establishes price incentives and policy coherence; and b) The significant financial, regulatory and structural constraints faced by traditional sources of financing for green infrastructure – governments, corporate actors (e.g. utilities, project developers and others) and the banking sector.

5. The global financial crisis, and responses to it, led to a transformation of the financial landscape, with changes in behaviour by the banking sector in particular. Long-term financing by banks has declined as they de-risk (deleverage) globally, although it is beginning to revitalise in some areas (Pooler, 2014). In the capital markets, a range of factors including ambiguous macroeconomic prospects and declining forecasted returns for equity investments in publicly traded companies have had adverse effects on demand for long-term equity capital (OECD, 2015a). In addition to constraints in the banking sector, other traditional sources of finance such as corporate actors also face their own constraints (OECD, 2015a).

6. Despite these constraints, the banking sector remains a key provider of investment financing, but it likely will not be able to compensate for constraints among other traditional sources and fill the massive financing gap for sustainable infrastructure on its own. For instance, the People’s Bank of China (PBoC) estimates that China will need to invest at least RMB 2 trillion (USD 320 billion) per year in green sectors in order to meet the environmental targets under the 13th Five Year Plan (2016-2020). Public fiscal resources, however, can cover no more than 15% of these investments (Green Finance Task Force, 2015).

7. A related and broader issue is whether the financial system can enable capital reallocation consistent with the ‘green’ transition and for the long run, i.e. by providing financing for companies and industries that protect and improve the environment and shifting financing away from fossil fuel industries and environmentally-harmful activities (Boissinot, Hubert and Lame, 2016; Wehinger and Nassr, 2016 forthcoming). It is only through such a re-allocation that the infrastructural foundations of the global economy can be rewired to be consistent with keeping the global temperature increase to well below 2°C, as called for under the Paris Agreement.

1.3 The role of institutional investors

8. In this context, much attention has been focused on the potential for institutional investors – including pension funds, insurance companies, investment funds, and sovereign wealth funds – to significantly increase their investments in green infrastructure. For instance, McKinsey (2016) estimates that institutional investors could provide USD 1 trillion to USD 1.5 trillion in additional private capital for sustainable projects—up to half of the current annual infrastructure investment gap. But that will happen only if a range of structural challenges and market barriers currently adding costs and restricting returns are removed, and if policies are put in place to ensure adequate returns to meet institutional investors’ liabilities.

9. In a low interest rate environment, and if governments provide a sound enabling environment, green infrastructure projects could be attractive to institutional investors. In many cases institutional investors have to invest for the long-term in order to fund liabilities that are multi-generational in nature.

As a subset of green infrastructure, sustainable energy projects offer many of the attributes of “core” infrastructure assets and have a number of unique characteristics which can appeal to institutional investors and are not monetised in internal rate of return calculations. For instance, institutional investors require stable and predictable cash flows to meet their liabilities. These liabilities can be met in part through direct investments in sustainable energy assets, which can provide steady, long-term, inflation-linked, income streams, due in part to low operating expenses and stable contracts for revenue. These income streams also have low correlations to the returns of other investments (OECD, 2015a; 2016b).

10. Despite these factors favouring green infrastructure investment, the broader context in which institutional investors make their capital allocation decisions has tended to limit their investments in these types of “real assets”. Their decision-making process for allocating capital among different types of instruments and asset classes is complex and varies significantly across institutions and geographies. Institutional investors have varying risk appetites, liability profiles, investment preferences, illiquidity tolerances and other constraints which will determine the extent to which they will seriously consider investments in green infrastructure. Moreover, institutional investors will not make an investment just because it is “green”. Their primary concern is the risk-adjusted financial performance of the asset (OECD, 2015a). Their willingness to finance major investment projects in any given country will be heavily influenced by perceptions of the country’s sovereign risk, investment climate, policy settings, and institutions.

11. Institutional investors managed USD 92.6 trillion in assets in 2013 in OECD countries (projected to grow to USD 120 trillion by 2019) and USD 10 trillion in emerging markets and developing countries (OECD, 2015a; OECD/Bloomberg Philanthropies, 2015).⁶ Continued growth in funds under management is occurring in most markets. The main exposure of institutional investors to green infrastructure so far has been through indirect investments⁷, via holdings of the debt and equity of listed corporations active in the green infrastructure industry (OECD/Bloomberg Philanthropies, 2015). Such indirect investments can be important for supporting sustainable energy projects in particular, as over half of the capital directed to sustainable energy in 2015 came from corporate on-balance sheet financing (BNEF, 2016). However, the scope for institutional investors to increase their indirect sustainable energy infrastructure investment is constrained by their willingness to purchase new debt and equity issued from corporates, which depends on institutional investors’ perception of risk-adjusted return opportunities and the state of corporates’ balance sheets (OECD, 2015a). Furthermore, indirect investment -- unlike direct investment in projects -- does not necessarily translate into investments in projects and contribute to addressing the infrastructure investment gap.

12. While there are expanding pockets of activity in direct green infrastructure investment in projects by institutional investors, as illustrated in the examples provided in this report, these types of investments have been minimal compared to the scale of their assets. Looking just at large pension funds surveyed by the OECD (see next section and Annex B), direct equity investment in unlisted infrastructure

⁶ Total assets of institutional investors in 2013 amounted to USD 92.6 trillion maximum. Note that there is a double counting issue with this number as mutual funds manage some assets from pension funds and insurance companies. Total assets of institutional investors (excluding investment funds) amounted to USD 57.7 trillion in 2013. This lower figure excludes assets of investment funds that are managed alongside pension and insurance funds.

⁷ Indirect infrastructure investments are investments in companies which are involved in the infrastructure industry either as manufacturers, operators or providers of on-balance sheet financing, or via intermediaries such as private equity funds targeting corporate investments, as distinct from direct investments in infrastructure projects.

projects⁸ of all types accounted for only 1% of their asset allocation in 2015, and green infrastructure accounted for only a fraction of that 1% (OECD, 2016a).

1.4 *Barriers to institutional investment in green infrastructure and challenges*

13. The regulatory environment in which institutional investors operate and the risk-return profile of investments will determine whether institutional capital can be mobilised to support infrastructure development – and whether the infrastructure in question is “green”. Policymakers can take actions to create an investment environment in which investors have lower risk perceptions and there are significant reductions in the cost of capital, which is fundamental to reducing the costs of green infrastructure.

14. The OECD has produced a significant amount of analysis discussing the barriers to institutional investors’ investment in infrastructure in general and sustainable energy infrastructure in particular⁹. OECD (2015a) (“Mapping Channels to Mobilise Institutional Investment in Sustainable Energy”) studied a collection of reasons for limited investment by institutional investors in sustainable energy projects specifically. It found that investors with fiduciary responsibilities generally look to policy makers to foster investment certainty and improve the risk-adjusted returns available from sustainable energy, and that many institutional investors have yet to conclude that sustainable energy investments offer a sufficiently attractive risk-adjusted financial return. Standing in the way of increased investment are a number of potential obstacles, some that apply to infrastructure generally, others that are specific to sustainable energy. The report summarised these issues into four categories:

1. Weak, uncertain or counterproductive environmental, energy and climate policies.
2. Regulatory policies with unintended consequences.
3. A lack of suitable financial vehicles with attributes sought by institutional investors.
4. A shortage of objective data and skills to assess transactions and underlying risks and returns.

Table 3, which is reproduced from the “Mapping Channels” report, provides additional details on and examples of barriers to institutional investment in sustainable energy.

Table 3. What are the barriers to institutional investment in sustainable energy infrastructure?

Barriers		
1. Issues with infrastructure investments	1.1 Direct investing challenges	a) Short term investment horizons of investors. b) Need for liquidity with many investors (low tolerance for illiquidity risk). c) Challenges with bidding process for assets on projects and timing; lack of investor best practice and expertise; smaller investors can lose out to more sophisticated, larger investors in bidding. d) Need scale >\$25-\$50bn in AuM and dealflow to maintain costly direct investing team with expertise. e) Min \$100-200m deal “ticket” size; expensive and time-consuming due diligence; higher transaction costs.

⁸ This should be contrasted with the more routine type of institutional investment made in corporate stocks and bonds.

⁹ See for instance the G20/OECD Policy Note on pension fund financing for green infrastructure and initiatives (OECD, 2012)

	1.2 Regulatory and policy issues	a) Regulatory and policy uncertainty. b) Uncertain new policy application e.g. Solvency II for pension funds? c) Illiquidity and direct investment restrictions e.g. capital adequacy rules and higher charges (Solvency II, IORP II Directive). d) Accounting rules e.g. mark to market for illiquid assets.
	1.3 Lack of "bankable" project pipeline and quality historical data	a) Few countries publish infrastructure road maps with project pipelines. b) Decreased participation of project finance banks (due to Basel III, deleveraging, structural factors) creates interruptions in project development and construction. c) Little historical pricing data or indices for benchmarking investments such as private placement debt. d) No liquid market to exchange financial stakes in projects.
2. Issues particular to sustainable energy infrastructure investments	2.1 Risk-return imbalance	a) Market failures: insufficient carbon pricing and incentives; presence of fossil fuel subsidies. b) Insufficient economic business case: cost of capital and perceived risk is too high and return is too low. c) Electricity market challenges (structure and design). d) Low natural gas pricing in some jurisdictions.
	2.2 Unpredictable, fragmented, complex and short duration of policy support	a) Instances of retroactive support cuts and support switching (FiT to FiP creates cash flow volatility) or start and stop (PTC). b) Unintended consequences of unrelated policies (e.g. can discourage investment by tax-exempt pension funds or EU unbundling preventing majority ownership of both transmissions and generation/production).
	2.3 Potential misalignment with climate change risk and the transition to a low carbon economy	a) Lack of a responsible investment code. b) Lack of clarity on fiduciary duty and stewardship with respect to environmental, social and governance and stewardship (ESG) issues. c) Carbon content of portfolios rarely disclosed.
	2.4 Special species of risk and lack of data on the performance of sustainable energy investments across asset classes	a) Technology and volumetric risk management require expertise and special risk management tools. b) Lack of data.
	2.5 Competition for capital	a) Competition with traditional infrastructure assets and with transmission and distribution infrastructure.
	2.6 Small scale of assets	a) Distributed and micro-generation assets too small for institutional investors interest and few means exist to bundle them.
	2.7 Market perception	a) Negative publicity created by bankruptcies of early-stage companies and poor performance of VC investments due to temporal industry consolidation and macroeconomic factors transfer to projects which were unaffected.
3. Lack of suitable investment instruments and funds	3.1 Issues with fund and vehicle design	a) High fees associated with fund structures. b) Liquidity trade-off with connection to underlying asset and associated benefits: difficult to offer liquidity without asset disconnect, churn and leverage in fund. c) YieldCos are new innovations for listed equity but depend on bankable pipelines of projects and experienced human resources and may need to evolve further to fulfill their potential.
	3.2 Nascent green bond markets, few indices/funds,	a) Small pipeline of projects, high transaction costs, minimum deal size. b) Definitional uncertainty. c) Few liquid benchmark indices for listed debt and equity as market is still nascent or insufficient demand for products.
	3.3 Restricted access	a) Current national legislation does not enable sustainable energy

	to existing vehicles (Covered Bonds, MLPs & REITs)	to qualify for these vehicles.
	3.4 Challenges with securitisation	a) Lack of standardised project documentation and credit risk assessments. b) Lack of large enough portfolios of loans on bank balance sheets. c) Legacy reputational risk from the GFC.
	3.5 Credit and ratings issues	a) Historical lack of ratings data, expensive process. b) Absence of monoline insurers since GFC.

Acronyms and abbreviations: Asset-Liability Matching (ALM), Assets under Management (AuM), Institutions for Occupational Retirement Provision (IORP II Directive), Feed in Tariff (FiT) Feed in Premium (FiP), Production Tax Credit (PTC), Global Financial Crisis (GFC), Master Limited Partnership (MLP), Real Estate Investment Trust (REIT).

Source: OECD 2015a, OECD analysis updated from Kaminker and Stewart (2012), CPI (2013), BNEF (2013); Kaminker et al. (2013)

15. In addition to the above-mentioned barriers affecting institutional investment in green infrastructure in developed countries, there exist further barriers that are unique to emerging economies and developing countries. These are the countries that have large projected electricity demand which implies colossal future infrastructure build. The mismatch between investment opportunities and risks, and the need to address investment barriers, is particularly evident in emerging and developing economies. Examples of further barriers affecting green infrastructure investment in these countries include: (i) options to mitigate regulatory, currency and corruption risk are generally less available to investors and more costly than in developed countries; (ii) investment contracts are not standardised across countries making due diligence more time consuming and expensive; and (iii) international arbitration is often not an option leaving disputes to be solved in local courts. A more comprehensive set of supplementary barriers in emerging economies and developing countries is provided in OECD (2015a) and World Bank/IMF/OECD, (2015).

16. PRI (2016, forthcoming) undertook a multi-year dialogue on ESG with institutional investors and found a series of barriers related to green finance (broadly defined), where policy makers' efforts are presently disjointed and fragmented. These are presented in abridged form below, split between demand (i.e. the scale of the project pipeline) and supply (i.e. of financing from institutional investors) for green investment, along the same structure that this report takes.

Demand for green investment:

1. Policy frameworks: Insufficient predictability thereof; policy fragmentation; lack of price signals (e.g. carbon pricing) and discrepancy between action on green finance among government-sponsored investors and private investors.
2. Lack of definition and market standards: Leading to heightened due diligence and monitoring transaction costs.
3. Investor governance: Lack of policy encouragement to consider material green and ESG risks as part of their fiduciary duty and to include within their mandates; and mismatches in time horizons due to misalignment of interests in the investment value chain.
4. Capacity for green: A gap between high-level commitment to principles and full implementation in investment practice, compounded by difficulties in embedding specialist skills.

Supply of green investment:

5. Investment opportunities and pipeline: Lack of mainstream equity and debt capital market options with appropriate risk-return profiles that can be included within regular asset allocation

decisions (also reflecting a dearth of projects related to demand-side issues); project investments perceived as requiring specialist internal skills; lack of aggregation of small-sized projects.

6. Inadequate data: Data on company environmental practices and performance and green investment track records still developing and not yet sufficiently comparable.
7. Inadequate risk analysis: Scenario analysis and risk assessment methodologies of material green issues still developing.

17. After examining a set of these barriers in depth, OECD (2015a) proposed nine high-level policy recommendations and policy considerations for governments to facilitate institutional investors' investment in sustainable energy infrastructure (as a subset of green infrastructure), building on findings from previous G20/OECD reports. These are given in abridged form in Annex B.

1.4 Climate risk

18. The preceding discussion focuses on factors impacting how institutional investors view the opportunity presented by investment in sustainable energy and other green infrastructure. Another consideration that could impact green infrastructure investment as well as investment in emissions-intensive projects and activities is how investors view climate risk. In the wake of the Paris Agreement, investors can be expected to perceive increased regulatory risks around unabated fossil-related investments and the potential for lower returns from such investments. Such changes in perceptions may be triggered by the expectation of increasingly stringent carbon pricing and climate change mitigation policy, and by an evolving investor governance and disclosure landscape. Climate change itself, policies and technological changes in response to climate change, and green finance all create risks that have various implications for the financial sector and institutional investors (Wehinger and Nassr, 2016 forthcoming). As described by Bank of England (2015) and Carney (2015), among these are “physical risks” from climate change that mostly affect the insurance industry¹⁰ but can extend to other sectors (e.g. banks' mortgage loan portfolio can be exposed¹¹). Related are “liability risks” for corporations that may be held responsible for climate-change related losses or damages and from which affected parties may seek compensation.

19. There are also risks linked to policy and technological responses to environmental challenges including climate change which can affect the financial sector and institutional investors. These and related “transition risks” generally result from the adjustment process towards a cleaner and lower-carbon economy that can prompt a reassessment of asset values (Dietz et al., 2016) as their ability to generate returns is impaired and they face pre-mature write-downs or even conversion to liabilities, thus there is a potential for these assets to become stranded (“stranded assets”) (CTI, 2011; Caldecott, McDaniels and Dericks, 2014). These risks mainly affect lenders and (equity) investors in projects concerned, but the re-pricing of assets may have effects that can go beyond the institutions or the sector in which it occurs, including broader economic effects (including for sovereigns and their ratings) and potentially impacts on financial stability (Dietz et al, 2016; Bank of England, 2015; Carney, 2015).

¹⁰ The financial management of these impacts is a key challenge, and has been covered in work of the OECD; see Wolfrom and Yokoi-Arai (2016).

¹¹ There may be implications for banks where there is significant underinsurance of climate risks as uninsured losses from climate change-related extreme events could create financial stress for bank clients, e.g. uninsured or underinsured households forced to default on mortgages or other consumer credit as a result of disaster losses (Wehinger and Nassr, 2016 forthcoming; Wolfrom and Yokoi-Arai, 2016).

20. Despite growing awareness of climate-related risks to the financial sector and institutional investors in particular, the understanding of these risks is still incomplete (and may remain so) due to their complexity (ESRB, 2016). Climate-related physical risk management in the insurance and reinsurance sectors is relatively sophisticated, but in other sectors, and with regard to other sources of risks (i.e. transition risks), the work is still at an earlier stage in terms of data availability and quality, tools and methodologies as well as capacities devoted to environmental issues impacting the financial sector (FDF, 2016). Enhanced transparency and disclosure of climate-related and environmental risk exposures across the corporate and financial sector could help not only to improve understanding and analysis of the risks, but also to improve the decision making of borrowers, lenders and investors alike. This could contribute to improved risk pricing and could support a more orderly transition to a low-carbon economy, allowing financial market actors to take a view on current as well as future risks, and adjust investment strategies, improve long-run decision making and foster long-term investment by institutional investors (Wehinger and Nassr, 2016 forthcoming).

21. For such reasons, disclosures with a focus on carbon exposures and their risks should become standard in the non-financial as well as the financial sector. Efforts to improve disclosure are being undertaken at the OECD (OECD, 2015c), as well as by the FSB's Task Force on Climate-related Financial Disclosures (TCFD) (FSB, 2016). The NGO CDP has also been very active on disclosure issues. It requests "information on the risks and opportunities of climate from the world's largest companies on behalf of 827 institutional investor signatories with a combined US\$100 trillion in assets."

2. Strengthening the demand for green institutional investment to develop organically

22. For institutional investors which manage a very large share of national savings, a fundamental pre-condition for investing in green infrastructure is the establishment of appropriate domestic framework conditions, which provide the clear price signals, predictability and policy coherence that investors need. While simple enough in principle, such a framework often proves difficult to achieve in practice, as retroactive policy changes, weak carbon pricing, fossil fuel subsidies and unintended effects of non-climate-related (e.g. financial and investment) regulations can undermine policies that are otherwise supportive of the low-carbon transition.

23. OECD/IEA/ITF/NEA (2015) and OECD (2016b) both find that even though technology costs are falling fast, policy and market obstacles still constrain overall growth in investment in renewable energy, limiting the pipeline of bankable projects and affecting the risk-return profile of investments. In addition to insufficiently ambitious climate mitigation policies, the misalignment of other policies and regulations with respect to climate goals can also act to hinder investment. Such misalignments may occur across the general investment environment, for instance in the areas of investment policy, competition policy and electricity market design, trade and financial markets policy (OECD/IEA/ITF/NEA, 2015). The first four recommendations from OECD (2015a) given in Annex B, were matched against barriers and targeted at creating preconditions and the enabling environment to drive demand for institutional investment.

2.1 A survey of institutional investment activity and demand for green investment

24. In locations where sufficient preconditions are in place and other aspects of the enabling environment create circumstances in which investment demand is generated, investment will be more likely. Indeed, despite the overall low levels of investment in infrastructure compared to the size of the institutional investor market, investment demand for green and sustainable infrastructure is strong and growing, and investment activity is ramping up.

25. While no unified and systematic database exists for tracking stocks and flows of investments in green infrastructure by institutional investors, a number of estimates are available from different sources and methodologies or templates for tracking and reporting investments are emerging. For instance, the Asset Owners Disclosure Project (AODP, 2016) estimates that the stock of “low-carbon investments” across a range of asset classes by institutional investors is valued at USD 138 billion in 2016. On an individual and proportional basis, the UK Environment Agency Pension Fund holds the highest rank in the survey with 26.4% of AuM invested in low-carbon investments. At the national level, the Netherlands tops the country table for low-carbon investments on both an absolute and proportional basis – with an aggregate of USD 39 billion invested in low-carbon, representing 3.4% of the total AuM in the country. This survey uses a reporting taxonomy for eligible investments elaborated by the “Low Carbon Investment Registry”, which in turn reports entries by institutional investors tallying to USD 50 billion. These figures could be considered as lower bounds to the stock of investments, given that they only describe investments by those who choose to report them.

26. The OECD’s Large Pension Fund Survey (OECD, 2016a) found that of the 26 pensions and reserve funds that reported¹² sector allocations in their infrastructure portfolios, nine reported exposure to renewable energy totalling USD 1.4 billion of investments, compared with USD 25 billion of non-renewable energy sector investments and USD 27 billion of transport investments. Using a wider definition, funds reported “green” investment through a variety of channels, with exposure to green equities, green bonds, and in alternative investments such as real estate, private equity, and infrastructure. The aforementioned Swedish pension fund AP2 reported 9% of its total portfolio was invested in green assets. Dutch pension fund ABP, and the New Zealand Superannuation Fund both reported 6.7% of their total portfolios were invested in green assets. These funds were leaders in the overall survey population in terms of green investment – most funds reported much lower or no exposure to green investments. The largest allocation of an infrastructure portfolio to renewables reported was 19% (PFA, Denmark), while the smallest reported was less than 1% of total infrastructure investment (OMERS, Canada).

27. In addition, some institutional investors are poised to significantly increase investment in this area. Goldman Sachs (2015) finds that in the last few years, institutional investors have begun to recognise that successful low carbon technologies benefit from a mix of policy support, market acceptance, technical advances and cost reductions. For certain green infrastructure sectors (e.g. LEDs, onshore wind, solar PV, and hybrid & electric vehicles) these dynamics combine to create a virtuous (self-reinforcing) cycle. Table 2 summarises a wide assortment of existing institutional investor commitments, targets and allocations to “green finance”, all actions taken in the last three years. Once again, a mixture of terms is used for defining the nature of the green financing actions, with 24 different terms used across the 38 actions.

28. In September 2014, a coalition of three pension funds (CalSTRS, APG and PensionDanmark) pledged to increase low-carbon investments across all asset classes to USD 31 billion by 2020, and had already reached USD 29 billion by the end of 2015. Among insurance companies, the SRI Initiative launched in 2014 commits its participants to doubling their USD 42 billion of “green, climate-smart investments” in 2012 to USD 84 billion by 2015, and increasing the 2012 figure by a further 10 times to USD 420 billion by 2020. By July 2015 the figure had already reached USD 109 billion, well in excess of the 2015 target. A plethora of other institutional investor initiatives geared at sustainable finance were showcased in the margins of COP 21 including, inter alia, the Portfolio Decarbonisation Coalition, the Montreal Carbon Disclosure Pledge, the Divest-Invest Pledge, and the Aligned Intermediary.

¹² The survey reviewed trends in assets and asset allocation by 99 Large Pension Funds (LPFs) and Public Pension Reserve Funds (PPRFs), which in total managed USD 10.3 trillion in assets, one third of the total worldwide assets held by this class of institutional investor.

Table 4. Institutional investor commitments, targets and allocations

Actor	Sector	Commitment	Allocation (latest available)
Aggregate			
Institutional investors	Sustainably managed assets	n/r	USD 21.4 trillion (2014)
Institutional investors	European renewable energy equity	n/r	EUR 26 bn or 37% of aggregate deal value
Institutional investors where public action deployed	Green infrastructure	n/a	USD 8 bn (2016)
Portfolio Decarbonisation Coalition	Low or lower-carbon assets	USD 100 bn by COP21	USD 600 bn (2015) – already 6x the target
Montreal Carbon Pledge	Disclosure of carbon footprint	USD 500 bn	USD 3 trillion (2015) – already more than 6x the target
Asset Owners Disclosure Project	Low-carbon investments	n/r	USD 138 bn or 0.4% of index AuM (2016)
Institutional investors in the Netherlands	Low-carbon investments	n/r	USD 39 bn (3.4% of total NL index AUM - 2016)
Low Carbon Investment Registry	Low-carbon assets	n/r	USD 50 bn
Industry			
OECD Large Pension funds	Renewable energy projects	n/a	USD 1.4 bn
Coalition of CalSTRS, APG and PensionDanmark	Low-carbon investments across all asset classes	USD 31 bn by 2020	USD 29 bn (2015)
Insurance industry (The SRI Initiative: ICMIF and IIS)	Green investments / Climate smart investments	Double the 2012 amount (USD 42 bn) to USD 84 bn by 2015, and increase by 10x to USD 420 bn by 2020	USD 109 bn (July 2015), already in excess of the 2015 target
Catalytic Finance Initiative	Clean energy projects	USD 10 bn by 2022	USD 1.5 bn (2015)
Cubico Fund (OTPP, PSP Investments, Santander)	Water and renewables projects	USD 2 bn	USD 2 bn
Aligned Intermediary (University of California Regents, TIAA CREF, NZ Super, OPTrust)	Climate infrastructure (clean energy, water, waste)	USD 1 bn	n/a
Individual			
Pension funds			
PensionDanmark	Renewable energy projects	10% unlisted equity	EUR 2.5 bn
PFA Pension	Renewable energy projects	n/r	19% of infrastructure portfolio
PFZW	Sustainable investments	EUR 16 bn by 2020	USD 4 bn (2015)
UK Environment Agency Pension Fund	Low-carbon investments		26.4% of AUM (calculate USD figure)
AP2	Green assets	n/r	9% of total portfolio
AP2	Green bond strategic asset allocation	1% of portfolio	SEK 4.2 bn (USD 500 million) (2016)
ABP	Green assets		6.7% of portfolio
NZ Super	Green assets		6.7% of portfolio
New York State Common Retirement Fund	Sustainable investment	USD 5 bn (incl. launch of a USD 2 bn low-emission index)	USD 1.5 bn (2015)
Insurance companies			
Allianz	Renewable energy projects	EUR 4 bn	EUR 3 bn
AXA	Green investments	EUR 3 bn by 2020	
SwissRe	Climate risk and resilience coverage	USD 10 bn by 2020	USD 1.5 bn (2015)
Aviva	Low-carbon infrastructure	GBP 500 million per year to 2020	
Asset managers			
BNP Paribas Investment Partners	Low-carbon assets		EUR 14 bn (2015)
Endowments			
University of California	Breakthrough Energy Coalition	USD 1.25 bn over 2016-20	

<i>Family offices</i>			
Threshold Group	Impact investment		USD 1 bn
<i>Other investors and financial institutions</i>			
Divest-Invest (140 foundations and other investors)	Public pledge to divest portfolio of fossil assets and re-invest at least 5% in “clean energy and climate solutions” ¹³	USD 12 billion in total assets that have committed at least 5%—and in many cases over 10% of redirected investment	Actual amount of funds divested and re-invested difficult to track due to varying degrees of disclosure
Citigroup	Green financing	USD 100 bn	
Bank of America	Low-carbon business	Increase from current USD 50 bn to USD 125 bn by 2025	
Wells Fargo	Greener economy	USD 30 bn by 2020	
Goldman Sachs	Clean energy	USD 150 bn by 2025	
Re-Invest 2015: Banks and non-banking financial companies	Renewable energy investment in India	INR 712 bn (USD10.7 bn)	INR 295 bn (USD 4.4 bn) (March 2016)
Google	Renewable energy projects	USD 2.5 bn	
Source: OECD analysis (author)			

¹³ The details of the commitment are: “1) Stop any new investments in the top 200 fossil fuel companies. 2) Drop coal, oil and gas from our investment portfolio by divesting from the top 200 fossil fuel companies. 3) Invest at least 5 percent of our portfolio into climate solutions defined as renewable energy, energy efficiency, clean technology and clean energy access.”

2.2 *Institutional investors have driven the growth of a green bond market*

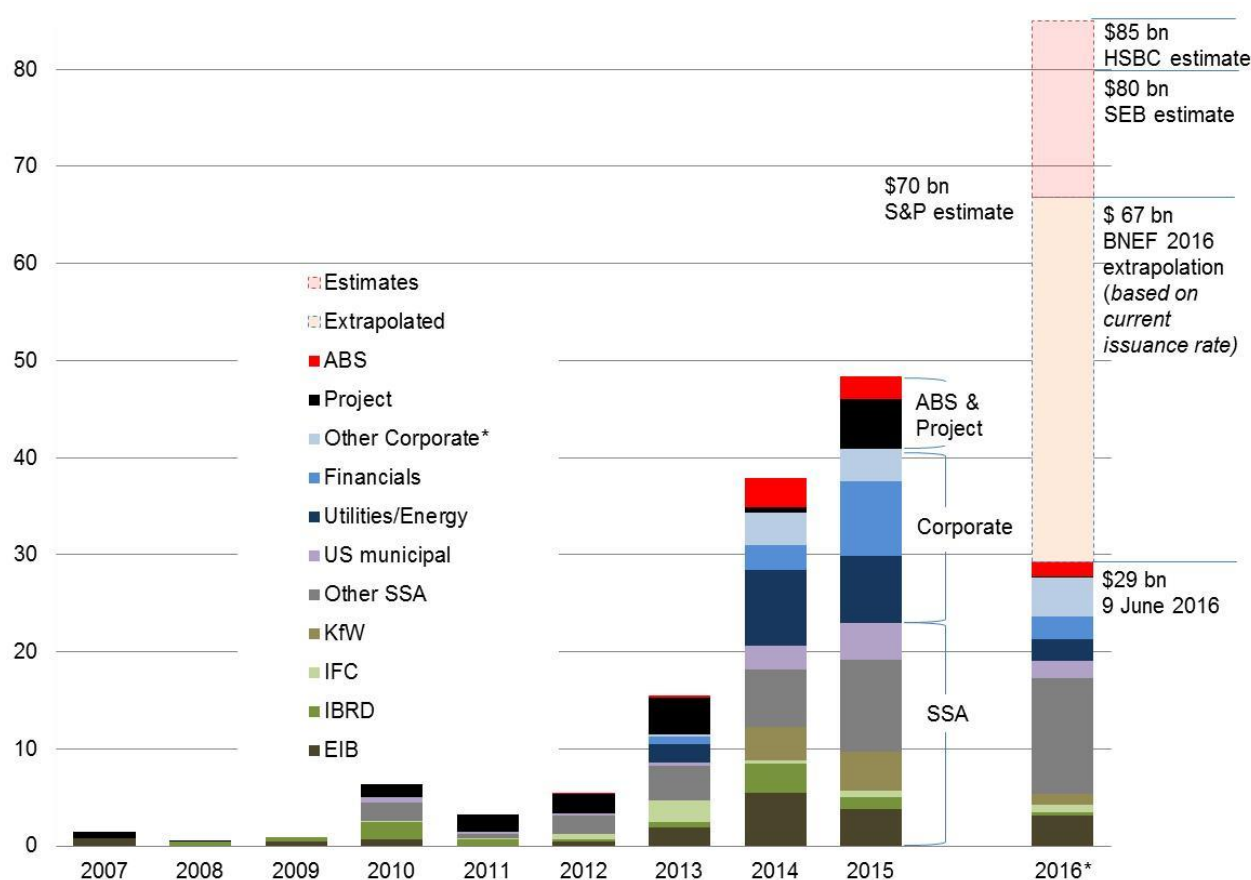
29. Institutional investors have driven the growth of a market for green bonds, investing in the majority of issuances while working to improve the market's structure and green integrity (OECD, 2016c forthcoming). Bonds are a core component of pension funds' and insurance companies' portfolios¹⁴, and bonds with long tenors are potentially a good fit with institutional investors' long-term liabilities, allowing for asset-liability matching. Green bonds fit within the investment portfolios of mainstream institutional investors and can reconcile latent and emerging demand from institutional investors for sustainability-themed, ESG-screened investments. The green bond "label" serves as discovery mechanism for institutional investors and helps to lower search costs associated with identifying green opportunities in a figurative ocean of fixed-income opportunities (OECD, 2016c forthcoming).

30. As shown in Figure 2, annual issuance of green bonds increased to USD 42 billion in 2015 and passed the same issuance milestone already by July of 2016, compared to USD 18 billion by July 2014. Data from the 2016 survey of Large Pension Funds (LPFs) and Public Pension Reserve Funds (PPRFs) (OECD, 2016a) reported an increase in allocations to green bonds in 2014 and 2015, partly due to an uptick in issuance and available supply, but also increased investor interest. In response to the greater availability of green bonds, a dozen institutional investors have made commitments or targets for green bond investments in excess of USD 15 billion to date, and 14 dedicated green bond funds have emerged (with 9 launched in 2015 alone). In 2016, Swedish pension fund AP2 established a standalone green bond portfolio, arguing the market has "achieved a maturity and size" to justify the fund's implementing a separate investment strategy and classifying its green bond holdings as a distinct asset class. In the margins of COP21, asset owners, investment managers and individual funds managing over USD 11.2 trillion of assets signed a statement in support of the green bond market.

31. In the emerging market for labelled and unlabelled green bonds, bonds have mainly been used for refinancing (and recycling lending) and for funding on-balance-sheet activity (for existing and forthcoming projects) by corporates, MDBs, and sub-sovereign, municipal and agency issuers. The market has also featured asset-backed securities and project bonds – two bond categories that could (and would need to) play a much larger role in a 2-degree policy scenario, provided the right policies are in place (OECD, 2016c forthcoming).

¹⁴ OECD pension funds and insurance companies in 2013 invested on average 53% and 64% respectively of their portfolio in bonds (simple average) (OECD, 2015a).

Figure 2. Labelled green bond issuance and market composition (USD Billions)



Note: "Other SSA" includes other types of Sub-sovereign, Supranational and Agency issuers such as development banks, local funding authorities, export credit agencies, etc. "Other Corporate" includes sectors such as Consumer Discretionary and Staples, Technology, Industrials and others. Climate Bonds Initiative calculates USD 41.8 billion of annual green labelled bonds issued in 2015. BNEF's figures are higher (USD 48 billion) as they capture project bonds that are "tagged green" on the Bloomberg Terminal.

Source: OECD analysis (author) based on BNEF data in OECD (2016c forthcoming)

Table 5. Over EUR 12 billion in institutional commitments or targets for green bond investment (May 2016)

Green Bond Commitments or Targets			
Actor	Sector	Commitment	Comments
Credit Agricole	Bank	EUR 2 bn	Target by end of 2017
Barclays	Bank	GBP 2 bn	Increased from 1 bn target
KfW	Public Financial Institution	EUR 1 bn	Within 4 years
HSBC	Bank	USD 1 bn	No time frame
Zurich	Insurer	USD 2 bn	No time frame
Actiam	Asset manager	EUR 1 bn	No time frame
AXA	Insurer	EUR 1 bn	No time frame
Aviva	Insurer	Increase holdings	No time frame
Deutsche Bank	Bank	EUR 1 bn	No time frame
California State Treasury	Public Financial Institution	USD 1.1 bn	No time frame
Bangladesh Central Bank	Central Bank	Some of its foreign currency reserves	No time frame
AP2	Pension Fund	1% of portfolio allocation	No time frame
AP4	Pension Fund	Strong commitment and significant allocation to green bonds	No time frame

Total EUR 12bn +

Source: OECD analysis (author)

14 Green bond funds manage EUR 1.16 billion (May 2016)

Actor	Focus	Assets Under Management
Storebrand	Green bond fund	EUR 500 million
Foresight	Unlabelled green bond fund	EUR 200 million
Humanis	Green bond fund ("HGA Obligations Vertes")	EUR 125 million
AXA IM	Green bond fund (WF Planet Bonds)	EUR 80 million
Mirova	Green bond fund	EUR 62.55 million
Calvert	Green bond fund	EUR 61.29 million
SEB	Green bond fund	EUR 55 million
Erste Asset Management	Responsible bond global impact fund	EUR 41.6 million
Raiffeisen Capital Management	Green bond fund	EUR 35 million
Allianz	Green bond fund	EUR 20 million
State Street	Green bond fund	EUR 20.34 million
Columbia Threadneedle	Social bond fund	USD 20 million
NN Investment Partners	Euro green bond fund	EUR 20 million
Nikko AM	World Bank green bond fund	SGD 16.46 million
Total	EUR 1.16 billion (as of May 2016)	

Source: OECD analysis (author)

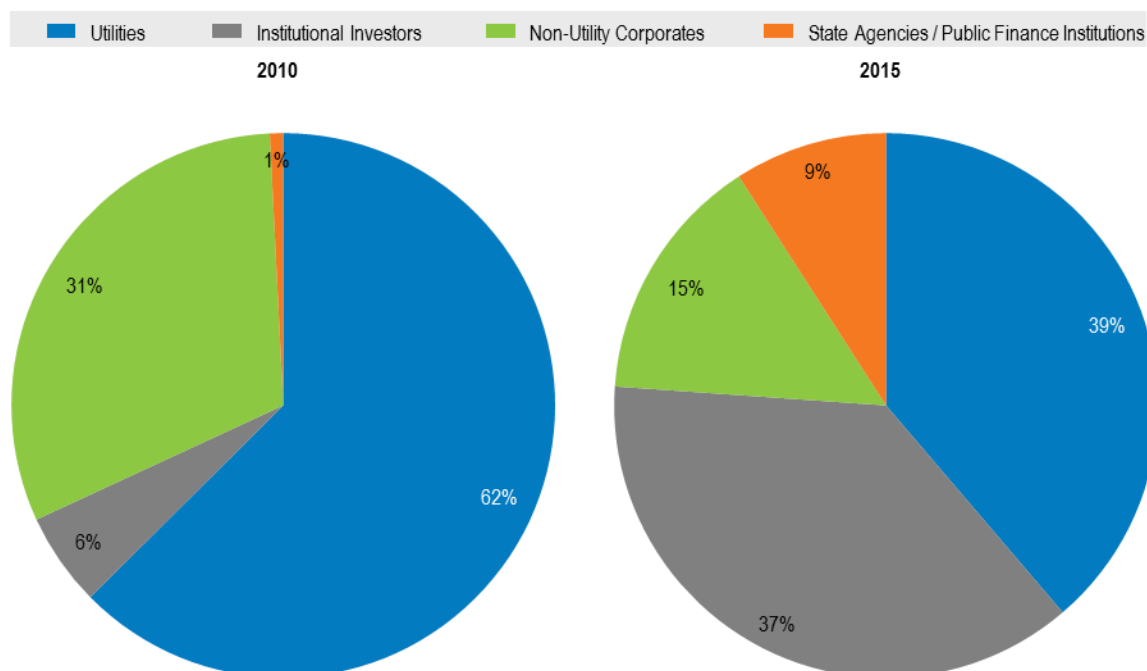
2.3 The case of renewable energy investment by institutional investors in the EU

32. A growing number of institutional investors have identified renewable energy assets in Europe as a source of inflation-linked, long-term and stable cash flows. This increased appetite can be attributed to a number of factors including the presence of policy support mechanisms that create revenue stability (e.g. Feed-in-Tariffs). An enduring low interest rate environment with low-yielding government bonds has led some pension funds and insurers to invest in renewable energy directly, citing their fiduciary obligation to identify stable attractive returns with low correlations to other asset classes (e.g. PensionDanmark has allocated EUR 2.5 billion to renewables and Allianz owns 63 wind farms and seven solar parks worth EUR 3 billion).

33. Recent data from OECD's *2016 Business and Finance Outlook* confirms the growing prominence of institutional investors in renewable energy in Europe (OECD, 2016b). In 2010, utilities financed 62% of equity in wind energy projects in Europe, while institutional investors had financed only 6% (Figure 3). By 2015, utility finance had decreased to 39%, while the share of institutional investors increased to 37%, making up for part of the difference. The increase of equity provision by institutional investors in the sample¹⁵ can be traced mainly to the acquisition of brownfield assets or portfolios for onshore wind deals. Pension funds and insurers were not involved in any greenfield onshore wind-power transactions included in the 2015 sample. This suggests that institutional investors look to the onshore wind sector mainly for the acquisition of existing projects.

¹⁵ The data on investment, including new build and acquisition transactions, is compiled from the BNEF database of clean energy projects. The sample for 2010 includes 70 projects (57 new builds; 13 acquisitions), and the sample for 2015 includes 44 projects (29 new builds; 15 acquisitions). The total disclosed transaction value of the deals included in the sample was USD 11.7 billion in 2010 and USD 14.9 billion in 2015. The aggregated transaction value of greenfield projects stood at USD 10.8 billion in 2010 and USD 11 billion in 2015. The volume of total equity invested has decreased from USD 6.6 billion in 2010 to USD 6.1 billion in 2015. The institutional investor category includes pension funds, insurance companies, private equity and infrastructure funds.

Figure 3. Change in equity mix in wind energy projects in Europe, 2010 and 2015



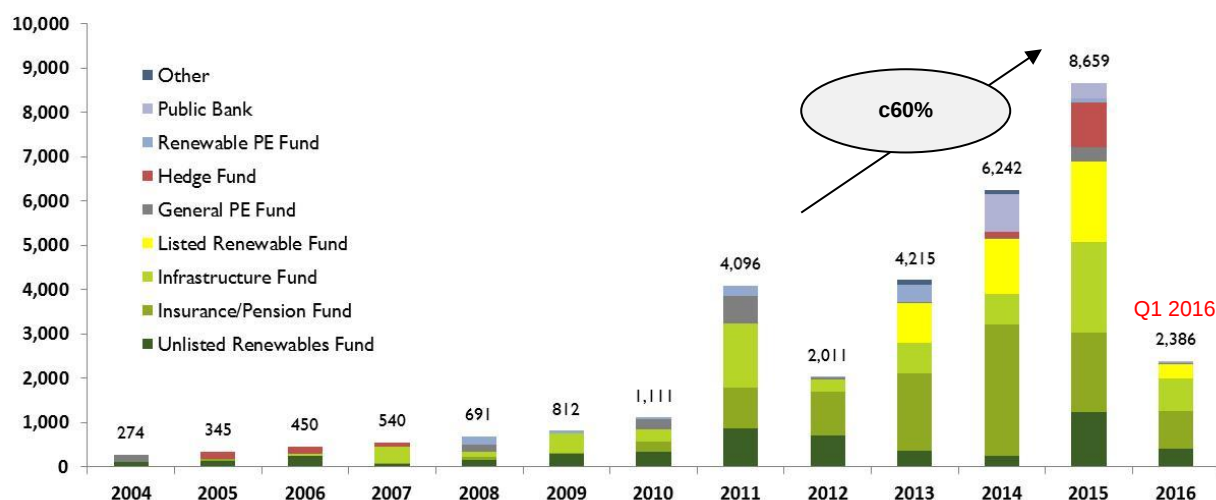
Note: Figures correspond to shares of total equity in sample.

Source: BNEF (2016), OECD calculations.

34. Figure 4 illustrates results from a database maintained by HgCapital focused just on renewable energy in the EU. Using this dataset, institutional investors (broadly defined in Figure 2) have allocated over EUR 25 billion in equity in European projects that have a combined debt and equity investment in excess of EUR 70 billion. Institutional equity investment in EU renewables grew with a 60% CAGR from EUR 2 billion in 2012 to EUR 8.7 billion in 2015.

35. According to HgCapital (2016), the number of active institutional investors in renewable energy has increased from fewer than 10 in 2004 to over 75 in 2016, with direct investment (as opposed to investment through funds) by pension funds, insurance companies and listed “Yieldco” or investment trust funds the fastest growing sources of new capital. In the UK and Germany, with perceived stable regulatory regimes, institutional investor equity has increased as a percentage of total equity investment in EU renewables from 1% in 2007 to 17.5% by the end of 2015.

Figure 4. Institutional equity investment in EU renewable energy projects by investor type (EUR Millions)



Source: Proprietary HgCapital research reproduced with permission of HgCapital

36. In terms of institutional investment in EU renewables, according to HgCapital (2016) operating projects or projects that have completed construction are overwhelmingly favoured by institutional investors, accounting for nearly 80% of all institutional equity capital invested in renewable energy projects since 2011. The number of investors that will invest in completed projects has risen over the last four years, with over 70 active investors. Around 20 institutional investors take construction risk and fewer than 10 currently support project development. Direct project equity accounts for 89% of institutional capital invested in renewables since 2004, and 93% since 2011.

37. Data from HgCapital (2016) also describe an emerging ecosystem of investment in EU renewables. It is one in which private equity funds, dedicated renewable energy fund specialists, and large strategic developers such as Nordic utilities take the early stage risks in developing, building and de-risking projects. Once de-risked, these projects become attractive investments for pension funds, insurance companies, listed Yieldcos and generalist infrastructure funds who are seeking stable but lower yields.

38. In this context, institutional investors are playing a role in recycling capital from the balance sheets of utilities through the sales of project stakes or refinancing. Banks, private equity funds, project developers and utilities can then redeploy the proceeds into the development and construction of new projects (OECD, 2016b). Similarities have been drawn to the commercial real estate sector, where private equity type funds -- which are prepared to take on greater risks in exchange for higher returns -- develop, build and lease out new properties which are then sold on as cash flowing investments to pension funds, real estate investment trusts and other long term investors (HgCapital, 2016).

3. Catalysing the supply of green institutional capital: A stock-taking of approaches

39. While some of these investment figures and pledges may seem large on an absolute basis, they are minute compared to the scale of institutional assets under management, and the scale of the investment demand and financing gap for green and sustainable infrastructure. Further, the individual allocations and pledge levels and activity cited in the previous sections are largely exceptions to the rule that institutional investment in green infrastructure projects have been limited to a very small percentage of the portfolio.

40. The last five recommendations from OECD (2015a) focused on a further element of a strong domestic policy framework, creating the supply-side conditions for scaling up green infrastructure investment by institutional investors. These actions are centred on the establishment of specific policies, instruments, funds, risk mitigants and transaction enablers for mobilising institutional investment. There is an important role for governments in both reducing barriers to investment and supporting the development of investment channels, such as green bonds, funds and direct investment, which can hold the key to scaling-up institutional investment in green infrastructure. The third part of this progress report focuses on these channels, tools and techniques.

3.1 *Research Methodology*

41. The categories of public sector actions considered in the report are informed by the empirical framework laid forth in the Mapping Channels Report (OECD, 2015a), which used a base of 70 examples of institutional investment in sustainable energy (companies and projects) to develop a framework that classifies investments according to different types of financing instruments and investment funds, and highlights the risk mitigants” and “transaction enablers” that governments along with public financial institutions can use to mobilise institutionally held capital. While the methodology was used to analyse the specific case of sustainable energy in the Mapping Channels Report, it was developed with intention of being applied to green infrastructure more broadly, and so is appropriate to use to inspect a broader set of investments in this research.

42. The scope and data collected (in the “stock-taking” research) covers green infrastructure sectors for which there are existing examples of and information on investment by institutional investors, where the public or official sector was present in the investment transaction (the “deal”) using some form of intervention to enable or facilitate these transactions and mobilise private financial capital. The specifications and format used for the stock-taking research are given in Box 1.

Box 1. Attributes included in stock taking

Under each sector, examples of “deals” were included in the form of micro case studies containing key information on the following attributes:

- Physical asset descriptor (e.g. Solar PV installation, [x] MW in [y] Location)
- Channel and financial structure (e.g. direct equity investment; [x] USD)
- Institutional investor (e.g. [name]; public pension fund)
- Stage of the project cycle where investor participated if appropriate (e.g. construction, operation, refinancing, multiple)
- Role and nature of public sector action (e.g. [public financial institution name]; credit enhancement)

43. Risk mitigants include an array of targeted interventions generally aimed at reducing, re-assigning or re-apportioning different investment risks using a variety of mechanisms. Transaction enablers facilitate institutional investment in sustainable energy infrastructure projects by reducing the transaction costs associated with these investments while also mitigating risk in some cases. A partial list of risk mitigants and transaction enablers is shown in the two right-hand columns of Figure 5. Additional examples and definitions are provided in Tables 1 and 2, and a more complete discussion is provided in OECD (2015a).

Figure 5. Defining instruments, funds, risk mitigants and transaction enablers to facilitate green investment

Financial Capital Type	Financing instruments		Funds	Risk mitigants	Transaction enablers
	Capital Market Securities	Cash			
Debt	Sovereign, Suprnational and Agency (SSA) bond Project bond Corporate bond Covered bond Asset-Backed Security (ABS) Collateralised Debt Obligation (CDO) Structured Note	Senior Secured Loan Senior Unsecured Loan Subordinated Loans Junior Loan	Infrastructure debt funds (listed and unlisted) Private debt funds (targeting companies) Special Purpose Vehicle Bond fund Exchange Traded Funds Mutual Fund	Subordination Securitisation Loan or performance guarantees Insurance products Currency swap Public seed capital for funds Cornerstone stake	Warehousing or pooling Co-investment Joint-venture or consortium Co-investment platform Co-operation and collaboration
Mixed	Convertibles (equity and debt) and Mezzanine financing		Mixed debt and equity funds		
Equity	Stock (share)	Unlisted Share	Infrastructure equity funds (listed and unlisted) Private equity funds (targeting companies) Venture capital funds (targeting companies) Special Purpose Vehicle Exchange Traded Fund Mutual Fund YieldCo and other listed structures		

Source: OECD (2015a)

3.2 Results of the stock-taking research

3.2.1 Geography

44. The research resulted in 33 case studies collected (shown in Table 3), which were then divided into eight categories of green infrastructure assets in the database. In total, the case studies included 67 examples of the use of risk mitigants and transaction enablers. Investments were logged in 17 countries. It is important here to note that this study is illustrative only and there would be similar cases in countries not named here. G20 countries hosted the majority of investments observed including multiple deals in Australia, Canada, China, France, India, Italy, Mexico, South Africa, the UK, and the USA.

45. Examples of institutional investment outside of the G20 were also found, for instance in wind projects in Kenya and Uruguay, a water utility plant project in Peru, a geothermal project in the Philippines, a pan-Asian fund, a pan-African fund, and a fund targeting countries eligible for Official Development Assistance.

Table 6. Green infrastructure sectors covered in stock-taking

Sector and Sub-sector	Number of deals	Deal Names
Sustainable energy (power generation and storage) Technologies in sample include: Onshore and offshore wind, solar PV and concentrated PV, solar thermal, geothermal, small scale hydro, bioenergy, fuel cells.	18	GIB Offshore Wind Fund, Greencoat UK Wind, Lake Turkana Wind, Albion Community Power, Crescent Dunes Solar, Bloom Energy, Off Grid Electric Tanzania, Hawaii GEMS, Pampa Wind, ReNew Wind, Hindustan Solar, Tiwi MakBan Geothermal, Montalto di Castro Solar, NTR Wind Fund, Ararat Australia Wind, Cestas Solar, Seine Rive Gauche Wind, Gemini Wind
Green Enabling Infrastructure (Offshore wind interconnectors)	3	Greater Gabbard OFTO, Gwynt y Mor OFTO, Duddon Sands OFTO
Energy efficiency projects (in commercial and residential buildings)	3	Cheltenham Hospital, IDB Efficiency ABS, NY WHEEL
Low-carbon Mobility	2	Quebec Electric Rail, EV Charging China
Green Buildings	1	Hines Poland Fund
Agriculture & Forestry	1	AATIF
Water and Sanitation	1	Consorcio Agua Azul
Mixed Green Infrastructure	4	GEEREF, Kommuninvest Aggregator, CT Green Bank C-PACE, Asia Climate Partners
Total	33	

Source: OECD analysis (author)

3.2.2 *Physical assets*

46. Over half of the deals (18) were in the sustainable energy sector. Within the other half of the sample, six deals involved energy efficiency and green enabling infrastructure such as off-shore wind interconnectors (three each) and two involved low-carbon mobility. Four deals featured multiple types of green infrastructure. The stock-taking was not intended to be comprehensive and was supposed to be limited to selected examples to provide a picture of the range of approaches used. Nevertheless, a fairly thorough search of readily available public information was undertaken. The distribution of samples across the categories reflected the amount of identifiable (and publicly available) institutional investor activity in each sector, with very few examples to be found for some sectors.

47. For instance, in the green buildings, agriculture & forestry and water & sanitation sectors only one example could be identified per sector. While assessing and explaining the paucity of examples in certain sectors is beyond the scope of this research, the lack of data in itself is a finding which would be worthwhile to investigate in future research.

3.2.3 *Stage of project life-cycle*

48. The majority of case studies in the sample focused on construction stage project investment. This finding is at odds with others showing that the vast majority of “organic” institutional investment in renewable energy (i.e. investments occurring without direct specific public intervention) is centred on lower-risk operational assets. Based on this trend, governments appear to be targeting their public intervention at the construction stage, perhaps to address a perceived financing gap specific to the construction stage.

3.2.4 *Public and official sector actors*

49. The results of the research suggest that there are in fact many ways in which governments are already working to help mobilise institutional investment in green infrastructure, using a variety of approaches. A range of public or official sector actors were involved across the case studies. Six deals featured more than one actor, with the *Gemini Wind* deal featuring four (EIB and three export credit

agencies). Six multilateral development banks (ADB, AfDB, EBRD, EIB, IDB and IFC/WBG) were involved in 12 deals (36%).

50. Given the relatively recent establishment of public green investment banks (GIBs), it is notable that five such institutions, located in three countries, were involved across one quarter (eight) of the deals (UK GIB, Australia CEFC, NY Green Bank, Connecticut Green Bank, Hawaii GEMS). A recent OECD report (OECD, 2016b) examines the role of GIBs, which are publicly capitalised entities established specifically to facilitate private investment into domestic low-carbon, climate-resilient infrastructure¹⁶ and other green sectors such as water and waste management. These dedicated green investment entities have been established at national level, state level, county level and city level. GIBs have been added to the ranks of other public financial institutions, including MDBs and bilateral development finance institutions, which are mobilising private investment in sustainable energy and other green infrastructure using interventions to mitigate risks and enable transactions. Other OECD reports focus on the activities of public financial institutions in this area (Miyamoto and Chiofalo, 2015; Cochran et al., 2014).

51. Seven public financial institutions (including national development banks, export credit agencies and a local funding agency) were involved in nine deals (27%). These included actors from six countries: Belgium, Canada, Denmark, Germany, India, Italy and Sweden (ONDD, EDC, EKF, KfW, IIFCL, SACE, and Kommuninvest). Two government-sponsored “blended capital” funds made investments captured in the dataset (Danish Climate Investment Fund and the Africa Agriculture and Trade Investment Fund). The Green Climate Fund was involved with a deal as well, despite only recently becoming operational.

52. A full third of the deals (11) featured actors related to seven sovereign governments and their ministries or agencies (Danish government; French Treasury; German Federal Ministry for Economic Cooperation and Development; Ireland Strategic Investment Fund; Japan International Cooperation Agency; UK Department for Business, Innovation and Skills; and the US Department of the Treasury, Department of Energy, and Agency for International Development). Sub-sovereign governmental actors in Canada and the US were also involved in two deals (Government of Quebec and the Delaware Strategic Fund).

3.2.5 Institutional investors involved

53. Institutional investors were by definition involved in all of the case studies. As distinct from the “organic” institutional investment that is described in section 2, this research focused on deals that featured some type of public or official sector intervention that occurred alongside capital provision by pension funds, insurers and investment managers (that predominantly manage institutional capital). Private equity funds and other forms of investment vehicles that do not disclose their investors are beyond the scope of the research. Half of the deals featured “undisclosed institutional investors”, whose presence in the deal was mentioned publicly but the actors were not named. Total institutional capital committed across the 33 case studies is approximately USD 8 billion.

54. Pension funds were the most active type of institutional investor, with 17 different actors named out of a total of 27 institutional investors whose participation in the deals was disclosed publicly. Notably, five Canadian pension funds (AIMCo, CDPQ, PSP Investments, OPTrust and OTPP) were involved transactions domestically as well as in Australia, the UK and the US. Other institutional investors identified in the sample were from Australia (AMP), Denmark (PBU, PensionDanmark and PKA); France (Mirova); Germany (Allianz, Euler Hermes and KGAL); Japan (Nipponkoa Insurance); New Zealand

¹⁶ Low-carbon and climate-resilient (LCR) infrastructure projects either mitigate greenhouse gas emissions or support adaptation to climate change or both (OECD, 2016b).

(NZSuper); Sweden (AMF Pensionsförsäkring, AP3 and AP4); the UK (Aviva, Greater Manchester Pension Fund, Legal & General, LPFA, and Strathclyde Pension Fund); the US (CalSTRS, UN JSPF, and the Packard and Calvert foundations).

3.3 Risk mitigants in the stock-taking research

55. The 44 risk mitigants logged across the 33 deals include an array of targeted interventions generally aimed at reducing, re-assigning or re-apportioning different investment risks using a variety of mechanisms. By providing coverage for risks which are new and are not currently covered by financial actors, or are simply too costly for investors, risk-mitigating tools increase the attractiveness and acceptability of sustainable energy projects for institutional investors that are particularly risk-averse (e.g. pension funds). These are laid out in a typology and summary shown in Table 7.

Table 7. A typology and summary of risk mitigants deployed

Risk Mitigant	Short description of public or official sector intervention	Deal Example (Name)	Sector	Financing Channel	Actor that deployed risk mitigant	Institutional investor involved
Credit enhancement¹⁷	<i>A credit enhancement is any intervention that improves the chances that financing will be repaid. It is a form of public investment that results in a contingent liability.</i>					
Layered fund subordination	Taking a subordinated position in a fund to give priority to private investors with regard to claims on assets.	GIB Offshore Wind Fund	Sustainable energy	Intermediated unlisted project equity	UK Green Investment Bank	Strathclyde Pension Fund, undisclosed Sovereign Wealth Fund
		AATIF (Africa Agriculture and Trade Investment Fund)	Sustainable agriculture	Intermediated private equity fund	KfW & German Federal Ministry for Economic Cooperation and Development (BMZ)	Undisclosed institutional investors, Deutsche Bank
Partial credit guarantee	Guaranteeing payments for the principal and interest on debt issuance up to certain percentage.	Hindustan Solar	Sustainable energy	Listed project bond	IIFCL, ADB	Yes Bank and other institutional investors
		Energy Efficiency Securitization by the IABD	Energy efficiency	ABS	IADB	Undisclosed institutional investors
		Greater Gabbard offshore transmission link	Sustainable energy	Listed project bond	EIB, EC	Numerous undisclosed institutional investors
Loan guarantee	A legally binding agreement under which the guarantor agrees to pay any or the entire amount due on a loan instrument in the event of non-payment by the borrower.	Crescent Dunes Solar CSP	Sustainable energy	Direct investment in unlisted equity of a project developer	US Department of Energy	Public Sector Pension Investment Board (Canada) and Ontario Teachers' Pension Plan
Revenue guarantee	Guaranteeing certain cash flows for a project	Consortio Agua Azul	Sustainable water	Direct investment in listed project bonds	Government of Peru	Undisclosed local pension funds
		Cestas Solar	Sustainable energy	Direct equity co-investment in asset	French Treasury	Mirova, KKB, ACof, Omnes

¹⁷ Other forms of credit enhancement are possible but were not observed in this deal sample. These include for instance: Loan Loss Reserves and Insurance, Interest Rate Buy-downs and Debt Service Reserves.

Risk Mitigant	Short description of public or official sector intervention	Deal Example (Name)	Sector	Financing Channel	Actor that deployed risk mitigant	Institutional investor involved
Public Investment	<i>Any form of direct public investment or presence in any deal structure.</i>					
Cornerstone stake	An investment in an offering that occurs early in the investment process so as to increase chances of success and to play a demonstration role to attract other investors.	Lake Turkana wind farm	Sustainable energy	Intermediated unlisted equity investment project	Danish government, DCIF (a government-owned fund)	DCIF, Danish pension funds
		Cheltenham General Hospital	Energy efficiency	Intermediated unlisted equity investment project	UK Green Investment Bank	Aviva Investors
		Hines Poland Sustainable Income Fund	Green buildings	Intermediated private equity fund	EBRD	Undisclosed "foreign institutional investor"
Blending	Strategic mixing of concessional, non-concessional and for profit financing to attract risk-capital	Albion Community Power	Sustainable energy	Direct investment in unlisted equity of a pure-play corporate	UK Green Investment Bank	The Greater Manchester Pension Fund, Strathclyde Pension Fund
Grant	Concessional funds allocation	Off grid electric Tanzania	Sustainable energy	Unlisted debt investment intermediated through a debt vehicle	U.S. Agency for International Development	The Packard Foundation, Ceniarth, Calvert Foundation.
Fund seeding	Public investment to help establish private equity funds that specialise in green projects.	GEEREF	Sustainable energy and energy efficiency	Equity: unlisted intermediated fund of funds	EIB	At least 8 private equity funds with institutional investor limited partners

Source: OECD analysis (author)

56. Risk mitigants targeted at credit enhancement (an intervention that improves the chances that financing will be repaid) were deployed 23 times across the sample. The most common technique is the partial credit guarantee which accounted for over half (13) of credit enhancements. Otherwise, five instances of subordination, three revenue guarantees and two loan guarantees were observed.

57. Public investment as a form of risk mitigant was used 21 times, with cornerstone stakes being the most widespread (10). Cornerstone stakes are public investments made in a structure early in the investment process so as to increase chances of success and to play a demonstration role to attract other investors. These were followed by grants (six), the “blending” of concessional and institutional capital to take (four), and one example of seeding fund with public capital.

3.4 Transaction enablers in the stock-taking research

58. Transaction enablers facilitate institutional investment in green infrastructure projects by reducing the transaction costs associated with these investments, or creating new channels, and also mitigating risk in some cases. As most institutional investors have limited experience with direct investment in green infrastructure projects, the cost associated with identifying, executing and managing investments is often prohibitive.

59. Transaction enablers were used 19 times in the sample. Warehousing (pooling small transactions) and securitisation (transforming illiquid assets into tradable securities) were the focus of six transactions. There were six further examples of co-investment and syndication by public actors alongside institutional investors. Public-private partnerships were used on four occasions, and three instances of public actors deploying conduit structures to leverage the capacity and capabilities of a larger or more specialised public institution to access normally unavailable channels.

Table 8. A typology and summary of transaction enablers deployed

Transaction Enabler Type	Short description	Deal Example (Name)	Sector	Financing channel	Actor deployed that the transaction enabler	Institutional investor involved
Securitisation	A technique whereby illiquid or small-scale assets are transformed into securitised products.	Energy efficiency securitisation in Mexico	Energy efficiency	Unlisted debt investment, intermediated	IDB	Numerous institutional investors
Warehousing, pooling	Bundle together smaller projects to get them to a commercial scale that is attractive for institutional investors.	Off Grid Electric	Sustainable energy	Unlisted debt investment, intermediated	Off Grid Electric set up a debt investment vehicle	The David and Lucile Packard Foundation and other family offices
		Greencoat UK Wind	Sustainable energy	Intermediated project equity	Greencoat UK Wind (a listed infrastructure fund)	Numerous institutional investors
Co-investment, joint-ventures, partnerships, consortiums and loan syndication	Institutional investors partner up with other investors to invest in an asset.	Ararat Australia Wind	Sustainable energy	Unlisted direct project debt financing (loan)	Australia Clean Energy Finance Corporation	OPSEU Pension Trust
		NY WHEEL (Warehouse for Energy Efficiency Loans)	Energy efficiency	Direct unlisted debt investment in company structure	NY Green Bank	Undisclosed Institutional Investors, Citigroup
Co-operation and collaboration	Informal sharing of knowledge and resources between actors.	Electric public transport system in Québec	Low-carbon mobility	Unlisted equity investment	LISEA (a concession company created for this project), EIB	Caisse de dépôt et placement du Québec

Conduit aggregation	Leveraging a larger or more specialised public institution to access normally unavailable channels	Kommuninvest aggregator	Mixed green finance	Intermediated, listed SSA green bond	Kommuninvest (Swedish Local Funding Authority)	Ap3, CalSTRS, Joint Pension Fund	AP4, UN Staff
		CT Green Bank C-PACE	Sustainable energy	Intermediated, unlisted non-rated pooled project bonds	Connecticut Green Bank	Undisclosed institutional investors	

Source: OECD analysis (author)

60. Nearly a third of the 33 deals made use of a risk mitigant as well as a transaction enabler. For example, the *Africa Agriculture and Trade Investment Fund* involved three risk mitigants including a credit enhancement (subordination) and two public investments (a cornerstone stake and blending), alongside a partnership transaction enabler. On the other hand, *CT Green Bank C-PACE* featured one risk mitigant (subordination), and four transaction enablers (pooling, warehousing, securitisation and conduit). The *Gemini Wind* transaction was notable again for its usage of three different partial credit guarantees, as well as subordination and co-investment techniques.

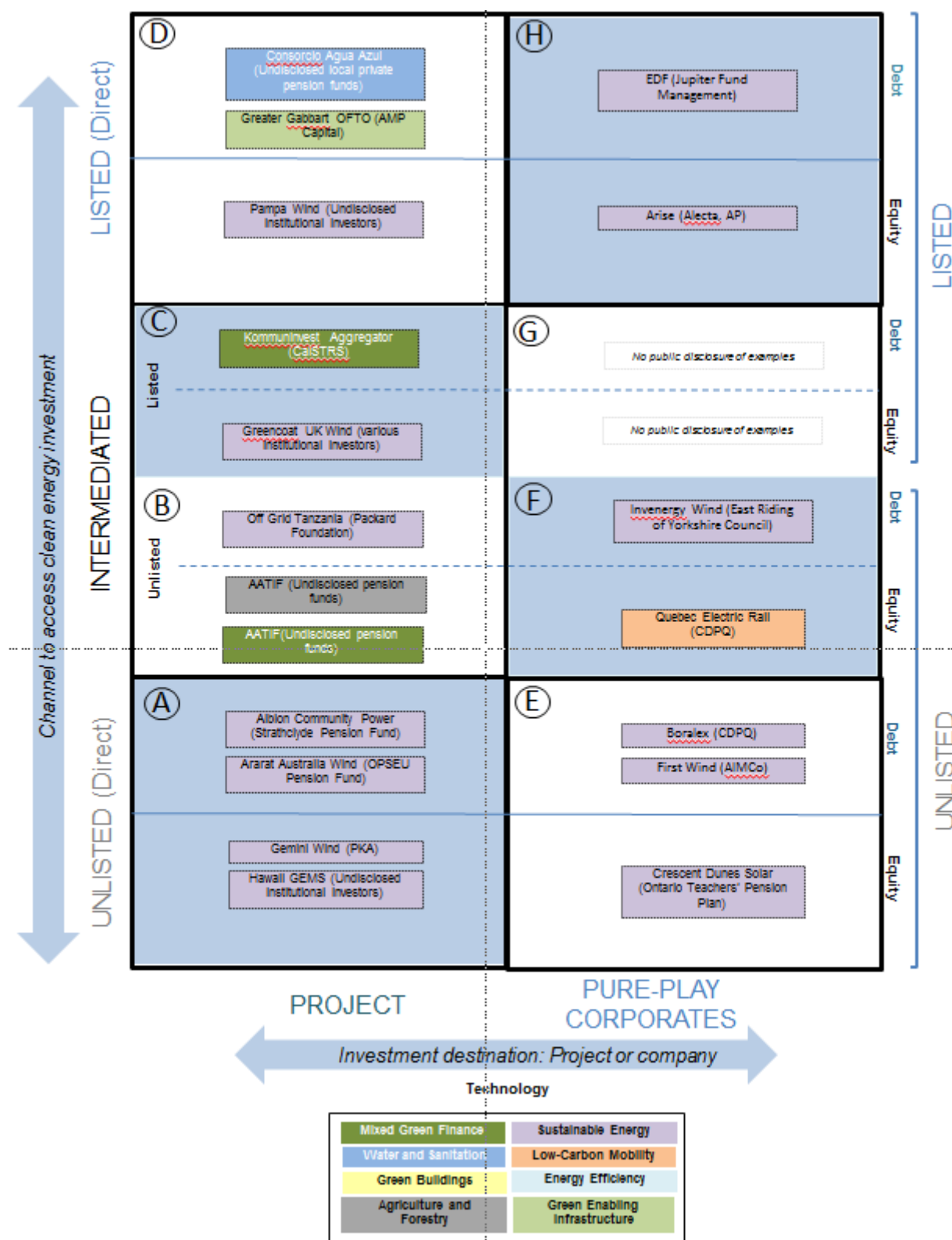
3.5 Mapping channels used by investors in the stock-taking research

61. As described in “Mapping Channels” OECD (2015a), a variety of investment channels are potentially available to institutional investors for accessing green infrastructure, and different channels may be more appropriate when taking into account certain decisions that are routinely made. For example, large institutional investors evaluate prospective investments based on decisions to make the investment directly (“in-house”) or to create a contract with an intermediary (“out-source”) to make the investment on their behalf. Channels can provide exposure to listed or unlisted debt or equity, a single project asset or company or can bundle multiple smaller-scale projects together. Mapping Channels (OECD, 2015a) developed a “Matrix Frame” to visualise the different channels for investment. Some of the deals from the stock-taking research are plotted on such a Frame in Figure 6.

62. In terms of the investment channel used on the equity side (accounting for half of the deals), the most frequent routes to access green infrastructure by institutional investors were unlisted investments in projects made via intermediated funds (8 deals or 25% of the sample), followed by unlisted investments made directly in projects (4 deals, or 13%). There were also two examples each of unlisted direct investments in corporates and listed, intermediated investments in projects.

63. On the debt side, by far the most frequent channel used a project bond structure, accounting for 41% (13) of all deals. There were 10 examples (31% of the sample) of direct investment in a listed project bond structure, and a further three investments in listed project bonds. Of the project bonds, three quarters benefited from credit enhancement techniques; with 60% (8) credit enhanced through some form of partial credit guarantee. Finally, there were two other examples of debt financing (not in the form of a bond) included in the sample; a subordinated loan as part of the Gemini wind transaction, and an unlisted debt fund.

Figure 6 Plotting the stock-taking research examples on a “Matrix Frame” for visualising channels



Source: OECD analysis (Author)

4. Summary and implications for future research

64. Overall, this report endeavoured to both identify areas where organic investment is occurring, and approaches where the public sector is working to overcome barriers to institutional investment, with a view for laying the foundation for further research and analysis as appropriate, including potential additional work in 2017. A first step in determining future avenues for potentially fruitful research is to examine where the report had to draw its boundaries. As such, several areas lay beyond the scope of this report and could usefully be addressed in future research.

65. While the report focused for the most part on direct project investment, an analysis of the role of institutional investors in financing corporate investment would be useful to understand how much of the financing gap these sources can realistically fill. Green corporate investment by institutional investors could be useful to examine from several perspectives, from early stage venture capital and growth capital financing to passive listed equities strategies (e.g. low-carbon index strategies). A deeper inspection of the role of institutions in partnering with corporates on project investments through the project financing cycle, and their role in capital recycling, could similarly be useful.

66. Another area that was beyond the scope of this research was to assess and explain the paucity of examples in certain green infrastructure sectors. While the stock-taking was not intended to be comprehensive and was supposed to be limited to selected examples to provide a picture of the range of approaches used, the distribution of samples across the categories turned out to reflect the amount of identifiable (and publicly available) institutional investor activity in each sector, with very few examples to be found in some places. For instance, in the green buildings, agriculture/forestry and water/sanitation sectors only one example could be identified per sector. Future research could more systematically examine these important sectors also in need of private capital, to understand the role of institutional investors and what barriers might be specific to them.

67. The results of the 33 mini-case studies suggest that there are in fact many ways in which governments are already working to help mobilise institutional investment in green infrastructure, using a variety of approaches. Nearly a third of the deals made use of a risk mitigant as well as a transaction enabler and six deals featured more than one actor. Future research could examine some of the more innovative deals using a more comprehensive and methodical case study approach, to understand what factors were essential in mobilising institutional capital. Assessing empirically the efficiency and effectiveness of different types of risk mitigants and transaction enablers could also hold significant promise for future research, provided the data were of sufficient quality to undertake such a study.

68. With respect to individual actors, drawing on related OECD work (OECD, 2016d), this report also describes some instances where “green investment banks” (GIBs) have sought to engage institutional investors. In recent years, at least a dozen special-purpose GIBs have been established. These are domestically-focused public institutions that use limited public capital to leverage or crowd-in private capital, including from institutional investors, for sustainable energy infrastructure investment. Given the relatively recent establishment of GIBs, it is notable that five such institutions, located in three countries, were involved across one quarter (eight) of the deals. As such, future research could examine the specific role that GIBs play in catalysing institutional capital.

69. Another finding of the stock-taking concerned the specific channel used. The most frequent channel to access green infrastructure across the sample was via a project bond structure (the majority not labelled as green), accounting for 41% (13) of all deals. Of these project bonds, three quarters benefited from credit enhancement techniques; with the majority credit enhanced through some form of partial credit guarantee. This is consistent with findings from a forthcoming OECD report (OECD, 2016c forthcoming) on green bonds, which examines the potential for project bonds, among others, to support green

infrastructure finance. Given the prevalence of this specific channel, future research could examine these deals in depth and options for scaling-up credit enhancement mechanisms for project bonds.

70. Given that institutional investment activity has increased during a low-interest rate environment, key macroeconomic drivers for demand could be important to explore in depth, especially in the context of the ongoing global “search for yield” by institutional investors. Such research could also be geared at improving the understanding on prospects for long-term returns from green infrastructure investing by different types of institutional investor.

71. To date the majority of “organic” institutional investment in green infrastructure projects has occurred predominantly in OECD countries. A separate and very important question is how institutional investors approach green infrastructure investments in emerging markets and developing economies (EMDEs). A quarter (eight) of the deals took place in EMDEs, and three further deals involved mandates that extend to EMDEs. Studying the elements that needed to come together to make these deals work and overcome barriers would be important to determine which interventions hold the most promise for catalysing investment in EMDEs.

72. It follows that it will be very important to explore how institutional investors can interact with international climate finance mechanisms targeted at emerging economies and developing countries. An examination of the role of institutional investors in the emerging international “climate finance” architecture was outside the scope of this analysis but these issues currently arise in discussions around international climate finance and fund mechanisms (see for instance the work of the Global Innovation Lab for Climate finance).

Annex A. The role of sovereign wealth funds (SWFs) and strategic investment funds (SIFs) in green finance: Input provided to the OECD Progress Report by the World Bank Group¹⁸

This note provides a preliminary description of the role of sovereign wealth funds (SWFs) and strategic investment funds (SIFs) in green finance. Above all, the note provides an argument for strengthening the classification and reporting of the green investments of these types of funds. The sheer size of the capital managed by SWFs and SIFs means that their impact on green finance, which is historically a marginal amount, could expand significantly. But existing classification systems and data sources allow for only an approximate and superficial analysis of this impact. In the light of such limitations, existing classification systems and reporting standards used by SWFs and SIFs should be further developed. A unified global standard should allow for the aggregate reporting, assessment, and analysis of these funds' involvement in the green finance space. The next section describes the role of SWFs in green investment; the following two sections outline, respectively, the equivalent role of SIFs, and existing classification and reporting systems for green finance. The note concludes with recommendations drawn from the analysis.

Sovereign Wealth Funds and Green Investments

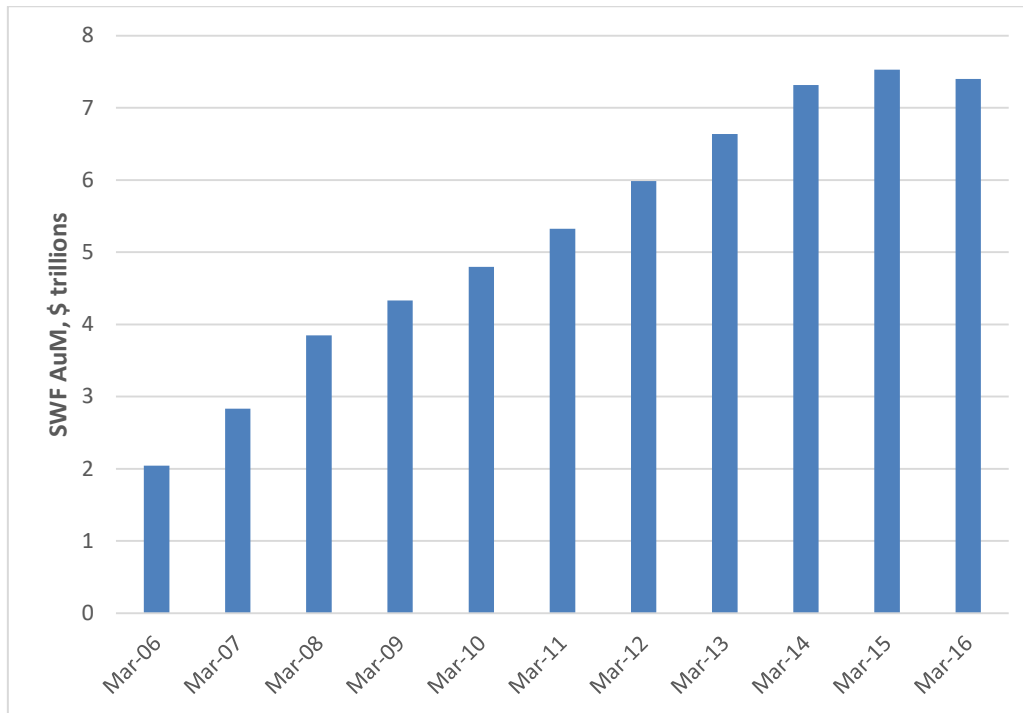
SWFs hold approximately \$7.4 trillion in assets,¹⁹ but do not typically have a mandate to include climate finance. By some assessments, they have in green investments performed below average compared to other institutional investors. According to the Asset Owners Disclosure Project (AODP 2016), which evaluates institutional investors according to their low-carbon activities, five of the ten largest funds (in terms of assets under management, AuM) with the worst rating were SWFs.²⁰

¹⁸ Annex A is authored by Jacob Owens, Håvard Halland and Michel Noel of the World Bank's Finance & Markets Global Practice, Investment Funds Group; May 2016.

¹⁹ The SWF AuM figure of \$7.4 trillion is taken from the Sovereign Wealth Fund Institute for March 2016. The Prequin 2016 SWF Review has SWF AuM at \$6.51 trillion in March 2016.

²⁰ Of the 10 largest funds given the lowest rating by the Asset Owners Disclosure Project (AODP), five are SWFs: the Abu Dhabi Investment Authority, the Kuwait Investment Authority, SAFE Investment Company, SAMA Foreign Holdings, and the Hong Kong Monetary Authority.

Figure 1. Aggregate Sovereign Wealth Fund Assets under Management (\$ trillion), 2006–16



Source: Sovereign Wealth Fund Institute, May 2016.

Note: AuM = assets under management; SWF = sovereign wealth fund.

Although existing classification of and reporting on SWFs' investments do not allow for the precise analysis of these funds' role in green finance, some preliminary estimates can be established (see the appendix for more information on the methodology used).²¹ The Sovereign Wealth Fund Institute (SWFI) tracks information on 79 SWFs, and has partial deal-flow data on 35 of these. Based on transaction data from the SWFI, only 118 of the reported 30,080 transactions from 2006–16 (that is, between January 1, 2006, and May 6, 2016) may be classified as green investments.

Total Reported SWF Deals

From 2006 through 2016, the total value of all deals reported by SWFs was \$995.8 billion. In 2006, the value of all reported deals was only \$16.8 billion, but peaked at \$189.2 billion by 2012, a 1025.13 percent increase.

²¹ In this analysis, a key distinction must be noted: the difference between AuM and total investments. In a given year, the total value of investments will be different from AuM. While historically many funds have disclosed their AuM, there are limited data on their deal flow. Further, some types of deals may be reported more or less often than others: bonds and cash holdings may be disclosed more often than real estate or private equity purchases, for example. Thus, the IEU deals provide only a snapshot of the IEU investments made by SWFs. Looking at the share of green investments among all IEU deals reported provides an approximation of their share of overall IEU investments. But because some asset classes are reported more or less often than others, the share of IEU transactions reported may not be representative of reporting in other sectors and asset classes.

Infrastructure, Energy, and Utility Investments

Infrastructure, energy, and utility (IEU) sector investments accounted for 18.7 percent (\$186.1 billion) of the value of all reported deals. Reported IEU sector investments grew from \$6 billion in 2006 to \$25.6 billion in 2015, an increase of 324.06 percent. IEU sector investments slowed to only 11.37 percent in 2013 (\$21.5 billion), but increased again to 26.17 percent (\$6.4) in 2016 thus far.

Green Investments

Due to the lack of information available about the investment deals, the study relied chiefly on investments into the renewable energy and energy efficiency sectors as the primary indicator of a green investment. Although the green space is much larger than this, encompassing climate resilience and mitigation in a number of different sectors, for the purposes of this paper, only these baseline green investments were examined.

Value of Green Investments.

Green IEU investments account for \$6.7 billion from 2006 through 2016. SWF Green investments grew from nil in 2006 to \$1.2 billion in 2015, with a peak of \$2.2 billion in 2013.

IEU Deals.

Green IEU investments represent 3.6 percent of the value of all reported IEU deals from 2006 through 2016. There are some indications that the share of green investments is increasing, although this trend tends to be driven by a small number of large individual investments. In 2006 there were no green investments in the IEU sectors. The following decade saw a limited and uneven increase, with peaks in 2013, when green investments made up 10.4 percent (\$2.2 billion) of all IEU investments, and in 2016 (through the beginning of May), when 13.4 percent (\$0.9 billion) of IEU investments could be considered green.

All Deals.

Despite the increase in green finance in the IEU sectors, it should be noted that green finance as a share of total investments remains very low. Green IEU investments account for only 0.7 percent of the value of all reported deals.²² Green investments accounted for 0 percent of the value of all reported deals in 2006. By 2015, green investments grew to 0.94 percent (\$1.2 billion) of the value of all reported deals.

²² Note: Due to the lack of information and unclear sector breakdown in the SWFI database, the paper only examines the IEU sectors for green investments. However, the analysis also includes any investments into renewable energy in the ICT sector within the IEU investments. While there may be green deals in the other sectors, the primary focus is on infrastructure and energy. Thus, in evaluating green investments, other sectors such as financials or real estate are not included.

Table 1. SWF Green Investments

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016*	Total, \$ billion
Total reported AuM (\$)	2,324.0	3,208.9	4,044.3	4,498.3	4,905.3	5,431.0	6,134.0	6,821.8	7,401.8	7,474.5	7,400.0	
Value of all reported investments (\$)	16.8	67.3	90.3	107.5	81.1	87.6	65.7	189.2	135.9	130.0	24.4	\$995.8
Infrastructure, energy, and utilities (IEU) investments** (\$)	6.0	13.2	16.5	27.0	18.8	17.6	17.7	21.5	15.7	25.6	6.4	\$186.1
% IEU investments of value of all reported investments	35.95	19.61	18.23	25.10	23.23	20.10	26.87	11.37	11.59	19.72	26.17	18.7%
% IEU investments of total reported AuM	0.26	0.41	0.41	0.60	0.38	0.32	0.29	0.32	0.21	0.34	N/A***	
Green IEU investments (\$)	0.0	0.0	0.0	0.0	1.1	0.2	0.0	2.2	1.1	1.2	0.9	\$6.7
% Green investments of total reported IEU investments**	0.00	0.00	0.00	0.09	5.61	0.89	0.27	10.43	6.84	4.76	13.41	3.6%
% Green investments of value of all reported investments	0.00	0.00	0.00	0.02	1.30	0.18	0.07	1.19	0.79	0.94	3.51	0.7%
% Green IEU investments of total AuM	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.03	0.01	0.02	N/A***	

Source: **Sovereign Wealth Fund Institute Transaction Database; internal WBG analysis.**

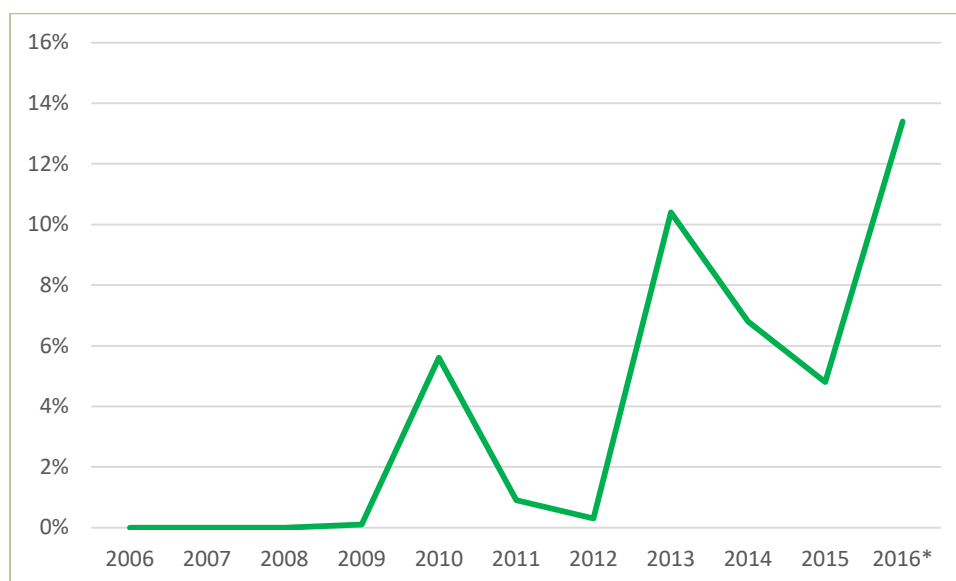
Note: *2016: This includes data from January 1, 2016, through to May 6, 2016.

**The data cover the IEU sectors, as noted in the SWFI database. Some investments in alternative and clean energy technology are also included to capture a more complete picture of green investments.

*** Cannot report as a percentage of 2016 yet, as deals for the entire year are required.

**** See annex for methodology.

Figure 2. The Green Investments of Sovereign Wealth Funds (as % of IEU investments)

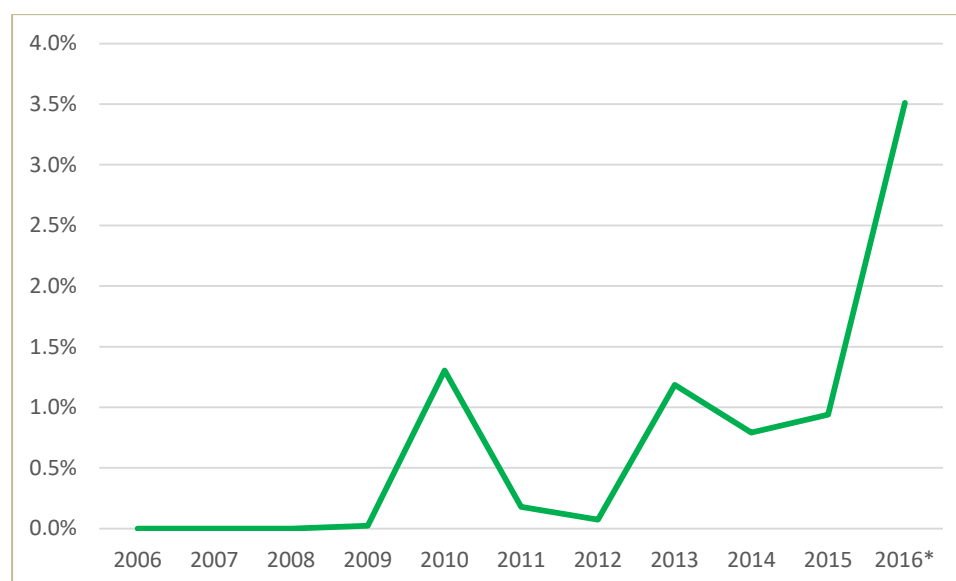


Source: Sovereign Wealth Fund Institute Transaction Database; internal WBG analysis.

Note: The data cover the IEU sectors, as noted in the SWFI database. Some investments in alternative and clean energy technology are also included to capture a more complete picture of green investments.

* Data for January 1, 2016, through May 6, 2016.

Figure 3. The Green Investments of Sovereign Wealth Funds (as % of Value of Total Investment)



Source: Sovereign Wealth Fund Institute Transaction Database; internal WBG analysis.

Note: The data cover the IEU sectors, as noted in the SWFI database. Some investments in alternative and clean energy technology are also included to capture a more complete picture of green investments.

* Data for January 1, 2016, through May 6, 2016.

Strategic Investment Funds and Green Investment

A new type of sovereign investment fund has emerged over the last few years as a credible way to address urgent investment needs in development and climate finance. Strategic Investment Funds (SIFs) have been established or are being planned in a growing number of advanced economies as well as in emerging markets and developing economies. SIFs invest to achieve the double bottom-line objective of both financial *and* economic returns, and have the capacity to offer professional investment expertise. They are sponsored and/or fully or partly capitalized by a government, by several governments, or by global or regional entities, and invest primarily in equity.

Box 1. Definition of Strategic Investment Funds

Strategic Investment Funds (SIFs) can be described as investment funds that exhibit all of the following four characteristics.

- Sponsored and/or fully or partly capitalized by a government, by several governments, or by global or regional entities
- Invest to achieve financial as well as economic returns, according to a double bottom line objective of financial and economic returns
- Have the capacity to offer professional investment expertise
- Invest primarily in equity. May also invest in quasi-equity or debt

Source: Halland, Noel, and Tordo, forthcoming 2016.

Several SIFs hold or aim for a significant share of green investments in their portfolio. These include funds such as the €8 billion Ireland Strategic Investment Fund (ISIF), and the \$625 million Philippine Alliance for Infrastructure (PINAI), among many others. Several international SIFs are active in the clean energy space, such as the Global Energy Efficiency and Renewable Energy Fund (GEEREF), a fund-of-funds managed by the European Investment Bank, and the Asia Climate Partners, partly capitalized by the Asian Development Bank. One explicitly climate-focused SIF is being established at the national level by Norway. As of 2016, at least 20 countries have established SIFs. For further information on the classification of SIFs, see the forthcoming paper ‘Strategic Investment Funds: Opportunities and Challenges’ (Halland, Noel, and Tordo; 2016).

Importantly, many SIFs focus on their role as cornerstone investors. They co-invest with domestic and foreign private investors for the purpose of attracting private capital to priority sectors and projects. These funds apply a public capital multiplier to their investments. The value of the public capital multiplier, defined as the amount of private capital mobilized per unit of public capital invested in a project, (see Halland, Noël, and Tordo [forthcoming 2016] for a more precise definition) varies greatly. Frequently it lies in the area of 1:10 to 1:15 for a direct investment SIF that is fully publicly owned and capitalized—and can be much higher for a fund-of-funds (a SIF that invests in other investment funds). The capacity of SIFs to catalyse the investment of institutional and private investors in clean energy projects has been demonstrated by funds such as GEEREF, the PINAI, and several others.

Box 2. The Green Investments of Strategic Investment Funds

Philippine Investment Alliance for Infrastructure

Established in 2012, the Philippine Investment Alliance for Infrastructure (PINAI) is a \$625 million, 10-year closed-end private-equity-type fund. The fund is managed by an external, private sector manager—Macquarie Infrastructure and Real Assets (MIRA)—and its policy objectives include (i) attracting top-tier international partners, (ii) fostering competition in domestic

infrastructure finance, and (iii) establishing a secondary market for well-performing infrastructure assets. PINAI aims to provide equity and quasi-equity (mezzanine debt) financing in core infrastructure assets exclusively in the Philippines. It seeks to invest in a portfolio of greenfield and brownfield projects across a broad range of infrastructure sectors (including power, transport, and telecommunications) and has a cap on greenfield exposure.

PINAI's first investment of \$85 million was in an 81 MW wind farm in the Northern Luzon. PINAI will own 32 percent of the project, while the two other private joint venture partners—AC Energy (Ayala Corp.) and UPC Renewables Partners—will own 64 percent and 4 percent, respectively.

Senegal's Fonds Souverain d'Investissements Stratégiques

Senegal's Fonds Souverain d'Investissements Stratégiques (FONSIS) is a strategic investment fund focused on attracting private investment to Senegal by operating as a private equity investor on behalf of the government. Established in 2013, it aims to invest in projects that stimulate economic growth and job creation in the framework of the national development plan while creating wealth for current and future generations. Its stated policy objectives include the support of economically strategic sectors, sustainable jobs, and small and medium enterprises (SMEs), as well as the optimization and management of state-owned assets.

In February 2015, FONSIS completed financing a €41.16 million, 30 MW solar energy project, Santhiou Mékhé, alongside the European investment company Meridiam. A third equity investor, Senergy SUARL, is a Senegalese company engaged in developing energy projects. FONSIS has committed to providing €2.63 million, or 32 percent, of the project's equity capital. Meridiam is the majority shareholder (53 percent) of Senergy PV SA, with a capital contribution of €4.36 million. Proparco, the French Development Agency's private sector arm, will provide €33 million in debt financing. In this way, FONSIS has been able to mobilize \$16 of external investment for every \$1 of its own invested capital—a multiplier of 1:16, well above its targeted average multiplier of 1:12.

Source: Adapted from Inderst (2016); Foce Consultora (2016); Halland and Noël, and Tordo (forthcoming 2016).

Existing Classification and Reporting Systems for Green Finance

The dearth of information on the green investments of SWFs in general, as well as on those of SIFs, is to some extent due to insufficiently developed classification systems; it is also due to these funds' lack of disclosure and reporting to existing databases. There are several classification systems, and at least one database, that would be useful precursors to (or partners in) a more fully developed system for the classification, disclosure, and reporting of the green investments of these types of funds. The most important of these systems are briefly discussed below.

Existing Classification Systems

Green finance is an expansive and varied space, and different definitions and systems are used by different industries. Examples of current schematics or frameworks include:

- [The Climate Strategies and Metrics](#), part of the Greenhouse Gas Protocol,²³ offers a valuable toolkit, but relies on the information provided by institutional investors themselves on specific projects. Further, it focuses on carbon risk, while green finance is a significantly larger space that encompasses not only carbon risk but also climate resilience, mitigation, and adaptation financing.
- [Climate Change Investment Solutions: A Guide for Asset Owners](#), published by the Institutional Investors Group on Climate Change,²⁴ provides a range of investment strategies and solutions associated with climate change risk. It offers a strategic overview of climate change investment solutions centered on policy evolution and change, and also describes asset allocation examples. The guide includes an insightful discussion of resilience sectors, and its broad categories could be used as a framework for specific subsectors.
- The [AODP Global Climate Index](#) provides a standard for assessing how large, global investors conduct climate-risk management. Climate-risk is specific financial risks attributed to climate change. The AODP uses a 41-question survey to assess engagement, portfolio carbon-risk management, and low-carbon investment. It provides a classification system evaluating funds overall, but not a database of the investments themselves. This system relies on asset owners' disclosures and includes only institutional investors with at least \$2 billion AUM. The scoring does not provide a detailed breakdown of green finance investments, but provides a comparative overview of different investor types and funds. It focuses on exposure to low-carbon investments, and not green finance overall.

As can be seen from these examples, there are various standards used in the green finance space. None is comprehensive, and most focus on policy and management rather than actual deal requirements to qualify as a green investment. A more comprehensive set of standards would be useful: any deal could then be quickly assessed to determine if it qualifies as a green investment. Further, many companies not initially established in the low-carbon or green space have begun projects or new programs in this area, leaving it unclear whether an investment in these companies counts as green finance. Ideally, a green finance categorization system for SWFs and SIFs would be built on existing frameworks and guides. It would be designed to be exhaustive and at the same time specific in identifying what constitutes a green versus a non-green investment across all asset classes.

Existing Databases

The successful implementation of a robust classification system depends upon the disclosure and thorough reporting of participating SWFs and SIFs. This requires that all deals in the green finance space be tracked, that the sectors and industries they occupy be clearly identified, and that there be standardized reporting of the details involved. Disclosure and reporting need to be comprehensive, since determining the proportion of green finance requires information on all the deals and investments conducted by a fund.

[The Low Carbon Investment Registry](#) (LCIR), a database compiled by the Global Investor Coalition on Climate Change and built largely upon the Climate Bonds Initiative Taxonomy, relies on the self-reported disclosures of institutional investors. It offers one of the most robust classification systems

²³ The Climate Strategies and Metrics are produced by the 2 Degrees Investing Initiative, the World Resources Institute, and the United Nations Environment Programme (UNEP) Finance Initiative through the Greenhouse Gas Protocol.

²⁴ The guide is produced by the Institutional Investors Group on Climate Change, the Investor Network on Climate Risk, the Investor Group on Climate Change, and the Asia Investor Group on Climate Change. It is a successor to the sector overview, [Financial Institutions Taking Action on Climate Change](#).

available, but focuses on the low-carbon space solely, while the green industry is larger. SWFs have minimal presence in this database. The LCIR has the potential to become a useful tool for SWF and SIF policy makers—that is, if more deals were disclosed and reported to the database.

Recommendations

In light of the large amount of capital managed by SWFs and SIFs, their long-term investment horizons, and thus their potentially significant role in green finance, it is important to strengthen the information available on these funds' green investments. Such measures would need to be implemented in partnership with representative organizations, in particular the International Forum of Sovereign Wealth Funds (IFSWF). The IFSWF has 30 fund members accounting for approximately 80 percent of SWF assets globally, and is responsible for establishing the Santiago Principles—a general governance framework for SWFs. Given their role in setting governance and transparency standards for SWFs, the IFSWF is uniquely positioned to address the need for greater information on green investments by SWFs.

Priority actions may include the establishment of a common classification system for SWFs' and SIFs' green investments, and revised standards for self-reporting among SWFs. Such reporting could feed into a new and separate database established specifically for SWFs and SIFs, or existing databases such as the LCIR.

SWFs and SIFs differ widely in terms of transparency and disclosure of information, and it is unlikely that the less transparent funds would at first find it in their interest to increase their reporting of green investments. But momentum could initially be built with the help of the more transparent and climate-conscious funds. As the global green investment agenda gains further traction, and pressure builds on investors to green their portfolios, traditionally less transparent SWFs may find it in their interest to join later.

Appendix (Annex A)

A Methodology Used to Evaluate the Green Investments of Sovereign Wealth Funds

Sectors. Using the Sovereign Wealth Fund Institute (SWFI) transaction database, the authors combined deals in the infrastructure, energy, and utilities (IEU) sectors, including all of their subindustries. They also included investments in alternative energy and solar industries within the technology sector, since these are part of the clean energy supply chain, and SWF investments in such companies could represent a shift into the green sector. Such industries represent a vast spectrum of different SWF assets. Meanwhile, the green energy and climate finance sector encompasses clean energy generation, distribution, and technology, as well as the reduction of energy use.

Green. Coding green investments was a several-stage process. First, any investments in renewable energy, such as solar or wind, were considered green investments. Second, the authors evaluated whether any investments in the infrastructure or energy sectors might be considered green because of the profiles of the companies involved, or because they focused on environmental or sustainable infrastructure. For example, Amyris is an industrial bioscience company that produces renewable alternatives to petroleum-based products, from fuels and lubricants to food ingredients and cosmetics. For the purposes of this analysis, Amyris is a green investment. Lastly, the authors decided to include investments in alternative energy technologies within the analysis. While traditionally these investments would be considered technology/information technology investments, they may be considered as part of the green energy supply chain since many of the companies involved produce the solar panels used in solar plants.

Transaction notes. The database is not exhaustive, and does not include many transactions from earlier years. Many SWFs are historically opaque, and a significant share of their investments was not made public. Further, the line between a green investment and a regular investment is not always clear. Many companies might be changing their corporate governance structure to be more environmentally friendly and moving into the renewable space, but might not be considered a green investment because of the large amounts they allocate toward traditional energy sources. On the other hand, some deals may not be counted as green investments simply because of a lack of information. Thus, the results represent the authors' best estimates, and should not be taken as an exhaustive analysis of SWF investments. Using the SWFI data for global assets under management, the authors used Q1 of a given year in order to get align the historical data with Q1 2016 data.

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Annex B. Recommendations for policy makers included in Mapping Channels (OECD, 2015a)

Governments have a central role to play in mobilising capital through the establishment of reform agendas that deliver “investment-grade policies”. In most countries, climate and investment policies have to date functioned quite separately and sometimes at cross-purposes, preventing or slowing investment in green infrastructure. Integrating climate and investment policies can help these different policy communities work together to achieve the common goal of achieving low carbon-and climate-resilient (LCR) economy and greener growth.

In view of the diverse and challenging barriers across policy domains to mobilising institutional investment for green infrastructure, an emerging policy priority is to understand what other policy initiatives are needed to reinforce and support efforts to scale up investment by institutional investors. For energy systems, this implies a more systematic and holistic analysis of the range of policy interventions that are required to undertake this challenge.

Building on findings from previous OECD reports, in particular the policy recommendations of the G20/OECD High-Level Principles of Long-Term Investment Financing by Institutional Investors and based on a review of key trends in institutional investment and investment channels (e.g. the rapid growth of the green bond market, and the emergence of “YieldCos”), the OECD gathered the following high-level policy options or directions on actions by governments to address barriers and facilitate institutional investment in green infrastructure. These recommendations are presented below in abridged form and focus on sustainable energy but are applicable to a wide range of green infrastructure. Annex C of OECD (2015a) provides the foundation for this abridged list with a comprehensive discussion of policy recommendations, annotated and referenced against existing OECD policy guidance and G20 recommendations.

1. **Establish preconditions for institutional investment and favourable framework conditions for long-term investment financing.** Take steps to: a) improve the business climate, rule of law and investment regime underpinning sustainable energy infrastructure investments; b) strengthen competition policy through designing open and transparent procurement processes; create a level playing field between independent power producers (IPPs) of sustainable energy and incumbent state-owned enterprises (SOEs); and c) encourage the formation of pools of long-term savings and improve the governance of institutional investors, including addressing “short-termism” and promoting long term investment while prompting disclosure of risks associated with long-term assets.
2. **Ensure a stable, transparent and integrated “investment-grade” policy environment addressing key barriers to investment by institutional investors.** Institute a “Green Investment Policy Framework”; avoid sudden or retroactive change to support policies in order to provide predictability to investors; examine the case for introducing barriers to policy change through legislation or contractual liabilities that make it unattractive to change retrospectively; examine potentially unintended consequences of policies that impede the mobilisation of institutional investment and ascertain whether regulatory and other financial market rules (e.g. accounting, solvency and investment restrictions) are unintentionally and unnecessarily hindering investment in sustainable energy.²⁵

²⁵ It is important to note that some financial regulations may have been designed to deliberately influence the cost of providing capital to some sectors, possibly including green infrastructure, reflecting assessments of heightened degrees of risk. If financial regulations are intended to influence the cost of providing capital to

3. **Improve risk-return profiles of sustainable energy projects by addressing market failures while improving electricity market design.** Put an explicit price on carbon; give a clear policy signal of a rising cost for CO₂ emissions over time through explicit and implicit carbon pricing policies; and phase out fossil fuel subsidies. Provide an electricity market context that assures a reasonable and predictable return for investors in power generation and associated enabling infrastructure. Promote well-designed and time-bound sustainable energy support policies, when needed, to improve risk-return profiles. Promote the use of contracts such as Power Purchase Agreements that provide the stable and certain revenue which is instrumental to attracting institutional investors who seek these cash flow characteristics.
4. **Establish a national infrastructure strategy and road map with project pipeline.** Develop a sustainable energy plan within a national infrastructure strategy which maps out timing, capacity needs and location for new assets; deployment targets; the duration and level of support policies; and technology-specific considerations. The strategy should be revisited and updated regularly based on periodic reviews to take into account evolving technology developments and views on policy needs. Create a credible sustainable energy pipeline to provide investors with confidence that investable projects will be forthcoming. Create and support facilities focused on improving the “bankability” of projects through preparation and selection and support initiatives aimed at improving enhanced partnership between the various actors along the project finance chain.
5. **Facilitate the development of markets for sustainable energy infrastructure financing instruments** (e.g. for debt in the form of green bonds) and funds (e.g. for equity in the form of listed YieldCo-type funds) tailored to investor risk profiles across the project lifecycle and developed in co-operation with investors. Evaluate the use of unlisted equity funds, providing structures and fee arrangements that are agreeable to investors; such funds have a large potential to attract investment, in particular, appealing to smaller investors that prefer diversification and outsourced asset management duties. Evaluate the case for passing or amending legislation allowing for sustainable energy infrastructure to be included in existing vehicles that appeal to a diverse set of investors with differing tax, liquidity or investment profiles (e.g. covered bonds, Master Limited Partnerships, closed- and open-end funds, and Real Estate Investment Trusts).
6. **Facilitate the development of risk mitigants** where they would “crowd-in” private investment and result in more appropriate allocation of risks and their associated returns (e.g. credit enhancements and revenue guarantees, first-loss provisions, insurance, cornerstone stakes, and risk mitigants targeting different challenges across stages of the project lifecycle).
7. **Reduce the transaction costs associated with sustainable energy investment.** Support channels for securitisation of sustainable energy debt to pool small scale projects using a prudent and judicious approach (e.g. supporting efforts to standardise contracts and project evaluation structures, creating aggregation and “warehousing” facilities). Encourage the bundling of assets to reach relevant scale, appealing to institutional investors, including consortia of small-scale PPP projects. Develop a sustainable energy project exchange network for large-scale projects; foster collaboration, innovation and knowledge-sharing amongst institutional investors and with other financial institutions.
8. **Promote market transparency and standardisation, and improve data** on performance, risks and costs of sustainable energy investments across available channels while promoting public-

some sectors, then these concerns should be considered, but must be weighed against the broader benefits to financial stability.

private dialogue. Strengthen, as appropriate, requirements for institutional investors to provide information on sustainable energy investments, following internationally agreed definitions, so as to enhance monitoring and understanding of the risk profile of these investments. Encourage the formation of benchmarks, including sustainability criteria, to facilitate due diligence of green infrastructure and asset allocation modelling.

9. **Consider the case for establishing a special-purpose “green investment bank” (GIB)** or refocusing activities of existing public finance institutions to mobilise private investment for sustainable energy infrastructure. GIBs can facilitate the development of financing instruments and funds, de-risking risk mitigants and transaction enablers to lower transactions costs, and provide technical advice and project preparation and selection.

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