Green Finance and Investment

Mapping Channels to Mobilise Institutional Investment in Sustainable Energy

OECD

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Preface

The next 20 years will need to see some USD 53 trillion in cumulative capital expenditure on energy supply and in energy efficiency to get the world onto a 2°C emissions path. This amount will be spent on dramatically extending energy services available in rapidly-growing emerging economies and developing countries and renewing the energy infrastructure of developed countries. The scale of this investment is so large that it will, inevitably, have to rely in large part on mobilising private capital. A key potential source is the capital controlled by institutional investors.

Whether institutional capital can be mobilised to support infrastructure development – and whether the infrastructure in question is "green" or "brown" – will depend on the risk-return profile of infrastructure investments and the regulatory environment in which these investors operate. The costs of sustainable energy are contingent on the cost of capital, which is influenced by the risk perceptions of investors. If governments wish to mobilise capital from institutional investors for sustainable energy, they need to simultaneously understand not only the barriers to investment and how to surmount them but also the channels through which such capital can flow.

Discussions on innovative financing solutions often do not illuminate how capital is already allocated to infrastructure investments and the particularities of the different investment channels used. Furthermore, institutional investors are often referred to generically without an appreciation of their sheer diversity. To effectively target government interventions to mobilise investment, policy makers need to take account of the range of investment channels available, and how the preferences, structures and risk appetites of different types of institutional investors impact on their investment decisions.

This report is intended to provide a wide array of policy makers (not necessarily just those familiar with financial policy) with a more complete view of the channels for investment in sustainable energy infrastructure. It also provides insights on the factors influencing investment decisions in different channels, the key policy levers and risk mitigants that governments can use to facilitate sustainable energy infrastructure investments, and an update on emerging channels that hold significant promise for scaling up institutional investment. These channels include, in particular, green bonds, YieldCos (publicly-traded funds that are formed to own operating projects producing cash flows) and direct project investment.

The report develops 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 intermediaries like public green investment banks and other public financial institutions can use to mobilise institutionally held capital. Underpinning the analysis is an empirical base of 47 examples of institutional investment in sustainable energy projects along with 20 examples of investment in "pure play" sustainable energy companies identified for the report. This framework can be used to identify where investment is or is not flowing, and to focus attention on how

governments can support the development of potentially promising investment channels. The report builds on five years of OECD contributions to a deepening body of policy and academic literature examining the potential role of institutional investors in financing green growth and the transition to a low-carbon economy.

While capital is available to be deployed, it is "bankable" projects that are lacking. If countries want to significantly augment the flow of capital allocated to sustainable energy infrastructure by institutional investors – particularly in the absence of an unambiguous carbon price signal – they need to consider policy interventions that make that allocation more likely. This report suggests ways in which they can.

Simon Upton
Director, OECD Environment Directorate

Foreword

At the core of the OECD's work on climate finance and investment is the recognition that policy makers need to focus on and strongly influence how decisions are made to invest in long-lived infrastructure if global climate change goals are to be achieved. To meet these goals, a massive shift of investment toward low-carbon, climate-resilient infrastructure must occur. For institutional investors in OECD countries which manage a very large share of national savings, a fundamental pre-condition for investing in sustainable energy infrastructure is the presence of investment grade policies – the domestic framework of policies that provides clear price signals and 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 pension fund) regulations can undermine policies that are otherwise supportive of the low-carbon transition.

A key element of a strong domestic policy framework is the establishment of specific financial policies, instruments, funds and risk mitigants that provide transitional support for new low-carbon and climate-resilient technologies. This element has been the focus of the OECD's ongoing work on institutional investors and sustainable energy infrastructure investment. There is an important role for governments in both reducing barriers to investment and supporting the development of important investment channels, such as green bonds, YieldCos and direct investment, which can hold the key to scaling-up institutional investment in sustainable energy. This report covers the landscape of sustainable energy investment channels and decision-making to shine light on how governments can help shift large capital flows to support the low-carbon transition. This report also addresses questions such as: why are green bonds, YieldCos and direct investment potentially promising channels? Are institutional investors already making such investments? Do all institutional investors view sustainable energy investments in a similar way? What risk mitigants can governments provide to influence investment decisions?

This report is a contribution to a deepening body of literature examining the potential role of institutional investors in financing green growth and the transition to a low-carbon economy. It also adds to literature examining the role of institutional investors in financing long-term investment more broadly. Lastly, the report complements other literature focused on identifying barriers to low-carbon investment, and analysing the potential for innovative financing instruments and risk mitigants to use limited public funds to catalyse private investment in support of climate action.

This report is transmitted to G20 Finance Ministers and Central Bank Governors at their meeting on 9-10 February 2015, in Istanbul. This report will contribute to a broader G20/OECD project to develop a "Taxonomy of Long-term Investment and Infrastructure Financing". It is designed to complement this overarching analysis by providing an

in-depth examination of sustainable energy as a discrete sector within the broader category of economic infrastructure.

The previous OECD report examining this topic (*Institutional Investors and Green Infrastructure Investments: Selected Case Studies*) was delivered to the G20 Study Group on Financing for Investment and 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. It provides a foundation of analysis for this report and can be referred to for more detailed explanations and examples of the issues discussed in this report.

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Acronyms and abbreviations

ABS	Asset Backed Security
ADB	Asian Development Bank
AIMCo	Alberta Investment Management Corporation
ALM	Asset Liability Management
AMF	Ascending Markets Financial Guarantee Corporation
AODP	Asset Owners Disclosure Project
AUM	Assets under Management
BIS	Bank for International Settlements
BNDES	Brazilian Development Bank
BNEF	Bloomberg New Energy Finance
CalPERS	California Public Employees' Retirement System
CalSTRS	California State Teachers' Retirement System
CDPQ	Caisse de Depot et Placement du Quebec
CO_2	Carbon dioxide
CPI	Climate Policy Initiative
CPPIB	Canada Pension Plan Investment Board
CPV	Concentrated Photovoltaic
CSP	Concentrated solar power
EIB	European Investment Bank
EDF	Électricité de France
EKF	(Danish) Export Kredit Fonden
EPC	Engineering, procurement and construction
ETFs	Exchange-Traded Funds
FSB	Financial Stability Board
GCF	Green Climate Fund
GIB	Green Investment Bank
GIC	Global Investor Coalition on Climate Change
GIEK	(Norwegian) Garantiinstituttet for eksportkreditt (Export Credit Agency)
GP	General Partner

GSIA	Global Strategic Investment Alliance
GSIS	Government Service Insurance System
IEA	International Energy Agency
IFM	Industry Funds Management
IFC	International Finance Corporation
IPO	Initial Public Offering
ITF	International Transport Forum
LCR	Low-Carbon and Climate-Resilient
LP	Limited Partners
MIGA	Multilateral Investment Guarantee Agency
MW	Mega Watt
NAPF	National Association of Pension Funds
NEA	Nuclear Energy Agency
NREL	National Renewable Energy Laboratory
OFTO	Offshore Transmission Owner
ONDD	(Belgian) Office National du Ducroire (Export Credit Agency)
OPIC	Overseas Private Investment Corporation
PAIDF	Pan African Infrastructure Development Fund
PBCE	Project Bond Credit Enhancement
PE	Private Equity
PIP	Pensions Infrastructure Platform
PPA	Power Purchase Agreement
PPF	Pension Protection Fund
PPP	Public-Private Partnership
PPRFs	Public Pension Reserve Funds
PV	Photovoltaic
REPIN	Renewable Energy Platform for Institutional Investors
SAA	Strategic Asset Allocation
SWF	Sovereign Wealth Funds
TCE	Transaction Cost Economics
UK BIS	United Kingdom Department for Business, Innovation and Skills
UK GIB	United Kingdom Green Investment Bank
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank

Executive summary

Agreements reached in Cancún, Mexico, at the 2010 United Nations climate change conference recognised the need for deep cuts in global greenhouse gas (GHG) emissions in order to keep the global average temperature increase below two degrees Celsius (2°C) above pre-industrial levels. To meet a two-degree climate change goal, massive investments will need to be made in the coming decades in low-carbon and climate-resilient (LCR) infrastructure. Public finance can and does play a critical role to "jump start", leverage and guide LCR investment, but transformational change will inevitably require large-scale private sector engagement.

However, traditional sources of private financing for sustainable energy infrastructure – governments, utilities, project developers and financial sector sources – face significant financial, regulatory and structural constraints. While the banking sector remains a key provider of investment financing, significant 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 sustainable energy infrastructure.

In OECD countries these investors held USD 92.6 trillion in assets in 2013. Continued growth in inflows of assets is occurring in both OECD and emerging economies and developing countries. Yet, while there are expanding pockets of activity in sustainable energy investment by institutional investors, as illustrated in the examples of large pension fund investments provided in this report, their investments in this area to date have been minimal compared to the scale of their assets. Looking just at large pension funds surveyed by the OECD, due to a range of barriers, direct investment in infrastructure projects of all types accounted for only 1% of their asset allocation in 2013. Large pension fund allocation to sustainable energy investment was estimated to be much smaller – only 3% of that 1% share.

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 sustainable energy 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 finance major investment projects in any given country, including investments in sustainable energy infrastructure, will be heavily influenced by perceptions of the country's sovereign risk, investment climate, policy settings, and institutions. At the same time, regulatory risks around unabated fossil-related investments can be expected to increase and returns from such investments can be expected to fall with the level of stringency of carbon pricing and climate change mitigation policy and improved governance and standards (e.g. on air pollution). This is particularly the case in the developing world where much of the infrastructure is likely to be built.

A critical issue for governments seeking to scale-up private investments is how to support the development of investment channels for sustainable energy that hold potential

to attract institutional investment and to lower the cost of capital for sustainable energy. To do so effectively, it is important for policy makers with varying degrees of familiarity with finance to have an appreciation of the full range of investment channels that are potentially available to institutional investors, and how diverse institutional investors consider investing in different channels. 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 a single project asset or company or can bundle multiple smaller-scale projects together.

The principal goal of this report is to provide policy makers with an integrated review of the myriad investment channels (instruments and funds) that can be used for sustainable energy infrastructure and the interventions that can enable or facilitate these investments, either through mitigating risks (risk mitigants) or lowering transaction costs (transaction enablers).

Risk mitigants include a range of targeted interventions generally aimed at reducing, re-assigning or re-apportioning different investment risks using mechanisms such as guarantees and insurance products, public stakes and other forms of credit enhancement. 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).

As a subset of risk mitigants, 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. As most institutional investors have limited experience with direct investment in sustainable energy infrastructure projects, the cost associated with identifying, executing and managing investments is often prohibitive. Transaction enablers include warehousing (pooling small transactions), securitisation (transforming illiquid assets into tradable securities) in a prudent and judicious way, and co-investment and collaboration among institutional investors.

To assist policy makers in visualising investments and their defining characteristics, the report provides a classification framework for understanding investment channels for sustainable energy infrastructure. The report uses a number of tabular and visual devices to illustrate how this framework works for individual transactions and groups of transactions. After defining terms and investment characteristics, the report uses "investment pathways" to illustrate how transactions can be classified. To illustrate different investment channels, the report describes and evaluates the 47 sustainable energy infrastructure project investments by pension funds that were identified for the purpose of the report, along with 20 investments by pension funds in "pure-play" corporations (i.e. corporations engaged exclusively in sustainable energy activities). It then uses "matrix frames" to provide a visual device to plot all of the transactions together and highlight trends. Another visual device ("schematic overview – transaction layers") is used at the level of a single transaction to highlight how instruments, funds, risk mitigants and transaction enablers have all come together in a specific investment example.

Policy makers and others can use the framework to: *1)* understand and compare different investment channels available in practice and in theory; *2)* illuminate where investment is or is not flowing; *3)* highlight potentially promising channels in which policy makers may consider the use of risk mitigants and transaction enablers to address investment barriers and mobilise flows; and *4)* target and undertake data collection on investments in different channels and undertake subsequent empirical analysis.

Assessment and recommendations

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") this report provides the following high-level recommendations on what governments can do to facilitate greater investment by institutional investors. Chapter 5 elaborates on these in detail, presenting nine key policy recommendations for governments to address barriers and to facilitate institutional investors' investment in sustainable energy infrastructure.

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; unbundle vertically integrated network operators; establish a wholesale electricity market; and create a level playing field between independent power producers (IPPs) of sustainable energy and incumbent state-owned enterprises (SOEs); and *c)* 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 policies retrospectively; address unintended consequences of policies that impede the mobilisation of institutional investment (e.g. "unbundling" regulation that forces investors to choose between owning transmission or generating assets); 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.
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 CO_2 emissions over time through explicit and implicit carbon pricing policies; and phase out fossil fuel subsidies while addressing potential adverse impacts of subsidies reform. 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 facilitating enhanced partnership between the various actors along the project finance chain.

5. **Facilitate the development of liquid 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 case for passing or amending legislation allowing for sustainable energy infrastructure to be included in existing vehicles that appeal to institutional investors (e.g. covered bonds, Master Limited Partnerships and Real Estate Investment Trusts).

6. **Facilitate the development and application 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, cornerstone stakes, and tools 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 projects using a prudent and judicious approach (e.g. supporting efforts to standardise contracts and project evaluation structures, creating aggregation and "warehousing" facilities). 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-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.

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

Chapter 1

An integrated overview of channels and approaches for mobilising institutional investment in sustainable energy

This chapter provides an integrated overview of the structure of the report, which delves into the various channels (financing instruments and investment funds) and approaches (risk mitigants and transaction enablers) for mobilising investment by institutional investors for sustainable energy infrastructure. To assist policy makers in visualising investments and their defining characteristics, the chapter introduces a framework for understanding investment channels which includes a classification system (elaborated in Chapter 3). The chapter provides definitions for the key issues covered in the report and provides an introduction to a number of tabular and visual devices which are used to illustrate how the classification works for individual transactions and groups of transactions. It provides an introduction to the diverse actors involved in sustainable energy financing and concludes by proposing where in the broader literature the report makes its contribution.

The principal goal of this report is to provide policy makers with an integrated overview of the various channels (financing instruments and investment funds) and approaches (risk mitigants and transaction enablers) for mobilising investment by institutional investors[1] for sustainable energy infrastructure (see Box 1.1). Building on and updating previous OECD analysis on institutional investors and green infrastructure investment (Kaminker

Box 1.1. **Sustainable energy infrastructure and costs**

"Sustainable energy" infrastructure as defined in this report 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, inter-connectors, energy efficiency, storage and electric vehicles). However, the focus of this report is on commercially scalable sustainable electricity generation technologies such as wind (on/offshore), solar (PV/CSP), small hydro (less than 50MW), biomass and geothermal as this is where the majority of institutional investment activity tracked by the OECD is occurring. Future work could look towards a post grid-parity (see glossary) world for sustainable energy as many of the technologies are decreasing in cost and increasing in efficiency, some much more rapidly than others, e.g. solar PV (IEA, 2014a). The Global Commission on the Economy and Climate (NCE, 2014) finds that in some markets, the average cost of energy from many sustainable energy sources is approaching that of new conventional generation, when levelised over the life of a new energy project. In some cases, the cost of sustainable energy is lower than for conventional generation. More detail on the increasing competitiveness of many forms of sustainable energy is provided in Annex 2.A1 (Levelised Cost of Electricity chart). It is also worth noting that investment in grids, transmission and distribution is also needed to compensate for the variability of sustainable energy (IEA, 2014b).

A stylised fact that has been described recently is that as technologies decrease in cost and become less subsidy-dependent, more conservative investors feel more comfortable allocating capital to these projects (Clean Energy Pipeline, 2014). An economic rationale for optimising the capital structure of sustainable energy financing exists (Bradford and Hoskins, 2013, Nelson, 2014) and places the focus of interventions on lowering the cost of capital for sustainable energy (Nelson and Pierpont, 2013, Nelson 2014). In a world of low cost components and falling installation and "soft costs", the cost of financing is the major driver of the long term levelised cost of electricity, particularly for those technologies that do not need fuel, such as most sustainable energy. An estimated 50-70% of the costs of electricity generation for sustainable energy are in the financial cost of capital, with only the balance being the physical or operational costs of the installation (Bradford and Hoskings, 2013; Bradford, 2015, forthcoming). Thus, small changes in the weighted average cost of capital (WACC) can have substantial impact on the levelised cost of a generator.

This provides impetus to identifying mismatches between investor and finance needs and finding solutions to optimising financial structures, even in minor ways, if the goal is to continue driving down the cost of outputs of these solutions. For instance, the Global Commission on the Economy and Climate (NCE, 2014) finds that significant, near-term opportunities can reduce the costs of finance by up to 20% for low-carbon energy in all countries through a mix of financial innovation, greater use of national development banks and concessional debt, and increased development capital flows into low-income countries.

*Although large hydro-electric power generation is a form of renewable energy and has attracted significant institutional investment, it is outside the scope of this version of the report as this report relies primarily on the BNEF database for investment transactions and its associated definition of "clean energy" which excludes large hydro. BNEF excludes large hydro arguing that this technology has been mature for decades and is at a very different stage of its roll-out than Solar PV.

and Stewart, 2012; Kaminker et al., 2013; Eklin et al., 2015, forthcoming), the report also provides recommendations on what governments can do to facilitate greater investment by:

- supporting the development of investment channels through which institutional capital can flow to sustainable energy infrastructure;
- using different approaches to mitigate risks and reduce transaction costs associated with sustainable energy infrastructure investments; and
- addressing key barriers to investment by institutional investors.

By analysing and presenting 67 recent examples of investments using the various channels, the report also provides an update of the state and trends of institutional investment in sustainable energy (Chapter 2). It extends previous OECD analysis on this topic by proposing a classification framework of financing instruments and investment funds, risk mitigants and transaction enablers for mobilising institutional investment in sustainable energy (see Table 1.1). The report is a contribution[2] to a broader G20/OECD project to develop a Taxonomy of Long-term Investment and Infrastructure Financing. It is designed to complement this overarching analysis by providing an in-depth examination of sustainable energy as a discrete sector within the broader category of economic infrastructure (see glossary provided in Annex A).

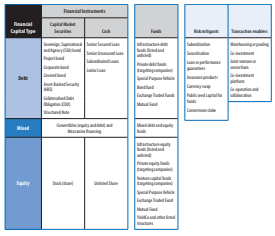
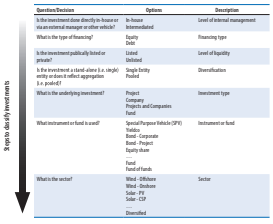
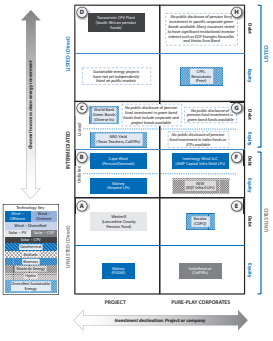
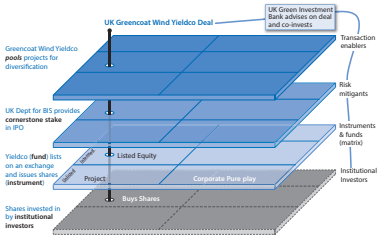
This report provides a framework through which policy makers can better understand how institutional investors make sustainable energy investments (in projects or companies) through financing instruments (see glossary, hereafter "instruments") and investment funds (see glossary, hereafter "funds"). It is also intended to help promote more clarity and the consistent and standardised use of terms. As Hambrick (1984, p. 27) observes, "to classify things is to bring parsimony and mental order to one's view of them." It is hoped that this effort to develop a focused, in depth classification framework as part of a broader taxonomy will provide similar benefits to policy makers, institutional investors and other parties interested in facilitating investment in sustainable energy infrastructure.

The report makes use of several graphics to discuss and illustrate different steps that have been used to classify investments. As a first step terms are defined and the different characteristics of investments are analysed. By examining investment traits steps can be created to classify transactions. Investment pathways show how a given transaction can be classified based on its characteristics. These pathways epitomise the classification framework. As a way to visualise the classification of all of the investments analysed, matrix frames are created to collectively plot these examples and highlight trends. Finally, a schematic overview provides a visual inspection of a single transaction to highlight how instruments, funds, risk mitigants and transaction enablers have all come together in a specific investment example.

Figure 1.1 is the component of the sustainable energy classification framework which provides an overview of the definitions of terms for the purposes of this report; illustrating for instance the difference between the categories of instrument, fund, tool and technique. For policy makers with a background in finance, this classification will be familiar, as it is inspired by recognised accounting standards.

In addition to providing this framework, the report incorporates and updates information and perspectives gained from five years of OECD work in the area of institutional investment in green infrastructure. This body of work includes consultations with institutional investors and financial intermediaries at workshops, in committee meetings[3] and interviews.[4]

Table 1.1. **Guide to components of the classification framework for institutional investment in sustainable energy**

Component	Graphic used in report	Function
1. Definitions (Figure 1.1)		Provides an overview of the definitions of terms for the purposes of this report; illustrating for instance the difference between the categories of instrument, fund, risk mitigant and transaction enabler.
2. Classification steps (Figure 3.2)		Describes foundational logic and steps taken to classify investments for the pathways.
3. Investment pathways (Figures 3.3 – 3.7)		Illustrates how specific transactions can be classified based on the steps, their characteristics and fundamental decisions to make an investment internally or externally and to invest in projects or companies.
4. Matrix frame (Figures 3.8 and 3.9)		Plots transactions on a matrix frame which is created using the logic, steps, classifications and decisions described previously.
5. Detailed transaction schematic (Figure 3.10)		Provides an in-depth look at an individual transaction to highlight the different instruments, funds, risk mitigants and transaction enablers used.

In discussions on climate finance and financing sustainable energy, it can be a challenge for policy makers to speak the same language as investors. Institutional investors are by their nature technically-oriented (and sustainable energy infrastructure investments feature their own specialised terms). In contrast, there is an understandable desire in many climate finance discussions to provide relatively simple answers to complex questions that may require specialised knowledge of finance and investments. Policy makers also may speak generically about mobilising capital from institutional investors for sustainable energy, but fail to realise the sheer diversity of such investors. These dynamics, and the tendency to

Figure 1.1. **Defining instruments, funds, risk mitigants and transaction enablers to facilitate sustainable energy investment**

Financial Capital Type	Financing instruments		Funds	Risk mitigants	Transaction enablers
	Capital Market Securities	Cash			
Debt	Sovereign, Supranational 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		

Note: This figure does not map relationships between instruments, funds, risk mitigants and transaction enablers and presents them as separate from each other although in fact direct relationships exist among them (e.g. CDO, Special Purpose Vehicle, Securitisation and Pooling). Analysis of derivatives such as swaps, options, futures and forwards are outside the scope of this report; however Chapter 4 discusses currency swaps. "Other listed structures" include Master Limited Partnerships and Real Estate Investment Trusts and are discussed in the report as potential structures for sustainable energy investment.

Source: OECD analysis.

search for "silver bullet" solutions, create communication barriers between investors and non-technical policy makers. They also can leave policy makers with a fragmented sense of the range of investment channels available to investors, how investors consider investments in these channels, and barriers to the development of these channels.

As such, this report endeavours to illuminate for policy makers the myriad investment channels (instruments and funds) that can be used for sustainable energy infrastructure. Central to an institutional investor's choice of investment channel is its decision to make the investment directly ("in-house") or to create a contract with an intermediary ("out-source") to make the investment on their behalf (see Chapter 3 for a more detailed explanation).

This report also provides further analysis and stocktaking of the risk mitigants that policy makers and other intermediaries can apply to the instruments and funds to enhance their effectiveness or appeal to institutional investors. In addition, the 67 sustainable energy investments by pension funds examined in this report highlight the innovative transaction enablers that the investors themselves are developing (sometimes along with governments) to deploy capital more effectively in this sector and reduce transaction costs. These tools and techniques are often discussed in the climate finance and sustainable energy literature in a disparate way. This report endeavours to align them so that they can be understood alongside instruments and funds.

The definitions, classification steps and investment pathways lead to the matrix frame which is intended to provide an integrated framework that can be used to: *1)* understand and compare different instruments and funds available in practice and in theory; *2)* illuminate where investment is or is not flowing; *3)* highlight potentially promising instruments or funds in which policy makers may consider the use of risk mitigants or transaction enablers to address investment barriers and mobilise flows; and *4)* target and undertake data collection on investments in different channels and conduct subsequent empirical analysis. A map of updated policy recommendations matched with barriers is provided to advise governments on what can be done to open the channels up for enhanced capital flows.

While this report focuses primarily on institutional investors, financial intermediaries play a critical role in the "ecosystem" of climate finance and investment. They come in private (e.g. monoline insurers and investment banks – see glossary) and public forms (e.g. national or multilateral development banks or other public financing institutions such as domestically focused green investment banks). These financial intermediaries have as a common objective the engagement and mobilisation of private finance (including from institutional investors). They deploy an assortment of instruments,[5] funds,[6] and risk mitigants[7] to finance sustainable energy infrastructure. Their activities have been examined in other OECD reports.[8]

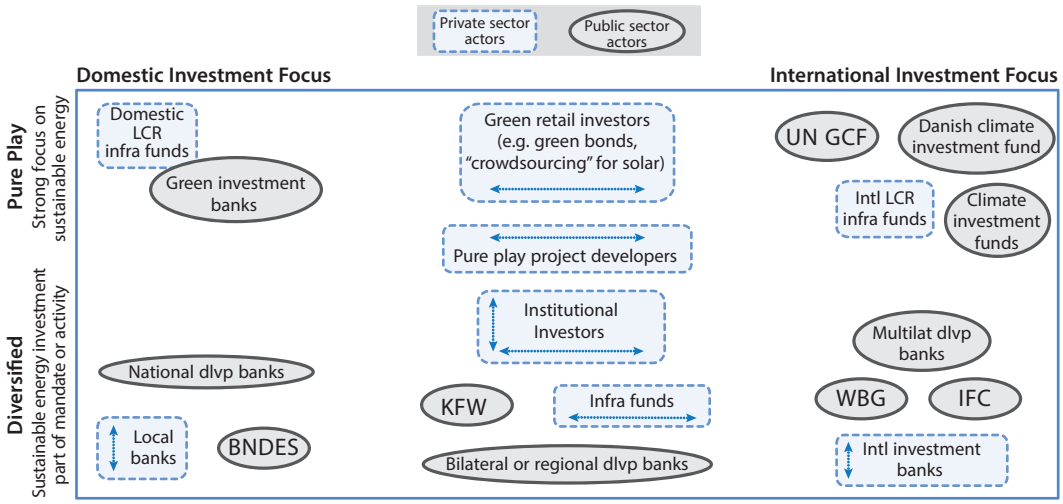
Drawing on related OECD work (Eklin et al., 2015, forthcoming), this report describes how "green investment banks" (GIBs) have sought to engage institutional investors. In recent years, at least a dozen special-purpose GIBs have been established. These are "domestically-focused public institutions that use limited public capital to leverage or crowd-in private capital, including from institutional investors, for sustainable energy infrastructure investment" (Eklin, at al., 2015, forthcoming, p. 1). A separate and very important question is how can institutional investors interact with and participate in sustainable energy investments in emerging markets and developing economies.

To date, institutional investment in sustainable energy projects has been predominantly in OECD countries and this is highlighted in Chapter 3 which provides details on the distribution of investments geographically across the sample of large pension fund investments. In addition to identifying promising channels for sustainable energy investments

in OECD countries, it will be very important to explore how institutional investors can interact with international climate finance mechanisms targeted at emerging economies and developing countries.[9] For instance in January 2014 Danish pension funds PensionDanmark, PKA and Paedagogernes Pensionskasse invested in the Danish Climate Investment Fund (a public-private fund backed by the Danish state to finance greenhouse gas emission-reduction projects in developing countries).[10] An examination of the role of institutional investors in the emerging international "climate finance" architecture is 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).

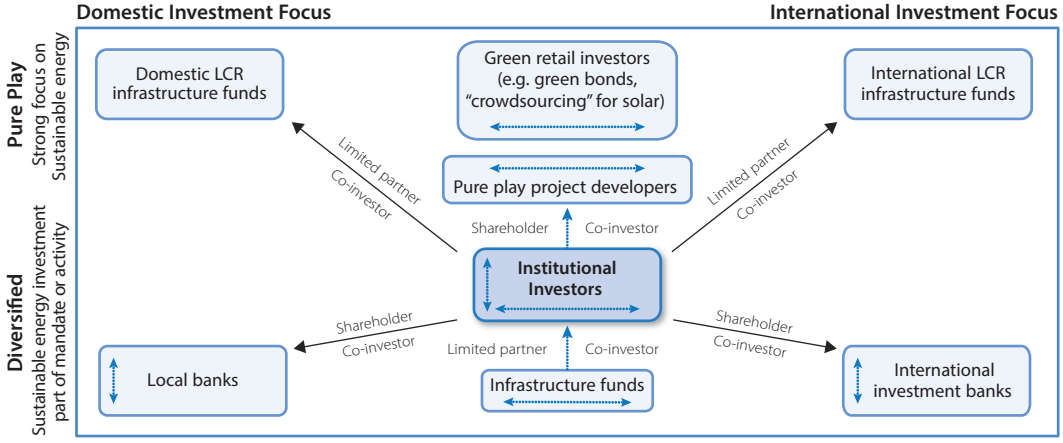
Figure 1.2 illustrates a number of the diverse actors involved in sustainable energy financing, their respective focus on domestic vs. international investment and on "pure-play" sustainable energy investment vs. diversified sustainable infrastructure investment (where sustainable energy is part of the mandate). For an additional illustration of the interactions among private actors active in sustainable energy investment, including institutional investors, see Figure 1.3.

Figure 1.2. **Existing public and private entities that finance sustainable energy**



Source: Adapted from Eklin et al. (2015, forthcoming).

Figure 1.3. **Institutional investor interactions with private sustainable energy finance providers**



Source: Adapted from Eklin et al. (2015, forthcoming).

This report is a contribution to a deepening body of policy and academic literature examining the potential role of institutional investors in financing green growth and the transition to a low-carbon economy (see for instance: G20/OECD, 2012; Inderst et al., 2012; Kaminker and Stewart, 2012; IFC, 2013; Kaminker et al., 2013; Nelson and Pierpont, 2013; Fulton and Capalino, 2014). It also contributes to literature examining the role of institutional investors in financing infrastructure more broadly and "financialisation" (see glossary) and product evolution (Clark et al., 2011; Clark and Monk, 2013; Sharma, 2013). Lastly, the report contributes to other literature identifying barriers to low-carbon investment, and analysing the potential for innovative financing instruments and risk mitigants to use limited public funds to catalyse private investment in support of climate action (see for example; Doornbosch and Knight, 2008; Ward, 2010; Kennedy and Corfee-Morlot, 2013; Frisari et al., 2013).

The previous OECD report examining this topic (Kaminker et al., 2013) was delivered to the G20 Study Group on Financing for Investment and 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. It provides a foundation of analysis for this report and can be referred to for more detailed explanations and examples of the issues discussed in this report such as securitisation for sustainable energy infrastructure.

However, a few important conclusions from the previous report are worth recalling. One finding was that "direct" investment in [sustainable energy] infrastructure projects, if properly structured, may have the potential to deliver attractive risk-adjusted returns [see glossary] with many of the other attributes sought by institutional investors, who have an interest in the long-term investment horizon (Kaminker et al., 2013, p. 45). The report also confirmed that an indispensable condition to increasing investments by institutional investors (or the "allocations" they make in their investment portfolios) to sustainable energy infrastructure is to make sure that these investments compete on a risk-return basis over different time horizons. This condition is essential because institutional investors have varying risk appetites, liability profiles, investment preferences, and constraints. Investors with fiduciary responsibilities to their clients or beneficiaries will not make an investment just because it is "green" – their primary concern is its (risk-adjusted) financial performance. Pension funds and insurers also have to invest in accordance with the "prudent person principle". Assets have to be invested in the best interest of members and beneficiaries and policyholders and in such a manner as to ensure their security, profitability, liquidity and quality (Kaminker et al., 2013).

Notes

1. Though the term "institutional investor" covers a wide range of organisations (including endowments, foundations, etc.), the focus of this report is on pension funds, public pension reserve funds, insurance companies and sovereign wealth funds, as the OECD is the leading organisation collecting statistics on these institutions and has been undertaking extensive analysis on their investments and their regulatory environments.
2. This report is a contribution to the OECD's broader work on institutional investors and long-term investment: see www.oecd.org/finance/lti.
3. Including the OECD Committee on Insurance and Private Pensions, OECD Working Party on Private Pensions, OECD Committee on Financial Markets and G20/OECD Taskforce on Institutional Investors and Long-Term Investment

4. Interviews were conducted using "close dialogue" as proposed by Clark (1998); a mode of case study research that uses structured and unstructured interviews in the context of relationships between nominal equals to reveal the actual logic of decision making.
5. E.g. World Bank Group or European Investment Bank green bonds in which institutional investors invest.
6. E.g. European Investment Bank (EIB) layered funds for institutional investment or the Renewable Energy Platform for Institutional Investors (REPIN).
7. E.g. EIB's Project Bond Initiative credit enhancement tool which has attracted institutional investors. See Chapter 4 for a discussion of this initiative.
8. See for example Cochran et al. (2014) for a review of five public financing institutions' activities to support the transition to a low-carbon economy and Eklin et al. (2015, forthcoming) for a review of green investment banks.
9. This report does not endeavour to cover all of the possible channels for investments in developing countries and the risk mitigants that can be deployed to de-risk those investments to overcome additional barriers. It is necessarily limited in its analysis by the sample of investments covered which focus predominantly on OECD countries. Future work could explore these issues in greater depth, e.g. analysis of the further options that may be unique to Sovereign Wealth Funds and developing country institutional investors.
10. See press release for more details www.pension.dk/en/english/About-PensionDanmark/News/PD-news/PensionDanmark-investing-DKK-200m-in-new-climate-in-vestment-fund1/.

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Chapter 2

The role of institutional investors in financing sustainable energy infrastructure

This chapter discusses the role of institutional investors in financing sustainable energy infrastructure. The chapter begins with a review of the rationale for investment in sustainable energy infrastructure and explores the financing needs and economic opportunities for the transition to sustainable energy provision. The chapter proceeds to highlight the strained financing capacity of governments, utilities and banks for sustainable energy project finance. Practical information is provided on the financial capabilities of institutional investors, as well as an examination of how their assets are allocated and their investment decisions are made internally. The barriers to institutional investment in sustainable energy are then explored. The chapter provides information on the state and trends of institutional investment in sustainable energy and emerging channels that hold significant promise for scaling up institutional investment, including green bonds, YieldCos and direct project investment.

This chapter is broken into five sub-sections. Sub-section 1 reviews the rationale for investment in sustainable energy infrastructure and explores the financing needs and economic opportunities for the transition to sustainable energy provision. Sub-section 2 highlights the strained financing capacity of governments, utilities and banks for sustainable energy project finance. Practical information is provided in Sub-section 3 on the financial capabilities of institutional investors, as well as an examination of how their assets are allocated and their investment decisions are made internally. The barriers to institutional investment in sustainable energy are then explored. The final section provides information on investor activity in financing sustainable energy and highlights the emergence of green bonds and YieldCos as promising new developments for channelling greater amounts of private capital to sustainable energy projects and corporates.

Financing needs and economic opportunity for sustainable energy

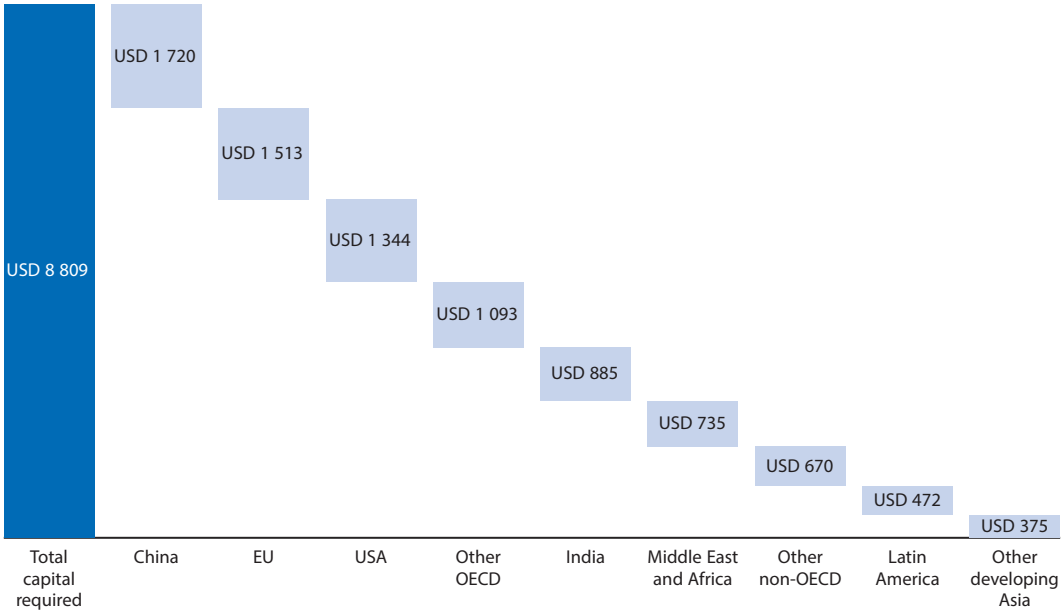
Greening growth and achieving climate objectives requires a transition to a low-carbon and climate-resilient economy. Global investments in infrastructure will have a major impact on whether a 2°C climate target[1] can be achieved, as they can "lock-in" future emission levels. According to a recent OECD report examining policy challenges for the next 50 years, unless CO_2 emissions are reduced, climate change could curb global GDP by 1.5% by 2060 and by nearly 6% in South and South-East Asia (OECD, 2014a). It is generally accepted that an infrastructure investment gap exists and is estimated to be much larger than the increment required to address climate change. That is, to shift onto a path to achieve a two-degree goal and to adapt to climate change the additional investment required is estimated to be relatively small (e.g. in the area of 10% or less of total investment requirements).[2]

The 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 recent 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 (2014a, p. 15) presents evidence that the USD 44 trillion[3] 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.[4]

To address this challenge and seize these opportunities, investments in sustainable energy infrastructure need to be scaled up significantly and shifted from fossil fuels throughout advanced, developing and emerging economies.[5] Beyond addressing this challenge, these investments will also support the broader development, economic, energy security, "energy access-for all", resource efficiency and green growth agendas.

The financial resources required for this transition are substantial (see Figure 2.1). Given that the scale of change required is systemic, not marginal, transformational change will ultimately require access to capital on a scale that only the private sector can provide.[6] For instance, the IEA (2014b) projects that USD 8.8 trillion in total investment in sustainable energy power plants globally will be required in 2014-35, in order to reduce energy-related emissions by 50% compared to 2005 levels. The IEA affirms that "private sector participation [including new sources such as institutional investors] is essential to meet investment needs in full" (IEA, 2014c). The public sector is likely to continue to play a leading role in commissioning sustainable energy projects in certain sectors, and to guide and "jump start" investment when needed (see Chapter 4).

Figure 2.1. **Sustainable energy investment requirements in the "450 scenario" 2014-35 (USD 2012, billions)**



Note: Figures are for power plant investment in: biomass, hydro, onshore and offshore wind, solar PV and "other renewables". Figures do not add up due to rounding.

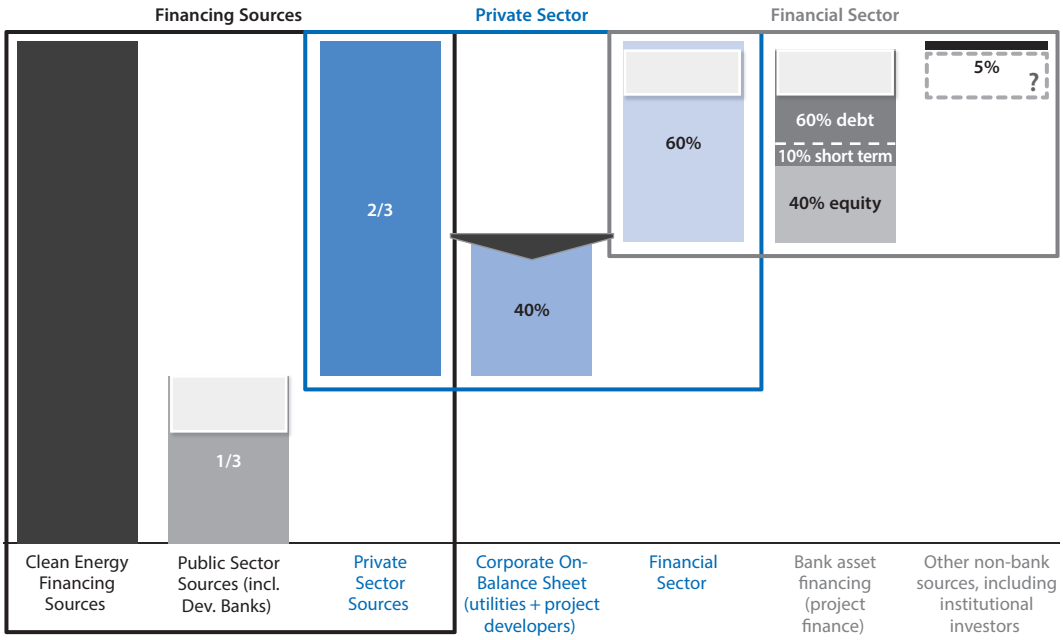
Source: OECD analysis; based on IEA data; IEA (2014b).

Dynamics of investment financing sources for sustainable energy

As presented in Figure 2.2, across the OECD the private sector accounts for roughly two-thirds of investment financing (through debt or equity) for sustainable energy infrastructure and public sector sources (i.e. local, regional and national governments, and national development banks) provide the remaining one-third.[7] In developing countries and emerging economies, the picture would be roughly reversed, with the public and "quasi-public sector" (state-owned banks and corporations) providing two-thirds of investment financing (IEA, 2014a; Kaminker, et al. 2013; Benoit, 2012).

Across the OECD, the private sector share is divided between corporate sources such as electric utility companies (40%) and the financial sector (60%). Bank financing, such as project financing consists of approximately 60% debt and 40% equity and accounts for roughly 95% of the financial sector's contribution and mostly consists of long-term loans.[8] The remaining 5% is provided by non-bank entities, including institutional investors. This total represents just a small share of the total capital being mobilised for infrastructure by institutional investors.

Figure 2.2. **Landscape of investment financing sources for sustainable energy and dynamics across the OECD 2008-14 (illustrative example, varies by country)**



Note: white boxes indicate where investment financing has decreased and are figurative representations that do not present actual magnitudes. The black triangle represents a cap and downward pressure on corporate sources of financing.

Source: OECD Analysis based on Kaminker and Stewart (2012); Feyen and González del Mazo (2013); Kaminker et al. (2013); OECD (2013); IEA (2014b); BNEF database.

Strains on traditional sources of sustainable energy finance

In the wake of the economic and financial crisis, public, corporate (e.g. utilities, project developers) and financial sector sources of investment financing for sustainable energy projects face significant constraints, and investment from all of these sources is expected to diminish in coming years. The economic and financial crisis has constrained government budgets in many OECD countries, putting downward pressure on public sources of investment financing for sustainable energy infrastructure. The fiscal consolidation efforts to reduce the share of government debt in GDP has also been accompanied in some countries by pressure to cut support to sustainable energy (IEA, 2014b).

Utility companies and project developers have little capacity to expand their investment in sustainable energy, as their balance sheets are constrained due to the negative impacts which an increase of debt could have on their credit rating and cost of capital (see glossary). The Economist (2013) notes that EU utilities have suffered vast losses in asset valuation, with their market capitalisation (see glossary) having fallen by over EUR 500 billion over the last five years. In May 2014 Barclays downgraded all high-grade bonds issued by the entire American electric utility sector because they "believe that a confluence of declining cost trends in distributed solar photovoltaic (PV) power generation and residential-scale power storage is likely to disrupt the status quo" (Aneiro, 2014, p. 1).

More specifically, it is expected that these trends will reduce the profitability and credit-worthiness of utilities, which are generally vulnerable to decreasing electricity prices caused by the increased deployment of renewable energy. The IEA (2014c) confirms that

the extent to which utilities can provide investment faces constraints. In addition to new project development, utilities have often played an important role in acquiring operating sustainable energy assets, allowing developers to recycle their capital for new projects. In Europe, utility cash flows have been cramped by reduced operating hours for conventional plants, stemming from a "perfect storm of low demand, high natural gas prices, low carbon and coal prices, and increased shares of low-marginal-cost renewables" (IEA, 2014c, p. 201). Utilities in Europe are also reported to be actively seeking partnerships with institutional investors to whom they might unload sustainable energy assets from their balance sheets (see for instance Steitz (2014)).

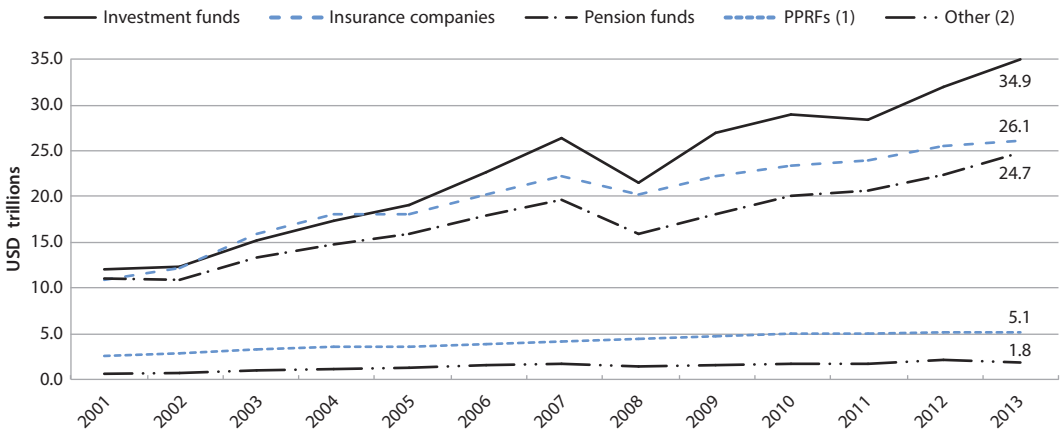
The financial crisis has affected the maturity transformation (glossary) process in financial markets and the ability of banks to channel long-term financing. In particular, newly exposed funding vulnerabilities, deleveraging (see glossary) and new regulations such as Basel III and Capital Requirements Directive (CRD IV) (see glossary) have prompted banks to reduce investments across illiquid asset classes and shorten tenors (i.e. the term or duration of loans). Deleveraging in the EU is particularly relevant because EU banks that had been large domestic and international "specialist" financiers of infrastructure have been harder to replace. The post-crisis Basel III rules aimed at strengthening the global banking sector have elicited concern, particularly in Europe, that new rules could result in reduced readiness from banks to provide long-term project and corporate loans, including for sustainable energy projects (Narbel, 2013; UNEP, 2014). Given the need for increased investment in sustainable energy infrastructure, and pressures on existing sources of financing, there is interest in exploring the extent to which institutional investors can expand their investments in this area (see dotted box in Figure 2.2), and play a greater role in directly filling the investment gap while acquiring operating projects from banks that are expected to remain important project financiers and corporates, therein helping them to recycle their capital for re-investment in new projects.[9]

Institutional investors and their potential to finance sustainable energy investments

Institutional investors include insurance companies, pension funds, investment funds, public pension reserve funds, foundations, endowments and other forms of institutional savings. As is shown in Figure 2.3, in OECD countries these investors held over USD 92.6 trillion in assets in 2013 (OECD, 2014b, c). Pension funds alone received USD 2.3 trillion in inflows in 2013 (OECD, 2014b, c). In emerging and developing countries, sovereign wealth funds are key sources of capital (Clark and Knight, 2010), with USD 6 trillion in assets as of January 2014 (Sovereign Wealth Fund Institute, 2014). Non-OECD pension, insurance and mutual fund local currency assets have also been growing rapidly, reaching USD 4.5 trillion in 2013 with 18.4% compound annual growth since 2000 (AMF, 2014; World Bank and ClimateWorks, 2014).

Institutional investors' decision-making process for allocating capital among different types of instruments and asset classes is complex and varies significantly across institutions and geographies. Box 2.1 provides an overview of asset liability matching and the asset allocation process for institutional investors, which are essential concepts for understanding how institutional investors make asset allocation decisions and manage risk, and for evaluating the feasibility of channelling institutional investor capital to sustainable energy investment. An understanding of these concepts can also guide policy makers to establish and support appropriate instruments, funds, risk mitigants and transaction enablers to facilitate greater investment flows.

Figure 2.3. **USD 92.6 trillion in assets under management by institutional investors in the OECD (2013)**



Note: Book reserves are not included in this chart. Pension funds and insurance companies' assets include assets invested in mutual funds, which may be also counted in investment funds. As 2013 annual data for investment funds, insurance companies and other institutional investors are not yet available, 2013 Q4 data have been used instead when available.

1. Data include Australia's Future Fund, Belgium's Zilverfonds (2008-2013), Canada Pension Plan Investment Board, Chile's Pension Reserve Fund (2010-2013), Japan's Government Pension Investment Fund, Korea's National Pension Service, New Zealand Superannuation Fund, Government Pension Fund - Norway, Poland's Demographic Reserve Fund, Portugal's Social Security Financial Stabilisation Fund, Spain's Social Security Reserve Fund, Sweden's AP1-AP4 and AP6, United States' Social Security Trust Fund.

2. Other forms of institutional savings include foundations and endowment funds, non-pension fund money managed by banks, private investment partnership and other forms of institutional investors.

Source: OECD Global Pension Statistics, Global Insurance Statistics and Institutional Investors databases, and OECD staff estimates.

Box 2.1. **Understanding institutional investor asset liability management and asset allocation decisions**

"Asset liability management" or "asset liability matching" (ALM) entails managing assets and cash inflows to satisfy various cash outflow obligations (liabilities). It is a form of risk management, whereby an institutional investor endeavours to mitigate or hedge the risk of failing to meet these obligations while seeking a target level of portfolio investment return.

ALM can be a resource-intensive and complex undertaking, making use of sophisticated mathematical models. The conclusion of the ALM process will provide quantitative recommendations for the amounts a fund can invest in different asset classes. The process attempts to create a blend of "return seeking" investments, such as public and private equity, and "liability matching" investments such as bonds and other fixed income instruments, relying on a large set of assumptions about the characteristics of the different asset classes, such as investment return, risk (standard deviation of investment returns), and correlation between different classes of assets. Notably, many ALM models are run by outside consultants to institutional investors and they are often not asked to include sustainable energy or infrastructure as a separate asset class. Without ALM to see the value of this asset class, allocations typically will not be made.

Beyond the standard decision to allocate a portion of most investment portfolios to publicly traded debt and equity instruments, each, it is also common for portfolio managers to make allocations to particular subcategories of these asset classes, as these allocations can be made in a manner that improves the risk-return profile of the entire portfolio (i.e. using academic portfolio theories).

Box 2.1. **Understanding institutional investor asset liability management and asset allocation decisions** *(continued)*

Following the ALM process, the next move can be to define a strategic asset allocation (SAA) for the fund. This splits the general asset classes into separate "mandates" (authorisations or instructions to invest a defined portion of the portfolio in a particular asset sub-class or sub-category) for instance, emerging market bonds versus American or European bonds. Mandates are then, typically, assigned to investment managers. Some funds may bypass these previous exercises and proceed directly to defining specific mandates that are then, typically, given to investment managers. The design and assumptions of ALM models vary with respect to the investment performance of different asset classes, leading to different model outputs (i.e. SAAs recommended by the model). Even if the ALM process includes sustainable energy and it is then defined within asset class allocations, the tactical asset allocation to sustainable energy will rely on investment beliefs about whether sustainable energy will outperform a benchmark or help the institution to meet a "risk budget". Consequently, the particular ALM model used and assumptions incorporated in the model can dictate whether an institutional investor will invest in sustainable energy across different asset classes.

Nelson and Pierpont (2013, p. 42) state that "the number of asset classes and their definition in the model, the return and risk characteristics ascribed to each of these asset classes and the estimated covariance between these asset classes, can have a profound impact on the ability of an institutional investor to invest in renewable [sustainable] energy and, possibly, take advantage of the specific investment characteristics that could provide more value to that investor."

Investors will also consider whether they will invest via funds, which use experienced teams to deploy capital, or whether they will pursue direct investments, which requires building internal teams and developing advisor and deal flow networks (McCrone, 2013a; Standard & Poor's, 2013; Fulton and Capalino, 2014). Smaller pension funds typically use consultants for ALM modelling and the investment categories they prescribe generally refer to specific mandates to be given to external managers ("outsourced").

The largest insurance companies generally have the most refined ALM processes, possibly due to regulatory reasons and their larger scale which supports more sophisticated modeling capabilities. The result is that from a strategic and ALM perspective Nelson and Pierpont (2013, p. 44) suggest that they appear to be much more able to see the value that the asset class has for reducing the institutions' risks and meeting future liabilities and invest in sustainable energy projects.

Institutional investors are increasingly important players in financial markets (Clark and Monk, 2013a,b; Dixon and Monk, 2013; Al-Kharusi, Dixon and Monk, 2014). In OECD countries, these investors traditionally have been seen as sources of long-term capital, with an investment horizon tied to the often long-term nature of their liabilities (e.g. pension benefits provided at retirement and life-insurance pay-outs). In a low interest-rate environment, infrastructure projects should in principle be attractive to institutional investors and these investors have the potential to play a much greater role especially as "recyclers of capital" (i.e. being in a position to acquire and hold assets for the long term from the creators of those assets who can then proceed to create more assets having freed up financial capacity on their balance sheets). In many cases institutional investors have to invest for the long-term in order to fund liabilities that are multi-generational in nature. These liabilities can be met in part through long-term investments, including direct investments in sustainable energy assets, which can provide steady, inflation-linked, income streams with low correlations to the returns of other investments (Kaminker and Stewart, 2012; Kaminker et al., 2013; Nelson and Pierpont, 2013; Fulton and Capalino,

2014). Morgan Stanley (2013) finds that in rising interest rate environments associated with inflation, "real assets" including infrastructure and sustainable energy have historically performed well, given their inflation-linkage and that such periods are associated with expanding economies and subsequent growth in demand for energy and power.

Although there is significant potential for institutional investors to expand their investments in sustainable energy, and there are pockets of activity (as illustrated in the 67 examples of different investments provided in Chapter 3), in general their investments in this area to date have been minimal compared to the scale of their assets. Due to a range of barriers discussed below, "direct investment" in infrastructure projects of all types was reported in a recent OECD survey to account for 1% of large pension funds' asset allocation on average in 2013. Among just those large pension funds that reported having direct exposure to unlisted infrastructure equity, the average exposure was reported to be 3% to unlisted infrastructure equity (Della Croce and Paula, 2014). OECD pension fund allocation to sustainable energy investment was much smaller – only 3% of that 1% share, according to some estimates (BNEF, 2013).

Yet while surveys report these small allocations, an increasing number of institutional investors have investments in infrastructure or are considering the asset class for future commitments. Indeed, in a handful of countries some institutional investors have found ways to allocate substantial amounts of capital to economic infrastructure (such as transportation assets). For instance, a recent OECD report (Inderst and Della Croce, 2013) examined how defined benefit pension funds (see glossary) in Canada have been using transaction enablers such as "seeding managers" to align interests and reduce fees for infrastructure investments. Defined contribution superannuation (see glossary) funds in Australia have been using intermediated fund structures (see discussion of transaction enablers in Chapter 4) to allocate over 10% of their assets to infrastructure.[10] There are also instances of large funds elsewhere that are growing quickly so have less need for liquidity and have established sophisticated in-house asset management capabilities for investment in infrastructure and sustainable energy in particular (e.g. PensionDanmark).[11] But these are largely exceptions to the rule that institutional investment in infrastructure has been limited to a small percentage of the portfolio.

Limitations and challenges for scaling up institutional investment in sustainable energy

At the core of the issue of limited investment is that investors with fiduciary responsibilities generally require policy makers to foster investment certainty and improve the risk-adjusted returns available from sustainable energy. 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 obstacles, some that apply to infrastructure generally, others that are specific to sustainable energy.

These obstacles as surveyed by the OECD (see Table 2.1) include policies that favour investment in incumbent technologies reliant on fossil fuel over sustainable energy, regulatory policies with unintended consequences, and a shortage of objective information, data and skills to assess transactions and underlying risks. Other barriers are specific to a lack of suitable financing instruments and funds, inconsistency among the contracts, documentation and assets which prevents project cash flows to be pooled into tradable and highly liquid securities, and inadequate tools for due diligence that would be necessary to build confidence among investors in new asset classes (Clean Energy Ministerial, 2014). Misaligned policy signals such as continuing support for fossil fuel use and production, low or no prices on GHG emissions, and unpredictable changes to support policies for sustainable energy are all issues that cause investors to hesitate before investing in sustainable energy. In addition, many institutional investors still lack the risk management

capabilities, knowledge, investment channels or the means to access sustainable energy infrastructure projects in a way that aligns with their varying sizes, operational models and investment objectives (Kaminker et al., 2013).

Table 2.1. **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 > USD 25-USD 50 bn in AUM and dealflow to maintain costly direct investing team with expertise. e. Min USD 100-200 m deal "ticket" size; expensive and time-consuming due diligence; higher transaction costs.
	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 on financial performance and risk of sustainable energy across different asset classes and investment channels.
	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 venture capital investments due to temporal industry consolidation and macroeconomic factors transfer to projects which were unaffected.

Table 2.1. **What are the barriers to institutional investment in sustainable energy infrastructure?** *(continued)*

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 to existing vehicles (Covered Bonds, MLPs and REITs)	a. Current national legislation does not enable sustainable energy 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 analysis updated from Kaminker and Stewart (2012), CPI (2013), BNEF (2013); as cited in Kaminker et al. (2013).

As described in Kaminker et al. (2013), some investment barriers are of a regulatory nature. For instance certain countries place restrictions on pension fund investment which can apply to infrastructure (see Della Croce, Stewart and Yermo, 2011). In the EU unbundling regulations have been cited as obstructing funds from investing directly in electricity generation if they are also investing in electricity transmission and distribution assets. Solvency II (see glossary) regulations have been cited as limiting insurers' appetite for illiquid (see glossary) investments and their treating sustainable energy infrastructure as an investment as risky as hedge funds. In addition, pension fund "fiduciary rules do not include an obligation to consider the risks of climate change in asset allocation decisions."(McCrone, 2013a, p. 1)

There are practical constraints that reflect a mix of scale and inertia: some sustainable energy projects may be too small to attract large funds; smaller funds may lack knowledge and the resources to build specialist teams; some institutions may feel that there are other, less risky types of infrastructure they can invest in making it not worthwhile to invest in building the expertise needed to evaluate sustainable energy; consultants, or "gatekeepers", that advise pension funds on investments may not themselves be familiar with sustainable energy projects; and the new YieldCo formations (see discussion later in this section) may not be large enough – yet – to command the attention of a wide institutional audience (McCrone, 2013a).

There are also policy and political issues. Ensuring a stable, clear and integrated "investment-grade" policy environment will play an important role in addressing key barriers to investment by institutional investors. Concerns about the stability of subsidy support for sustainable energy and uncertain political consensus on future energy choices in some countries have reduced demand for sustainable energy infrastructure investments

and raised the cost of capital. While as previously described, the practice of allocating capital to infrastructure is starting to become more conventional for institutional investors, many are "hesitating about taking one step further into sustainable energy projects" because of these policy stability worries (McCrone, 2013a, p. 1).

In addition to the above-mentioned barriers, there exist further barriers that are unique to emerging economies and developing countries. For instance, options to mitigate regulatory, currency and corruption risk are generally less available and more costly; investment contracts are not standardised across countries making due diligence more time consuming and expensive and international arbitration is often not an option leaving disputes to be solved in local courts. A comprehensive set of supplementary barriers in emerging economies and developing countries is displayed in Table 2.2. Yet these are the countries that have large projected electricity demand that implies colossal future infrastructure build. The mismatch between investment opportunities and risks is particularly evident here.

Table 2.2. **Risks and barriers are heightened for institutional investment in emerging markets and developing countries**

Market risks	Developer risk	Desire for proven track-record of asset developer, or guarantee from a larger parent or sponsor to backstop development risk
	PPA counterparty credit risks	Desire for high quality off-taker of energy, be it a nationalized energy company or investor owned utility; for prepayments, concern about being paid back in falling rates environment without attracting reinvestment alternatives
	Currency and rate risks	Ability of non-OECD investors to hedge foreign exchange risk if investment is outside OECD jurisdictions; concern about interest rate fluctuations and impact on market value of debt
	Concentration risk	Lack of investor depth requires significant hold position on original lender's balance sheet
	Liquidity risk	Concern on ability to exit investment, particularly for smaller-size opportunities
	Market risk	Concern about the borrower's ability to weather extreme fuel price dynamics that could undermine specific sustainable energy technology's competitiveness relative to alternatives
	Business model and execution risk	This concern is most pronounced for impact investors considering opportunities in energy access
Political risks	Retroactive policy change risk	Change in regulatory of legislative support for green investment undermines economic outlook for underlying credit of investment asset by changing revenue, tax or contract profile
	Sovereign risk	The degree of state-owned ownership in the energy sector is cited as a deterrent by many investors but it can also be a risk mitigant when SoEs are co-investors in projects. There is also a lack of creditworthiness of many state-owned power utilities as off-takers
		Currency convertibility and availability; repatriation and expropriation risks
	Communication risk	An absence of coherence and communication between investors and the respective public institutions can lead to sub-optimal policy development
Technology risks	Aversion to new platforms	Preferring evolutionary improvements on equipment platforms that have already undergone due diligence
	Scale concerns	Concerns about whether investment deal flow will be significant enough to justify investment of time to learn the sustainable energy sector

Source: Adapted from Bank of America Merrill Lynch, BNDES and World Bank (2014).

Recent trends in institutional investor activity

Despite the barriers and challenges for institutional investor activity in sustainable energy, there are signs of increased investment. Since 2008 institutional investors have started to become engaged in wind power in the United Kingdom, Sweden, Denmark, Germany, Netherlands, Australia, Canada and the US; and solar PV in Germany, Japan, South Africa, Australia, Canada, and the US; and sustainable agriculture in Brazil (Kaminker et al., 2013; McCrone, 2013b). This report details many of these investments as made by pension funds in Chapter 3.

There are a number of reasons for this increased activity. Sustainable energy projects offer many of the attributes of "core" infrastructure assets as previously described. Sustainable energy is also increasingly competitive with conventional forms of power generation and a new stylised fact has been described of increased investment by institutional investors in line with decreasing cost. Globally, sustainable energy is the fastest growing source of new electricity generation capacity and projects are emerging as a discrete, "investable" asset class for these investors with increasingly available instruments and funds that are overcoming some barriers. In particular, sustainable energy projects have a number of unique characteristics which can appeal to these 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. Some sustainable energy projects can now provide sufficient collateral, probability of success, and predictability of future cash flow to offer institutional investors the "pledgeable future income" they need.

Within sustainable energy (i.e. excluding CCS power generation) renewable energy power generation sources are not subject to fuel price volatility and are typically backed by long-term contracts with investment-grade counterparts, the cash flows streaming from power sales allow for asset-liability matching and help hedge the risks of long-dated liabilities.[12] In addition, sustainable energy assets could reduce exposure to the effects of inflation on pension funds' long-term liability (the pension benefit) if, for example, they are linked to Power Purchase Agreement contract structures which have protection against inflation. Another benefit of investments in sustainable energy projects is that if they are held through the economic life of the project, the returns should be minimally correlated with those of the general market (e.g. with broad stock market indexes).

Institutional investors also have interest in issues such as climate change which can have a long-term impact on economic growth and thereby impair the assets on which they depend to generate returns far into the future (see Global Investor Coalition, 2014). The Principles for Responsible Investment (PRI) (2014) annual report finds that 81% of asset owners see climate change as having a material impact on their portfolios. The growth of the UN-supported PRI with 1 260 signatories representing USD 45 trillion in AuM suggests that investors are increasingly tackling environmental risks and searching for opportunities. To date, concerns have manifested in a few instances of divestment; notably by the Norwegian pension fund Storebrand, Swedish pension fund AP2 and the Stanford University endowment; and calls for greater disclosure of carbon risk by French pension fund ERAFP (Storebrand, 2013; AP Fonden, 2014; Stanford News, 2014). Additionally, the World Bank, the US Export-Import Bank, the European Bank for Reconstruction and Development and the European Investment Bank have severely limited the cases in which they will finance new coal power projects and Dutch bank Rabobank has ceased lending to unconventional gas projects (McGarrity, 2013; Morales and Roca, 2013; Rabobank, n.d.). A growing body of literature examines how investors might better assess "stranded assets risk" (see Box 2.2) and "rebalance or tilt" their portfolios towards sustainable energy to

hedge against these risks (Ansar, Caldecott and Tilbury, 2013; Asset Owners Disclosure Project, 2013; Caldecott and McDaniels, 2014).

Box 2.2. **Stranded assets risk**

Stranded assets have been defined as "the unanticipated or premature write-down, devaluation or conversion to liabilities of assets as a feature of the creative destruction that drives forward capitalism" (Caldecott and McDaniels, 2014, p. 8). Fossil fuel assets (i.e. the coal, oil or gas resources and reserves that the fossil fuel companies have on their balance sheets) have been described recently as having "the potential to become stranded due to a range of environment-related factors – from climate or other environmental regulations, developments in clean energy technology, resource constraints, evolving social norms and litigation" (Caldecott, McDaniels and Dericks, 2014, p. 2). This is increasingly thought to represent a potentially significant and material risk (or opportunity) for the range of actors across the energy investment chain (Asset Owners Disclosure Project, 2013; Ansar, Caldecott and Tilbury, 2013; Carbon Tracker Initiative and The Grantham Research Institute, 2013; Caldecott and McDaniels, 2014; Fulton and Capalino, 2014). Conversely, political and regulatory decisions can strand sustainable energy sources if they rely on subsidy.

Angel Gurría, Secretary General of the OECD noted the following in the course of a lecture at the London School of Economics in October 2013: "If policy makers cap carbon emissions, the risk of 'unburnable assets' could have a significant impact on the valuation of some companies. It is worth recalling that the investors are in so many cases people like you and me. The Asset Owners Disclosure Project estimates an average of over 55% of pension funds' portfolios is being invested in high carbon assets or sectors greatly exposed to climate change physical impacts and climate change-related regulation. The looming choice may be either stranding those assets or stranding the planet" (Gurría, 2013).

The IEA (2014a, p. 43) states that stronger climate change policies will not only have an impact on future investment decisions, but may also affect the economics of existing energy sector assets. As a result of changes brought about by climate policy, some investment in fossil fuel-based assets, it suggests, may not be able to earn an economic return prior to the end of their economic life and risk becoming stranded assets "not recovering all or part of the their investment during the time that they are operational" (ibid. p. 43). It finds that by 2035 in the 450 scenario (see glossary), new fossil-fuel capacity in the power sector valued at USD 120 billion is stranded, upstream oil and gas investment of USD 180 billion is stranded, and coal mining investment of USD 4 billion is stranded (as most mines are old and have already recovered investment). However, the IEA suggests that if investors misread signals from policy makers and invest on the basis of a less ambitious climate policy environment (i.e. the "New Policies Scenario" – see glossary) but end up in a 450 scenario world, then there is higher potential for fossil fuel stranding than the numbers presented. It also follows that clarity on future policy frameworks minimises additional risk.

Analysis and debate concerning the issue is ongoing (see for instance the work of; inter alia, Carbon Tracker Initiative, University of Oxford Stranded Assets Project, the Bloomberg LP Carbon Risk Valuation Tool, 350.org and the prominent media coverage of the issue in the Economist, Financial Times, Telegraph, etc.). There are also skeptical arguments, notably in independent oil company responses to shareholder petitions from concerned investors (see ExxonMobil and Shell for instance).

In the margins of the 2014 UN Climate Summit, institutional investors made several notable announcements. Funds handling USD 2 trillion promised to support an expansion of the green bond market (RTCC, 2014a). A smaller group, worth USD 500 billion, committed to revealing the carbon footprint of their investments, under the Montreal

Pledge (Montreal Pledge, 2014). Three major pension funds announced plans to accelerate low-carbon investments across asset classes up to USD 31 billion by 2020 (RTCC, 2014b). Leaders from the insurance industry committed to doubling their climate-smart investments to USD 84 billion by 2015 and increasing their climate smart investments tenfold by 2020 (ClimateWise, 2014). Finally, a group of institutional investors managing USD 100 billion, including Swedish state pension fund AP4, pledged to decarbonise their entire equity portfolio as part of the Portfolio Decarbonisation Coalition (PDC) (UN, 2014).

With regard to Europe in particular, analysis of data collected by BNEF and investment fund HgCapital, shows that there is an emerging "ecosystem of investment" in EU sustainable energy and growing appetite for these investments. The number of active direct institutional investors has increased from less than 10 in 2004 to over 40 today with increasing allocations by director investors to sustainable energy in a handful of European countries with "stable" policy frameworks and large domestic pension funds and insurers. CPI suggests that globally there are around 45 pension funds and 100 insurers large enough for direct investing, representing USD 25 trillion (Nelson and Pierpont, 2013).

Research of secondary news sources, such as Bloomberg New Energy Finance, New World Energy Network, Clean Energy Pipeline and Clean Tech Connect, indicate that this trend is occurring in other markets, with ever-increasing institutional investor appetite in infrastructure assets in general and renewable energy assets in particular. The sector has even caught the attention of companies such as Google and investors such as Warren Buffet who, through his MidAmerican Energy, has invested USD 17 billion in North American wind and solar projects (Wall Street Journal, 2014).

This increased appetite can be attributed to a number of factors. An enduring low interest rate environment with low-yielding government bonds has forced some pension funds to cite their fiduciary obligation to identify stable attractive returns with low correlations to other asset classes as a reason for investing in sustainable energy (e.g. PensionDanmark). Additionally, an increase in appropriate instruments and funds to access sustainable energy, which lessens the need to invest directly, has coincided with rapidly falling costs of sustainable energy since 2008. For example, as discussed next, fixed income (i.e. bonds) are a key asset class for pension funds. Investments in green bonds provide an option for pension funds to fund projects and corporations that fit within their traditional asset allocation process and does not involve creating a separate investment class or category.

The evolution of institutional investor activity: The maturing green bond market

Traditionally, bonds have been the asset class favoured by OECD pension funds and insurance companies which in 2013 invested on average 53% and 64% respectively of their portfolio in bonds (simple average).[13] In 2013 the total amount of capital held in global debt securities (e.g. bond) markets issued by all types of entities (banks, governments, corporations, etc.) was around USD 100 trillion (Bank for International Settlements, 2014). Consequently, much attention has been focused on the potential to develop the use of fixed-income instruments such as bonds to support greater institutional investor participation in sustainable energy infrastructure investments.

One approach to attracting investor attention has been the development of thematically labelled "green" or "climate" bonds, similar to highway bonds or war bonds of past eras. The theory behind this approach has been to make it easy for investors interested in the climate change area to locate bonds that relate to that interest, and, for issuers, to attract

new investors particularly interested in the climate theme while obtaining risk-adjusted returns. Green or climate bonds are defined for the purpose of this report as fixed-income debt securities issued by governments, banks, MDBs, corporations and projects in order to raise the necessary capital for an asset which contributes to a low carbon, climate resilient (LCR) economy.

This market has seen significant growth in volume of issuances and scale of investor interest in recent years, although from a very low base. In 2011, the OECD valued the market size for all green bond issuance at approximately USD 15.6 billion – a marginal figure (0.017%) compared to the capital held in global bond markets at the time (Della Croce, Kaminker and Stewart, 2011). In 2014, USD 36.6 billion had been issued (Climate Bonds Initiative, 2015), adding to an entire market valued by HSBC and Climate Bonds Initiative (2014) at USD 503 billion (a 45% increase from the March 2013 estimate of USD 346 billion). HSBC and Climate Bonds Initiative (2014) forecast annual issuance to exceed USD 100 billion in 2015.

According to Climate Bonds Initiative (2014), this universe of fixed income instruments with proceeds used primarily for financing the transition to a LCR economy consists of over 1 900 bonds from approximately 280 issuers and remains dominated by transport (USD 358.4 billion – primarily rail transport), sustainable energy (USD 74.7 billion) and financial institution (USD 50.1 billion) themes. Of special note for institutional investor demand, USD 236.6 billion (or 47%) of the bonds could be eligible for inclusion on mainstream indices because they have features which institutional investors usually require such as Investment-grade ratings (BBB- and higher), currencies eligible on benchmark indices and issuance sizes over USD 200 million.

Climate Bonds Initiative among many others have observed strong growth in the market for green bonds starting in late 2013 and early 2014 and suggests that this growth has elevated the market designation from "niche" to "maturing" (Flood, 2013; BNEF, 2014; Climate Bonds Initiative, 2014; The Economist, 2014). However, further steps are required before this market becomes mature enough to support sustainable energy investments by institutional investors at a scale commensurate with the challenge discussed in this report.

The majority of green bonds have been issued by multilateral development banks,[14] corporations and financial institutions which have been "ring-fencing" (see glossary) the proceeds for green assets. These bonds are also referred to within the Green Bond Principles as "use of proceeds bonds". These bonds resemble "vanilla" corporate bonds or treasuries with standard bond documentation, but will include in addition language on how the proceeds will help mitigate GHG emissions for each issuance. The credit risk of these bonds will be that of the issuing entity, as opposed to asset-backed or project bonds discussed below. Increased issuances from these parties are encouraging as they will help prime the market for green bond offerings from traditional commercial and investment banks and other types of bonds (e.g. asset backed securities and covered bonds). However, the capacity for these actors to increase their issuances is necessarily constrained by the size of their balance sheets. An analysis of how far this constrains the market from growing is not currently available to be referenced and beyond the scope of this report but would be useful to understand how much of the financing gap these sources can realistically fill.

Project bonds finance specific projects where the debt is paid back from the cash flow generated by the projects rather than an issuer's balance sheet. Project bonds have been used to finance *large* sustainable energy projects around the world and can potentially play a major role in raising financing from institutional investors. However to date project

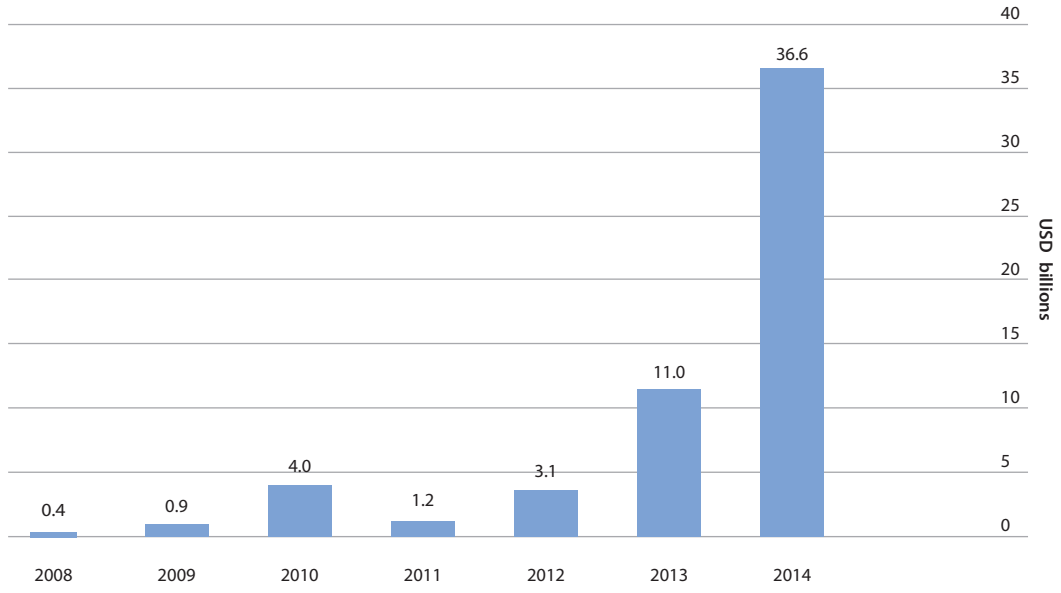
bonds financing construction of assets remain a minor proportion of the market partly due to institutional investor reluctance to take on construction risk. Debt finance for project development is, and is likely to remain, dominated by bank lending (Climate Bonds Initiative, 2014, p. 4). As such, the area where there is significant potential for project bonds to contribute is in the post-project-completion project bond market, where lenders and equity investors use bonds to re-finance assets, recycling and freeing up their capital for new projects.

Despite being small currently, the market for sustainable energy project bonds has growth potential. As described by Kaminker et al. (2013), utility-scale sustainable energy projects that are large enough to support the cost[15] of issuing a project bond (mostly for wind and solar) had issued over USD 7 billion of project bonds as of November 2013 to insurance companies, pension funds and other investors. Given the pipeline of 225 large (i.e. 95 megawatts and above) wind and solar projects in the United States and Europe, Bloomberg New Energy Finance estimates a potential clean energy bond market of USD 142 billion, with bond issuances of USD 18-USD 40 billion annually by 2020 (up from roughly USD 2 billion currently).

To be generally eligible for investment by institutional investors, bonds backed by revenues from sustainable energy projects must be rated as "Investment-grade" (see glossary). Limited performance history, however, can make this rating difficult for some projects to attain. Policy makers are working to address this problem and accelerate issuance of sustainable energy project bonds by using public funds to provide "credit enhancement" (see Chapter 4) to such issuances. By reducing the probability of investor losses, publicly funded subordinated debt or loan-loss reserve facilities (as being implemented by the Europe 2020 Project Bond Initiative) can improve the creditworthiness of sustainable energy project bonds and bolster investor demand.

Banks can also issue "covered bonds", which have been described as a potential middle ground between AAA-rated green bonds issued by multilateral development banks and

Figure 2.4. **The growth of the green bond market**



Source: Adapted from Climate Bonds Initiative Database (2015).

asset-backed securities relying uniquely on the cash flows from sustainable energy projects (Climate Bonds Initiative, 2014; Fulton and Capalino).[16] By creating liquid assets with a lower cost of funding, covered bond legislation, which now exists in nearly 40 countries and supports a USD 2.5 trillion global market for all types of covered bonds, has encouraged lending in designated areas such as housing and public infrastructure. To open up this route of financing, policy makers would need to revise covered bond legislation to allow banks to issue covered bonds based on sustainable energy loans. Bondholders have recourse to the bank (which makes them "covered") that made the loans in the case of default which makes them less risky.

Some sustainable energy projects will be large enough to individually issue bonds. Most projects including distributed generation, however, are too small to justify the expense of an individual bond issuance; as a result, the best way to link such projects to capital markets is to pool, or "securitise," them into a "special purpose vehicle," and then issue bonds backed by the cash flows from this pool (as discussed in Chapter 5).

The US National Renewable Energy Laboratory (NREL, 2013) argues that securitisation is a promising way to provide debt finance for portfolios of rooftop solar PV projects, a recent example being SolarCity's issuance of USD 54 million of notes backed by residential solar leases followed by a USD 70 million issuance and a USD 200 million issuance, each with a lower interest rate and less over-collateralisation.[17] Because many developers of sustainable energy projects lack the credit rating to themselves issue bonds, securitised bonds – where repayment depends on the quality of the assets rather than the creditworthiness of the issuer – have the potential to lower financing costs.

As described by (Kaminker et al., 2013), government institutions such as the US National Renewable Energy Laboratory are working to scale up the market for asset-backed securities (ABS). Fulton and Capalino (2014, p. 7) recommends that such endeavours must *1)* minimise the due diligence burden on buyers of sustainable energy ABS issues (by standardising Power Purchase Agreement terms); *2)* make future cash flows from such issues more stable (by strengthening the supply of operations and maintenance providers to keep systems in service); *3)* enable more accurate rating and pricing of such issues (via more detailed historical data); and *4)* limit downside risk for buyers of early sustainable energy ABS issues (via credit enhancement from banks).

Finally, the OECD has called for common standards and issuing principles which are essential for growing bond markets and preventing "greenwashing" scandals that would damage the reputation of bond issuers and investors alike (Kaminker and Stewart 2012; Kaminker et al., 2013). Investors need clarity about what really is green – what is important to environmental protection and addressing climate change and will ultimately decide for themselves how green they would like their portfolios to be. Progress is being made on this front by organisations such as the Climate Bonds Initiative with their Climate Bonds Standard and the Green Bond Principles now overseen by the International Capital Markets Association.

The evolution of institutional investor activity: The emergence of YieldCos

Having discussed innovations in the debt markets, there has also been the development of equity funds that similarly fit and provide a potentially attractive subcategory within traditional equity asset allocations. Listed equity funds that pool projects, known as YieldCos, are a good example of this trend in the sustainable energy field.

A "YieldCo" is a publicly traded (listed) investment fund structure that owns cash generating infrastructure assets which generally earn stable cash flows. Most notably, the YieldCo collects the stable cash flows and distributes them through public markets to shareholders as dividends while providing liquidity (i.e. investors are able to easily buy and sell shares in the YieldCo). YieldCos can also issue green bonds (e.g. NRG's USD 400 million green bond in 2014). YieldCos typically require an asset base of at least USD 500 million and an IPO value of USD 150-200 million.

A power producer creates a YieldCo to which it sells sustainable energy plants that have multi-year Power Purchase Agreements (PPAs) (see glossary). Those agreements are long-term contracts with utilities – the latter agrees to buy electricity from the plants at specified prices. The PPAs allow the YieldCo to pay a dividend. The YieldCo is liable for income tax but because of depreciation costs, it will not earn taxable income in the near future so no taxes are owed.

YieldCos are not the only investment fund structures that provide liquidity and more direct access to cash flows and can be listed and traded on an exchange. Real estate investment trusts (REITs) and Master Limited Partnerships (MLPs) are also examples where illiquid assets are bundled together in corporate structures with steady cash flows in the form of dividends, and then traded in liquid markets. The markets for REITs and MLPs in the US alone were valued at over USD 1 trillion in 2014. Feldman and Settle (2013) has examined this issue and found that due to current US federal income tax laws, regulations, and administrative interpretations, REITs and MLPs cannot finance a significant portion of the cost of sustainable energy assets. Efforts are underway to alter these rules by changing the definition of "real property" (for REITs) and "qualified income" (for MLPs). Even with rule changes, Feldman and Settle (2013) state that both investment vehicles have structural challenges to efficiently finance sustainable energy assets. Listed and private infrastructure funds do exist, but investors have expressed concern about expensive management fee structures, excessive use of leverage, churn and disconnect from the cash flow profile of underlying assets (see glossary for definitions and Nelson and Pierpoint, 2013 for discussion).

As a response to these limitations, since 2013, sustainable energy and other infrastructure-type assets have been bundled into YieldCo structures that are traded on exchanges. BNEF (2014) finds that US YieldCos and their UK equivalents, the quoted project funds, raised approximately USD 4.5 bn from investors in 2014. As the name implies, investors (both institutional and retail) that seek steady dividend cash yields based on real underlying assets are able to obtain these while also maintaining the ability to sell the shares easily with low transaction costs as they are liquid instruments traded on an exchange. NRG Yield, Greencoat UK Wind Energy, Pattern Energy, Abengoa Yield and Nextera are all examples of YieldCos that have listed on US and UK exchanges. Additional favourable attributes of YieldCos are cited (Morgan Stanley, 2014) as their abilities to offer dividend and asset growth. This is accomplished through the process of a "drop-down" where the YieldCo has a group of Right-Of-First-Offer (ROFO) agreements with its sponsor or parent that cover a set group of assets. Morgan Stanley explains that while the size of the potential acquisition differs by YieldCo, in aggregate they expect to see them increase their generation asset base over time (and as a result the cash flow and dividends).

However, analysts and bankers warn that because YieldCos are so new, their performance during a period of rising interest rates has not yet been tested. They also warn that if YieldCos do not manage to secure new projects with PPAs, perhaps because of a slowdown in the growth of the sustainable energy industry as tax breaks and other government incentives are withdrawn, then the companies will not be able to deliver their

planned growth (Crooks and Bullock, 2014; Global Capital Finance, 2014; Financial Times, 2014). Morgan Stanley (2014) expects YieldCos and their sponsors to play a signficant role in financing the deployment of sustainable energy in the United States through to 2020 but also states that the most significant risk YieldCos face is capital market risk, since access to reasonably priced funds to support expansion (i.e. finance the construction of underlying sustainable energy assets) is crucial. Other risks cited include trading and liquidity risk given that both markets capitalisations and public offering sizes are comparatively small.

Box 2.3. **How the YieldCo model may need to evolve to achieve its potential**

Nelson (2014) argues that widespread use of YieldCos (combined with municipal finance) could allow for wind and solar costs to drop by more than 20% compared to current project finance models in the United States. Yet although the advent of YieldCos has been an important first step, Nelson argues that to realise their significant potential to drive down costs and bring in capital for sustainable energy, current designs would need to evolve to consistently: *1)* provide highly predictable, long-term cash flows while paying out nearly all of the free cash generated from underlying projects, *2)* provide liquidity through listing on exchanges and having a large enough set of investors to attract equity research analysis, *3)* provide investment at low fees, and *4)* become established as part of the portfolio of options for institutional investors.

According to a GreenTechMedia (2014) summary of discussions held at the Renewable Energy Finance Forum Wall Street in 2014, issues such as these could be addressed as the market matures and financial regulators work with investors to find solutions to these issues. Public green investment banks could also play a role to help YieldCos mature more rapidly and to connect YieldCos with sustainable energy projects that are smaller than utility scale but larger than residential.

Additional players in this "ecosystem" of private investment include unlisted private equity and specialist renewable energy funds that take the early stage risks of developing, building and commissioning projects. Once de-risked, they become attractive investments for infrastructure funds and direct institutional investors seeking stable but lower yields. This model is similar to commercial real estate, where private equity-type funds 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 (Murley, 2013).

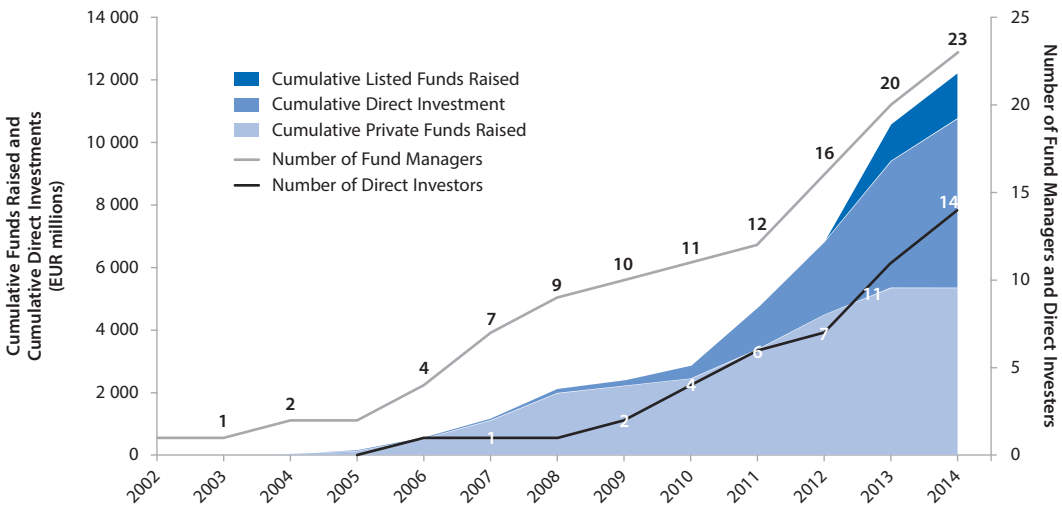
The evolution of institutional investor activity: Direct and intermediated project investment

In examining how to invest in sustainable energy projects, institutional investors are simultaneously considering where on the risk spectrum that they would like to invest and how they want to access the market. Sustainable energy assets at the operational phase can offer stable, bond-like long-term returns, but there is increasing competition for these assets. To compete for these assets, institutional investors must offer the asset owners a lower cost of capital – i.e. lower rates on long-term debt (Murley, 2014). In comparison, there is a relative shortage of up-front, equity capital for developing and constructing new sustainable energy assets. Thus, investors are working to determine whether they want to compete for the lower-risk operational projects which are also a good fit for certain institutional investors, or whether they prefer to seek higher returns for taking development and construction risk. As discussed in Chapter 3 investors must also consider if they will develop expertise "in-house" to deploy capital directly into projects and companies or they

prefer to outsource this process to external managers. Institutional investors can participate in "greenfield" investment, acquiring assets as they become operational or can acquire "brownfield" operational assets from utilities, project developers and other financial investors.

Figure 2.5 displays an overall increasing trend in Europe for institutional investment in sustainable energy (albeit with modest numbers compared to the infrastructure investment gap). Table 2.3 describes the characteristics of a number of notable investments in European sustainable energy by pension funds and insurance companies in recent years. As a group, institutional investors look to sustainable energy projects as an opportunity to provide long-term debt. However, not all institutional investors are the same – they have different risk appetites and liability profiles. For example, some (like insurance companies, which have equity investment expertise, and some exceptional pension funds with interest in and capacity for equity investments in sustainable energy, like PensionDanmark) are finding attractive equity investment opportunities and are relatively comfortable with engaging early in the project cycle and taking on or sharing construction risk with investment partners.

Figure 2.5. **Evolution of EU renewable power sector investment by institutional investors (2002-14)**



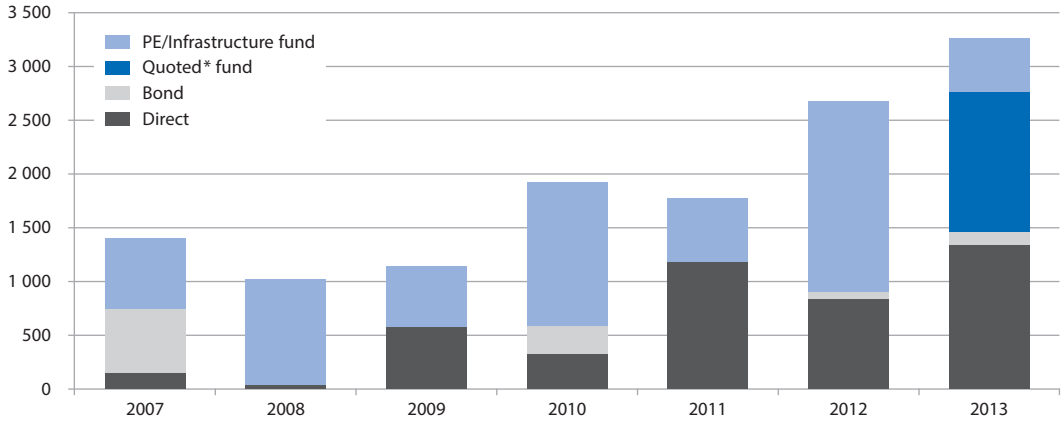
Source: Murley (2014).

Clean Energy Pipeline (2014a) states that for institutional investors return expectations for equity investments in sustainable energy projects are 5%-10% IRR p.a. after tax depending on country and technology; they are investing at 1-2 years after commissioning although will invest during construction if an EPC contract is in place and will look to holding the assets until the end of the assets' lifetime (20-30 years). Insurance companies are reported to prefer full control of the asset so often acquire a 100% ownership position whereas pension funds prefer to co-invest alongside experienced strategic or financial partners so will typically make minority investments. In terms of investment size, on average pension funds seek to deploy EUR 100-250 million at once while insurance companies seek to invest EUR 20-100 million (Clean Energy Pipeline, 2014a).

As such, equity investment has increased from less than EUR 300 million per year in 2004 in Europe to over EUR 1.8 billion per year in 2012, a compound annual growth rate in excess of 35%. Further, according to CohnReznick (2013, p. 21), over half of installed wind turbines in Europe are reported in their survey to be owned by institutional investors. Growing appetite is partly due to government bonds yielding around 2-3% and sustainable energy projects yielding around 6%. Additionally proposed Public Private Partnership (PPP) platforms have yet to come to fruition. Therefore institutional investors have not yet been able to consider PPP platforms as options which would compete with direct investment opportunities. Institutional investors have varying degrees of risk appetite, with data from HgCapital suggesting that they favour investment in de-risked operating assets over project development or construction risks (Murley, 2014).

Using data from BNEF, Figure 2.6 shows a rising trend in institutional investments in European renewable energy projects. These combine direct investment in projects by investors such as Allianz, MunichRe and PensionDanmark, investment via project bond issues, via specialist European renewable energy infrastructure and private equity funds, or via listed project funds (YieldCos) such as Greencoat UK Wind and Bluefield Solar Income Fund. On this measure, disclosed institutional commitments increased from around USD 1 billion per year in 2008 and 2009 to USD 2.6 billion in 2012. The equivalent figure for 2013 was projected to be between USD 3-4 billion.[18] In North America, using data from Clean Energy Pipeline (2014b), institutional investors exhibit sustained interest in acquiring operating sustainable energy projects in 2013 with pension funds, insurance funds, and infrastructure funds acquiring 38 renewable energy assets valued at USD 2.5 billion, in line with 39 acquisitions announced in 2012 (USD 5.0 billion), but significantly above the 13 acquisitions totalling USD 219 million in 2011.

Figure 2.6. **Institutional investor commitment to European sustainable energy projects (USD millions)**



*"Quoted" is a synonym for "listed on an exchange", i.e. a YieldCo.

Source: Bloomberg New Energy Finance. Note: This measures money committed by institutions, whether to funds, to bonds or directly to projects. It excludes corporate-level equity and bonds for project developers, and money raised by retail funds such as Venture Capital Trusts. 2013 figures are for the year to 24 October.

Table 2.3. **Characteristics of notable investments in European sustainable energy by pension funds and insurance companies in recent years**

Investor(s)	Stake acquired	Target	Deal size	Date announced
PensionDanmark, through infrastructure fund manager Copenhagen infrastructure Partners	67%	900 MW DolWin3 offshore wind grid connection	EUR 384 million	Feb-14
Gothaer Versicherung	Undisclosed	Juwi Renewable IPP, owner of a 450 MW portfolio of solar PV and onshore wind capacity	EUR 150 million	Jan-14
Predica (subsidiary of Crédit Agricole Assurances)	50%	Futures Energies Investment Holding (subsidiary of GDP Suez), which operates 440 MW of installed onshore wind capacity	Undisclosed, although will enable GDF SUEZ to reduce its net debt by some EUR 400 million	Dec-13
Allianz Capital Partners (alternative asset investment platform for Allianz)	100%	100 MW portfolio of three onshore wind farms, including a 76.5 MW project in Germany and two projects in France totalling 23.5 MW	Undisclosed	Jun-13
MEAG (asset management arm of Munich Re), General Electricity, EDF Energies Nouvelles	100%	Iberdrola Renovables France (operating 32 onshore wind farms in France totalling 321 MW)	EUR 400 million	Dec-12
Aviva Investors (asset management arm of Aviva)	100%	23 MW portfolio of over 7 000 UK residential solar PV assets	EUR 126 million	Aug-12
Irish Infrastructure Fund, asset management arm of Irish Life &Permanent PLC	75%	104 MW portfolio of ten onshore wind farms in the Republic of Ireland and Northern Ireland	EUR 200 million	Jun-12
PensionDanmark A/S, PKA A/S	50%	400 MW Anholt offshore wind farm	EUR 900 million	Mar-11

Source: Adapted from Clean Energy Pipeline (2014a).

Key takeaways for policy makers

- Since 2010, a significant increase in institutional investment in sustainable energy has occurred from a negligible level in 2005. By 2013, annual direct investment in projects was approximately USD 2.5 billion in Europe and 2-3 billion North America. There have also been innovations in the channels investors are using to access the assets. Yet, significant policy and investment barriers remain. The question is what investment channels and conditions will be required for a broader group of institutional investors to invest in sustainable energy at levels that contribute more meaningfully to total investment needs.
- Green bonds (including corporate, treasuries, project bonds, covered bonds and asset-backed securities), YieldCos and direct investment in projects are all promising channels that have experienced growth and innovation. In the geographies where they have emerged, they all have unique challenges which will need to be surmounted to evolve to a position where they can mobilise institutional investors at scale, connect directly to projects of all sizes, and contribute to lowering the financing costs of sustainable energy. Uncertainty exists over the

scope for these investment channels to emerge and develop in other geographies, especially in emerging and developing countries, and much further analysis is needed in this regard.

- These nuances become clearer in the broader context of investment options available to institutional investors (instruments and funds), the ways in which risks can be apportioned, shared or mitigated, and how transaction costs can be lowered. The classification framework that follows will define these terms, provide examples of how they have been used for investments in sustainable energy, and illustrate how institutional investors view and assess these different categories of investments and make investment decisions.
- Considering the potential for investment and initial investment activities by some institutional investors, this report seeks to test the notion that sustainable energy is becoming more established and identifies factors that contribute to this increased activity. This report therefore screened for and subsequently identified 67 investment cases that are explored in the following Chapter 3. The cases identified and the investment classification system proposed build off the notions of asset liability management, asset allocation, and the different types of instruments and funds presented in this chapter.

Notes

1. In the 2010 Cancun Agreements, Parties of the United Nations Framework Convention on Climate Change (UNFCCC) agreed to work together, with a view to reducing global greenhouse gas emissions so as to hold the increase in global average temperature below 2°C above pre-industrial levels.
2. According to the IEA, cumulative investment needs in energy supply and in energy efficiency will reach USD 53 trillion by 2035 to get the world on a path to achieve a two-degree goal, compared with USD 48 trillion based on today's policies. These figures do not consider avoided fuel costs, which are significant and offset increased investment needs in the power sector by 2035 in the IEA's "two-degree scenario" (IEA, 2014b, 2014c).
3. In real 2012 USD, i.e. excluding inflation; includes other infrastructure beyond just sustainable energy.
4. Even with a 10% discount rate, the net savings are more than USD 5 trillion.
5. Underscoring the importance of this, at the 2014 Ministerial Council Meeting, OECD countries invited "OECD, in co-operation with the IEA, the NEA and the ITF […] to examine how to better align policies across different areas for a successful economic transition of all countries to sustainable low-carbon and climate-resilient economies and report to the 2015 OECD MCM."
6. This topic has been the focus of extensive OECD analysis available at www.oecd.org/env/cc/financing.htm.
7. In developing countries and emerging economies, the picture would be roughly reversed, with the public and "quasi-public sector" (state-owned banks and corporations) providing two-thirds of investment financing. As these economies grow, however, so they come under pressure to expand the provision of pensions and healthcare. Demographic trends imply that these systems

will require an increasing share of public expenditure creating more competition for capital and scarcer resources for investment finance (IEA, 2014b).

8. There is significant variation among countries; however, the 60% of investment transactions in non-hydro sustainable energy in 2013 that disclosed financial information to BNEF shows that financing of capital expenditures through retained earnings and equity represented around 40%, a share far lower than what is observed for financing of conventional power plants in OECD countries (IEA, 2014c). Most of the remainder was financed with long-term loans and 10% by short-term loans, such as bridge finance (BNEF Database, private communication).

9. Although activity has decreased since the financial crisis, banks remain important providers of infrastructure finance, particularly when capital markets are thin and secondary debt markets nascent. Although their involvement varies substantially by region, banks have historically participated in the debt financing – and, to a lesser extent, equity financing – of projects. As the banking sector recovers from the financial crisis it is expected step in increasingly as project arrangers and facilitators, or to provide bridge financing (Standard and Poors, 2013).

10. In most defined contribution plans, pension beneficiaries can switch between investment options, generating a need for liquidity. Defined benefit funds have more ability to invest directly in sustainable energy projects as they have greater illiquidity tolerances.

11. Examples of direct investment using in-house expertise to invest in instruments and funds are explored in Chapter 3. Chapter 4 explores the use of risk mitigants and Chapter 5 discusses the use of transaction enablers.

12. A section of the balance sheet that lists obligations of the company that become due more than one year into the future.

13. Source: Authors' analysis, OECD Global Pension Statistics, Global Insurance Statistics and Institutional Investors databases, and OECD estimates.

14. Green bonds issued by multilateral development banks have been especially popular with institutional investors as, unlike asset-backed securities, these bonds are not tied to the cash flows from specific projects, but instead can benefit from the AAA ratings of the issuing institutions, enabling them to become immediately eligible for institutional investor portfolios.

15. Smaller projects (unless bundled) in general lack the scale needed to make a listed bond issue viable in terms of cost and market liquidity. However, not all bonds follow the same route; there are numerous listed and unlisted options, depending on the target section of the bond market, and some bond financings can be executed at least as efficiently as on a loan deal (Norton Rose Fulbright, 2012).

16. Covered bonds also rely on project cash flows but investors receive the added protection of having recourse to the underlying issuer as well as the projects. For a longer discussion including policy recommendations see Damerow, Kidney and Clenaghan (2012).

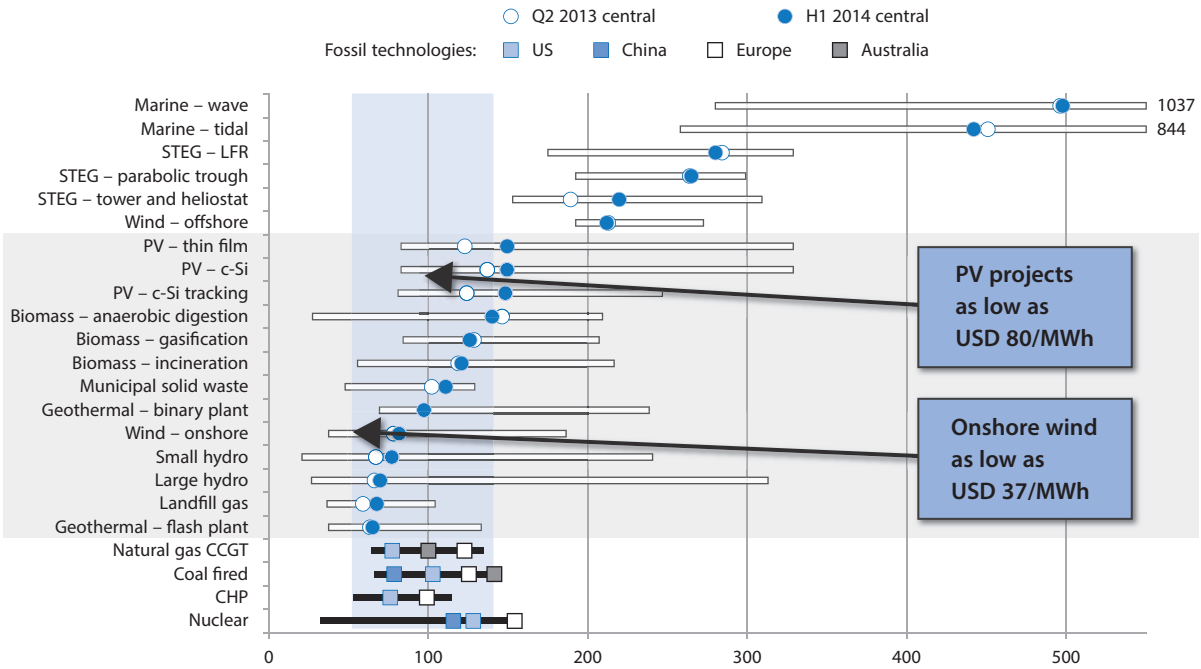
17. For more see CleantechIQ, "SolarCity Launches S&P Rated Bonds, Plans to Raise $54M," 15 November, 2013, http://cleantechiq.com/2013/11/solarcity-launches-sp-ratedbonds-plans-to-raise-54m.

18. These figures are not comprehensive. For instance, they exclude commitments to renewable energy infrastructure funds that invest worldwide, not just in Europe. They exclude commitments to companies that develop and construct projects as well as operate them. They also exclude fund closings that are not disclosed.

Annex 2.A1

Levelised cost of electricity

Figure 2.A1.1. **Levelised cost of electricity, H1 2014 (USD/MWH)**



Note: LCOEs for coal and CCGTs in Europe and Australia assume a carbon price of USD 20/t. No carbon prices are assumed for China and the United States.

Source: Bloomberg New Energy Finance.

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Chapter 3

Towards a framework for understanding investment channels

This chapter proposes a framework for understanding how institutional investors, specifically large pension funds, allocate capital to sustainable energy investments in projects or "corporates". The analysis is supported by 67 actual investment cases collected for the purpose of this report and described in detail. The chapter introduces a framework for understanding investment channels by constructing a classification system. Tabular and visual devices illustrate how the classification works for different types of transactions. "Investment pathways" illustrate decision processes, including the choice between direct or intermediated investment, in projects or corporations. "Matrix frames" visually plot transactions together and display trends. A "schematic overview" visual device is used at the level of a single transaction to highlight how instruments, funds, risk mitigants and transaction enablers have all come together in a specific investment example. The chapter concludes with how the framework can be used in the future.

This chapter describes and proposes for policy makers a framework for understanding how institutional investors, specifically pension funds, allocate capital to sustainable energy investments (in projects or "corporates" i.e. corporations) using instruments and funds. Figure 3.1 highlights the part of the framework that is the focus of this chapter and the relevant instruments and funds. This chapter discusses instruments and funds that are currently being used for sustainable energy investment and identifies where they have not yet developed in the market.

Figure 3.1. **A focus on instruments and funds**

Financial Capital Type	Financial Instruments		Funds
	Capital Market Securities	Cash	
Debt	Sovereign, Supranational 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
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

This chapter is organised into four sub-sections which focus on analysing the instruments and funds used by pension funds to invest in sustainable energy, highlighting their use in actual investment cases. As there is no existing database of institutional investor activity in sustainable energy, the first sub-section describes the methodology used to identify specific cases of investments in sustainable energy projects by institutional investors. A table provides summary information regarding the 47 cases of sustainable energy project investment highlighted in this report. These cases, in addition to examples of investment in sustainable energy corporates, are analysed further in the subsequent sub-sections.

A second sub-section on the geographic flow of investment exhibits the trends observed in the sample with respect to the direction of investment flows and highlights the tendencies for institutional investors to invest in domestic sustainable energy projects. A sub-section on "investment pathways" presents the investment cases as a result of different types of investment decision processes. For example, pension funds could frame the decision to invest in sustainable energy in the context of their own institutional capacity for such investment and their ability to support an in-house team that handles investment decisions versus the need to outsource investment management (e.g. investment funds) or use pooled funds (e.g. green bond funds). In addition, institutional investors may have a preference for specific types of investment exposure to sustainable energy e.g. they may prefer investing in projects, "pure-play" (see glossary) corporates or diversified corporates. Finally, a sub-section on investment pathways highlights the types of investments that are not yet being used by institutional investors. Examples of sustainable energy investment are then mapped in a matrix (see Figure 3.8) to provide a visual representation of the distribution of the sample by transaction type.

Methodology and samples summary data

Information for this report is drawn from a review and screening of market data and interviews to identify investments by institutional investors in sustainable energy infrastructure carried out by the authors between February and July 2014. The two main resources for identifying institutional investors were the Towers Watson 2013 Pension Ranking of the 300 largest pension funds and the Sovereign Wealth Institute's Fund Rankings.

The financing gap for investment in projects is widely recognised (Kaminker and Stewart, 2012; Inderst and Stewart, 2014). Investment in projects is considered to be key for filling in the infrastructure gap (Inderst and Stewart, 2014) and financing the transition to more sustainable energy (Inderst, Kaminker and Stewart, 2012). At the same time, direct investment is recognised to be the most difficult type of investment for institutional investors due to the skills and resources required (Nelson and Pierpont, 2013). Research for this report therefore focused on identifying institutional investors with the capability and resources to make direct, in-house investments in sustainable energy infrastructure projects and to assess their activity and interest in pursuing these investments. In addition, the research also sought to identify the use of risk mitigants and transaction enablers (see Chapter 4) that may have facilitated these project investments.

Not all pension funds will be capable or interested in investing in-house in sustainable energy projects. CPI suggested that assets under management (AUM) in the order of USD 50 billion are needed in order to justify the costs of building a dedicated team to invest directly in sustainable energy investments (Nelson and Pierpont, 2013) although as previously mentioned, instances exist of smaller pension funds accomplishing this successfully. In order to screen for pension funds and sovereign wealth funds (SWFs) with the capabilities to pursue these investments and allow an extra margin to capture potential investments, institutions with assets under management (AUM) exceeding USD 40 billion were initially targeted. Although insurance companies and asset managers often have significant AUM, they are not included in this initial screening and sample.[1] Future work could expand the screening to include insurance companies and asset managers. Select pension funds and SWFs with relevant investments that did not meet the AUM 40 billion cut-off were also added on a case-by-case basis as some are known to have developed significant in-house asset management capabilities (e.g. PensionDanmark).

Information on relevant investments was sourced using the Bloomberg New Energy Finance (BNEF) database and primary and secondary research using publicly available sources as well as close dialogue interview. Sustainable energy infrastructure investments are the current focus of this report and include wind,[2] solar,[3] biomass, waste-to-energy, biofuels, geothermal and small hydro (under 30 MW) (see Box 1.1 for definition). Approximately 130 institutions have been initially screened for relevant project investment in sustainable energy. As the focus of the research thus far has been on identifying and understanding debt and equity investments in projects by pension funds, cases of investment in pure-play or diversified corporates that develop or invest in sustainable energy infrastructure have been noted but have not been analysed in detail for the purposes of this report. In addition, while many relevant cases of sustainable energy investments by SWFs were identified during the screening, the information presented analyses only pension funds for the purposes of this report. By using the screening methodology and capitalising on investment cases already identified, future work could examine cases of SWF investment in sustainable energy infrastructure in greater detail.

The screening of 130 institutions identified 47 cases of sustainable energy infrastructure project investments in 2008-14 by pension funds that have been evaluated and are noted in the figures. In addition, the screening also revealed an additional 20 cases of pension fund investment in pure-play corporates in 1996-2014. Summary information from the project database is shown in Table 3.1. Based on estimates and available data, only about two-thirds of the 47 cases have disclosed financial transaction size information.[4] Of the 30 investment cases with available data, deals involving pension fund capital provided USD 8.03 billion for sustainable energy debt and equity financing.[5] Information regarding electricity generation capacity was available for 43 cases. Deals involving pension fund capital collectively promoted the creation or maintenance[6] of 9 450 MW of sustainable energy assets between the period of 2008 and 2014.

It is important to note that these 47 investments do not reflect the totality of debt and equity project investments in sustainable energy from the screened institutional investors. Rather, they represent a starting point for further analysis and can provide some initial findings regarding the instruments and funds used, the trends in terms of directionality of investment flow, targeted technologies and the level of project development. There are many limitations to this screening. As this screening has initially focused on using publically available information to identify investment cases, it is likely to underestimate the examples of sustainable energy project investment and significantly underestimate activity in listed sustainable energy debt and equity. The granularity of public disclosure of investments varies widely across pension funds and therefore produces the following limitations:

- Unlisted project investments (in-house) – Our research revealed that most pension funds do not provide details on individual infrastructure asset exposure therefore reducing the ability to identify relevant sustainable energy project investments.
- Unlisted project investments (via external manager) – Pension funds that lack capacity to invest in-house in infrastructure will do so through externally-managed infrastructure funds. Most pension funds do not disclose information on each fund they have invested in and their relative investment exposures. If a pension fund chooses to outsource investment in projects or corporates through infrastructure or private equity funds this information is not always publically available. Infrastructure and private equity funds similarly do not publically disclose their investors (i.e. limited partners).

- Investment in a listed equity (e.g. amount of shares held in a sustainable energy corporate) or listed debt (e.g. amount of green bonds held in a sustainable energy project or a corporate) is very difficult to identify. These investments are liquid and can be actively traded; therefore the amount of shares or bonds held can vary daily. Pension funds generally report on their holdings in listed equity and debt on a quarterly basis but this disclosure is likely to show only total assets invested with limited detail. Some pension funds do disclose their top holdings by debt and equity yet are unlikely to disclose all holdings. Finally, many pension funds outsource the management of their listed debt and equity portfolios to external managers so only information on external management may be reported without details on those managers' subsequent investment allocations and exposures.

Table 3.1 provides summary information from the 47 project investments by pension funds. As the focus of this screening was to assess the different instruments, funds, tools and techniques used by institutional investors to access sustainable energy investments, the size (value) of investment was not considered to be a key factor to merit inclusion. This screening decision also reflected the view that available data on investment size may not be precise, as valuation data can conflict and often is not accurate or comparable. These

Table 3.1. **Summary of cases of project investment by pension funds in sustainable energy**

	Number of cases	Percent of sample
Investor type		
Pension funds	47	100%
Investment type		
Direct	28	60%
Intermediated	19	40%
	47	100%
Geographic flow of investment		
North-North	39	81%
South-South	7	15%
North-South	2	4%
South-North	0	0%
		100%
Sector		
Wind	31	66%
Solar	11	23%
Biofuels	1	2%
Biomass	1	2%
Diversified sustainable energy	3	6%
		100%
Wind investment by type		
Wind – Onshore	21	68%
Wind – Offshore	10	32%
		100%

Table 3.1. **Summary of cases of project investment by pension funds in sustainable energy** *(continued)*

	Number of cases	Percent of sample
Solar investment by type		
Solar – PV	8	73%
Solar – CPV	2	18%
Solar – CSP	1	9%
		100%
Project location by region		
Europe	28	60%
United States and Canada	8	17%
Africa	4	9%
Asia	2	4%
Latin America	2	4%
Middle East	1	2%
Australia	0	0%
Global	2	4%
	47	100%
Year of investment		
2008	1	2%
2009	2	4%
2010	5	11%
2011	6	13%
2012	6	13%
2013	19	40%
2014	8	17%
	47	100%
Debt vs equity		
Equity	33	70%
Debt	14	30%
	47	100%
Project development status		
Greenfield	28	60%
Brownfield	16	34%
Both	3	6%

Source: OECD database on institutional investors and sustainable energy investments.

Note: Diversified sustainable energy refers to transactions that involved more than one type of sustainable energy. For example, an investment in project that involves both solar and wind would be considered to be "diversified solar energy". Solar technologies include solar CSP, solar PV and solar CPV. Concentrating solar power (CSP) devices concentrate energy from the sun's rays to heat a receiver to high temperatures. By contrast, photovoltaics (PV) and concentrating photovoltaics (CPV) produce electricity from the sun's rays using direct conversion with semi-conductor materials (IEA, 2011).

limitations could potentially be addressed through expanding the data sources and using econometric analysis estimation techniques. In the proceeding paragraphs, "North" refers to the 43 countries that are Annex I parties to the United Nations Framework Convention on Climate Change (UNFCCC) and all other non-Annex countries are considered as "South".[7]

Geographic flow of investments

Tables 3.2 and 3.3 provide an illustration of the geographic flow of equity and debt project investment for some of the cases reviewed for this report (e.g. the 47 investments by pension funds).[8] The landscape of institutional investors is heterogeneous and there are broad differences for institutional investors in terms of size and the extent of concentration across nations and regions of the world, which can make a difference in terms of the channel they would choose for investment in sustainable energy (Kaminker et al., 2013).

The investment strategies of institutional investors differ significantly across countries too. Institutional investors' asset allocation decisions are influenced by a variety of factors, such as market trends; the investor's risk appetite, liability considerations, governance structure and views on particular asset classes; regulation (e.g. pension fund regulations restricting investment in illiquid assets); cultural factors; tax issues; and the range of available investable assets and the depth of capital markets in the investor's home country. To date, investable assets and deep capital markets are predominantly located in the North.

Table 3.2. **Selected examples of the geographic flow of equity financing for sustainable energy by pension funds**

Source of Funds Country in (parentheses)		Investment destination – Country in [brackets]	
		North	**South**
	North	London Array [UK] (Canada) Nysted Wind [Denmark] (Denmark) Walney Wind [UK] (Netherlands)	Pagudpud Wind [Philippines] (Netherlands, Philippines) Mareña Renovables [Mexico] (Netherlands)
	South		Akhfenir and Haoum Wind [Morocco] (Morocco) Bokpoort CSP [South Africa] (South Africa) Pagudpud Wind [Philippines] (Philippines, Netherlands) Touwsrivier CPV Plant [South Africa] (South Africa)

Source: OECD database on institutional investors and sustainable energy investments.

Table 3.3. **Selected examples of the geographic flow of debt financing for sustainable energy by pension funds**

Source of Funds Country in (parentheses)		Investment destination – Country in [brackets]	
		North	**South**
	North	Bord Gais Eireann Wind [Ireland] (Denmark) Gemeni Wind [Netherlands] (Denmark) Seigneurie de Beaupré Wind [Canada] (Canada) Vents du Kempt Wind [Canada] (Canada)	
	South		

Source: OECD database on institutional investors and sustainable energy investments.

In the database of 47 project investments, 70% of investments were equity while 30% of investments were debt by number of deals. Of these 47 cases there are no examples of debt financing provided by institutional investors in the North to sustainable energy infrastructure projects in the South. In many cases, such debt financing is provided by multilateral or bilateral development finance institutions. Increased attention is being placed on developing investment funds using pooling and other transaction enablers to facilitate increased investment by institutional investors in the North and the South in sustainable energy infrastructure projects in the South. In addition, the World Bank and the IFC have issued green bonds that provide funding for projects that seek to mitigate climate change, including but not limited to sustainable energy projects. These green bonds are attractive to institutional investors as they carry the high credit rating of the World Bank Group (see further discussion of green bonds in Chapter 2).

Investment pathways used by institutional investors

The decision to invest in sustainable energy will depend on the characteristics of each institutional investor. The channel through which an investor chooses to invest in (or "gain exposure to") sustainable energy will depend on the mandates set by the governance structure of the investor, the outcomes of the ALM exercise and Strategic Asset Allocation process (as described in Box 2.1), the level of risk appetite, and the technical ability to engage in different types of investments. A challenge is that for institutional investors "sustainable energy" is not a discrete asset class. Rather, sustainable energy investments can appear in many different asset classes. Figure 3.2 provides one example of a way used in this report to classify investments.

Figure 3.2. **Steps taken to classify investments**

Steps to classify investments

Question/Decision	Options	Description
Is the investment done directly in-house or via an external manager or other vehicle?	In-house Intermediated	Level of internal management
What is the type of financing?	Equity Debt	Financing type
Is the investment publically listed or private?	Listed Unlisted	Level of liquidity
Is the investment a stand-alone (i.e. single) entity or does it reflect aggregation (i.e. pooled)?	Single Entity Pooled	Diversification
What is the underlying investment?	Project Company Projects and Companies Fund	Investment type
What instrument or fund is used?	Special Purpose Vehicle (SPV) Yieldco Bond - Corporate Bond - Project Equity share … Fund Fund of funds	Instrument or fund
What is the sector?	Wind - Offshore Wind - Onshore Solar - PV Solar - CSP … Diversified	Sector

Source: OECD analysis.

The "Make or Buy" Option

The sustainable energy classification framework shown in Figures 3.3 and 3.4 helps to describe to policy makers the different combinations available for investing in sustainable energy infrastructure and using the decision to make an investment internally or externally as the starting point. This choice is referred to in the academic literature as "the make or buy option" (Clark and Monk, 2013, 2012; Dixon and Monk, 2013). The make or buy option is a decision reflecting "a choice between in-sourcing and outsourcing the production of a [beneficial] institution's target risk-adjusted rate of return" (Clark and Monk, 2013, p. 2). While academics have explored this decision for broader investment categories, this report explores the decision in the context of sustainable energy.

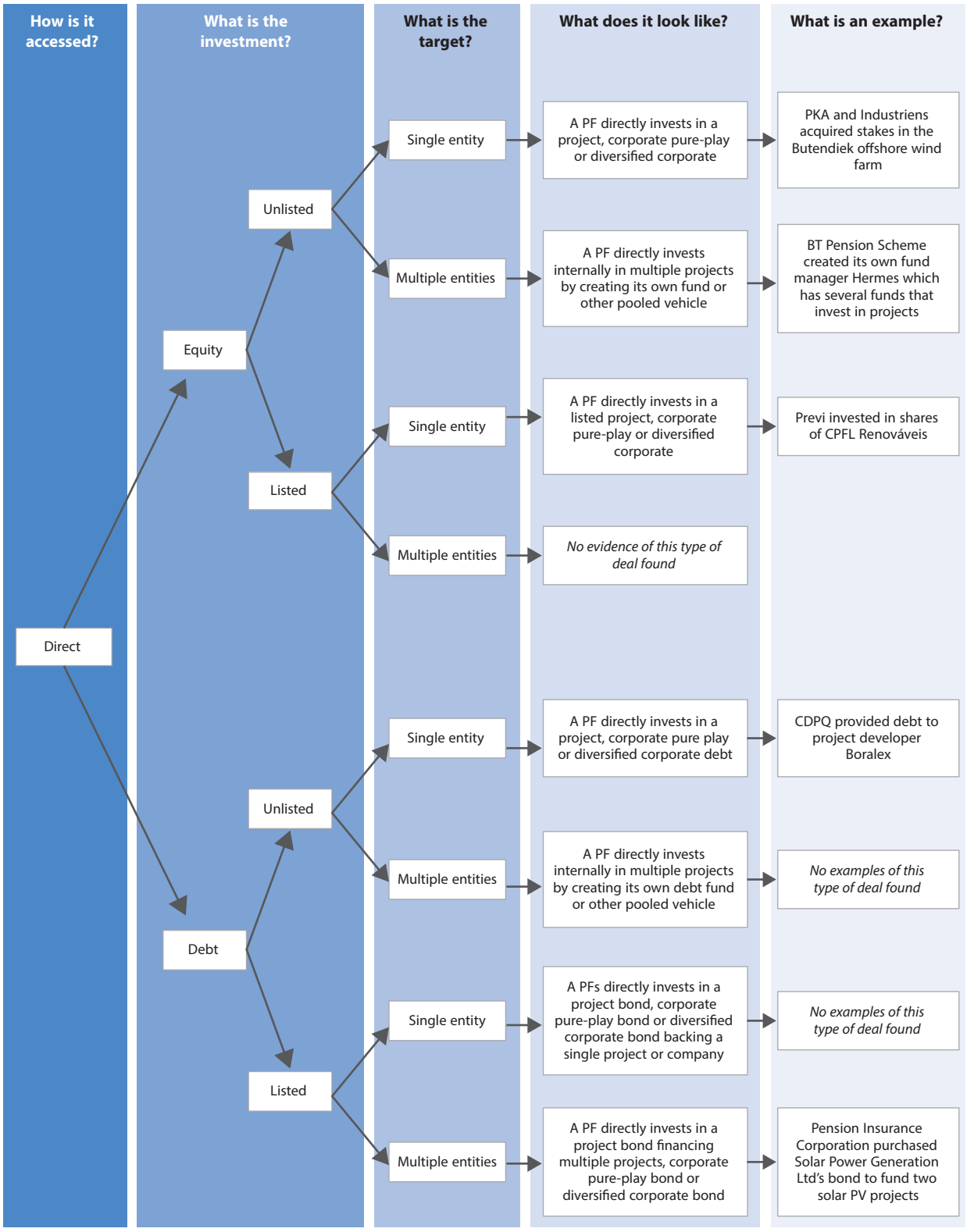
The Transaction Cost Economics (TCE) literature which dates back to at least 1937 (Coase, 1937) suggests that if an institution is sufficiently large to consider in-sourcing asset management and making the investment "in-house", then it will make that decision based in large part on where the transaction costs are lower. In other words, a frontier exists where the in-house production cost is per unit more cost efficient than the outsourced option. Coase saw it as a question of where on the margin do those costs shift in favour of one or the other.

In the area of infrastructure investment however, as Clark and Monk (2012) propose this may not apply as such in practice, as the frontier is more complicated and "lumpy" and the make or buy option, while not irreversible, is a fairly significant management decision. This derives from the fact that the fixed costs that come with establishing an in-house investment team may be quite significant and "sunk costs". In the first instance, an institution will either have the scale (i.e. significant assets under management) that is sufficient to consider a direct investment or will need to outsource the investment by writing a contract with an intermediary. This is the foundation for the following investment pathways.

Notably, some large pension funds have "seeded" subsidiary funds to execute and manage their direct investments (e.g. OMERS and Borealis or BTPS and Hermes GPE). These funds may also be open to other institutional investors, or co-investors. For the purposes of this report, these subsidiary funds are counted as direct investment and "in-house" as the assets are managed on behalf of parent institutional investors. Parent institutional investors may choose to separate these subsidiaries for legal and agency reasons, to improve alignment of interests, or to save on fees paid to specialist financial intermediaries. Clark and Monk (2014) explain how while these funds are functionally similar to "in-sourced" asset management, they provide more flexibility to parent institutional investors as sustainable and separate entities that can be sold or bought if over time parent interests diverge.

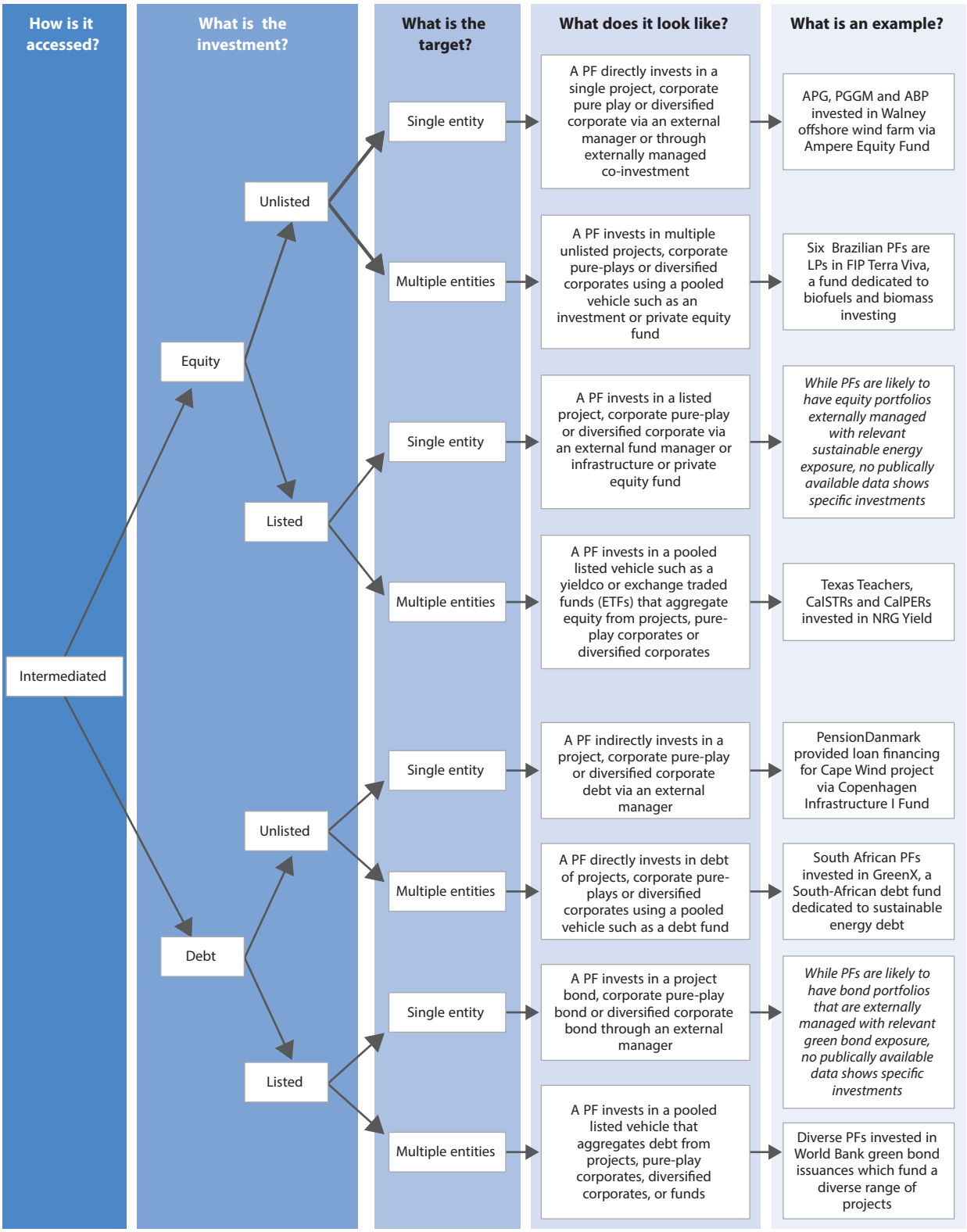
Figures 3.3 and 3.4 provide a visual representation of the sustainable energy classification framework and the various characteristics and examples of investments based on the starting point of the investor's decision between internally managing direct investment or using external managers or pooled funds to invest in clean energy infrastructure. The figures reflect a series of lenses or filters (composed of basic investment characteristics) through which investors consider different investment channels. Their decisions are informed by these lenses, and their preferences regarding these investment characteristics, including those relating to the make or buy option. The pathways put each of the 47 investments in context and spells out exactly which category each investments falls into. This helps map investments using common terminology. There are many different kinds of funds, for example, and this helps clarify the key distinctions. The pathways also provide a visual introduction to terms that were introduced in the definitional overview (Figure 1.1).

Figure 3.3. **Investment pathway for direct investment by "in-sourcing asset management"**



Source: OECD analysis.

Figure 3.4. **Investment pathway for intermediated investment by "out-sourcing asset management"**



Source: OECD analysis.

The pathways presented are derived through primary research (close dialogue interviews) with institutional investors to understand the permutations and investment decisions. Examples of transactions are derived through secondary research using the proprietary OECD database on institutional investors and sustainable energy investments. In some cases no examples of investments in a certain "theoretical" combination of characteristics were found. This may be a reflection of data limitations, or that the type of investment might be impractical, uneconomic, incompatible with risk considerations, more appealing to certain types of investor not covered by the sample (e.g. insurers), or simply unexplored by the financial sector.

Each investor will have different priorities when making decisions regarding how to allocate capital to sustainable energy which will also be strongly influenced by institutional rules and regulations regarding the types of permitted asset classes, targeted debt-to-equity split for their portfolio[9] and an investor's interpretation of fiduciary duty. Figures 3.5, 3.6 and 3.7 frame the decision to invest in sustainable energy as a decision based on the type of underlying investment and the subsequent types of investment options that can be considered as a result.

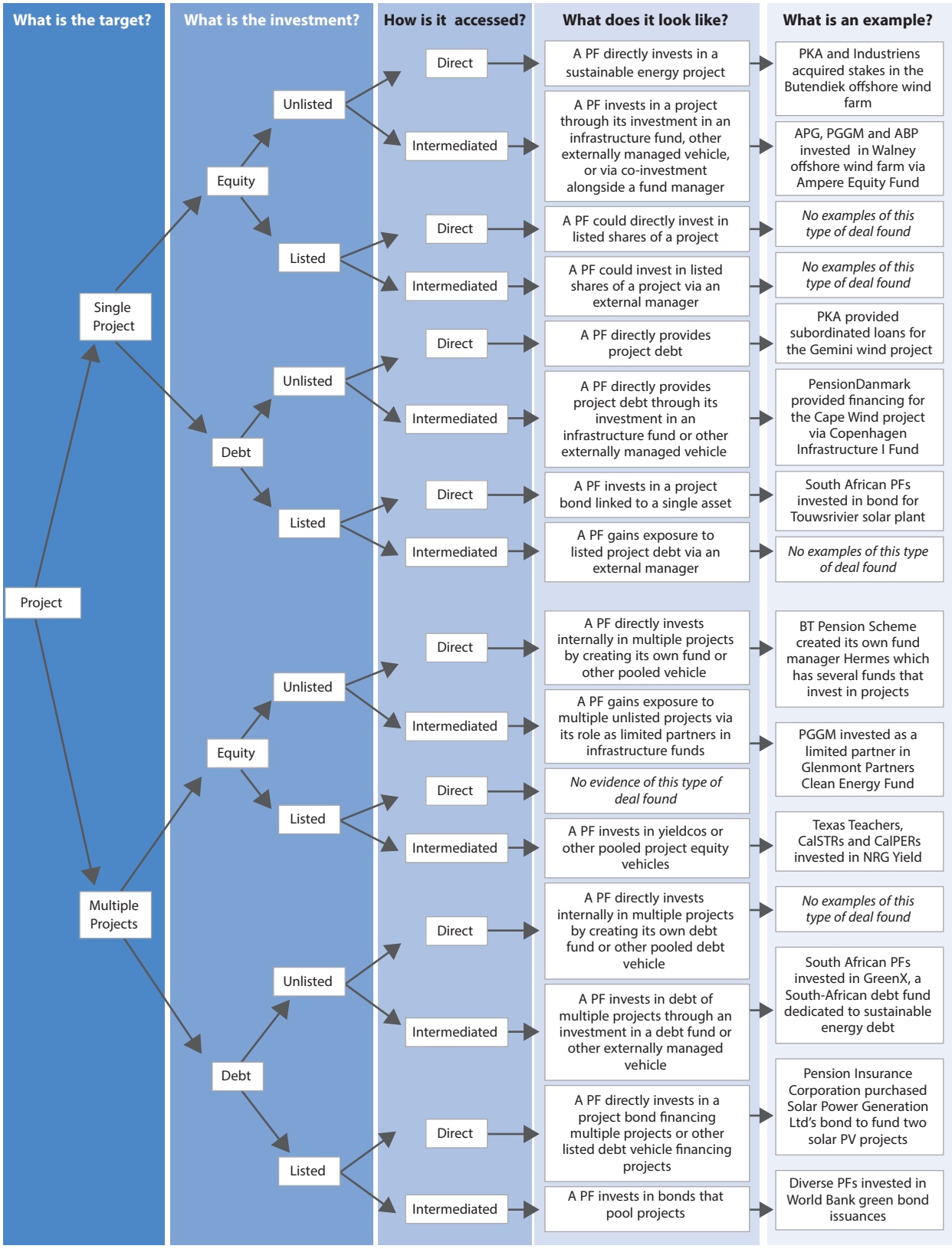
The investment pathways provided in Figures 3.5, 3.6 and 3.7 present alternative taxonomies to reflect the various characteristics and examples of investments if an investor decides to structure their investment decision as a choice between projects, pure-play corporates or diversified companies when assessing sustainable energy infrastructure. These decisions are fundamentally important as investments in projects and corporates come with very different characteristics and risks.

Corporate investment generally involves investment in publicly traded shares (equity) or bonds (debt) issued by corporations active in the sustainable energy sector. Such investments are generally easier for institutional investors to undertake given their liquidity, the availability of investment research and benchmarks. The disadvantage of this channel is that it has little or no connection to the infrastructure assets themselves. It therefore does not bring the associated benefits of direct investing (as described below), does not necessarily contribute to directly[10] filling the investment gap, and does not necessarily help lower financing costs for sustainable energy infrastructure, in contrast (potentially) with direct investment in projects.

As examined in detail by the OECD and others previously, direct investments in projects have a number of characteristics which can appeal to institutional investors beyond yield (Della Croce et al., 2011; Kaminker and Stewart, 2012; Inderst and Stewart 2014). They allow for asset-liability matching (e.g. cash flows from long-term investments and pension payouts), and help hedge the risks of long-dated liabilities. In addition, infrastructure assets could reduce exposure to the effects of inflation on their long-term liability (the pension benefit) if, for example, linked to Power Purchase Agreement contract structures which provide for stable cash flow and can have protection against inflation.[11] Another benefit of investments in sustainable energy projects is that if they are held through the economic life of the project, the returns should be negligibly correlated with those of the general market (e.g. with broad stock market indexes).[12]

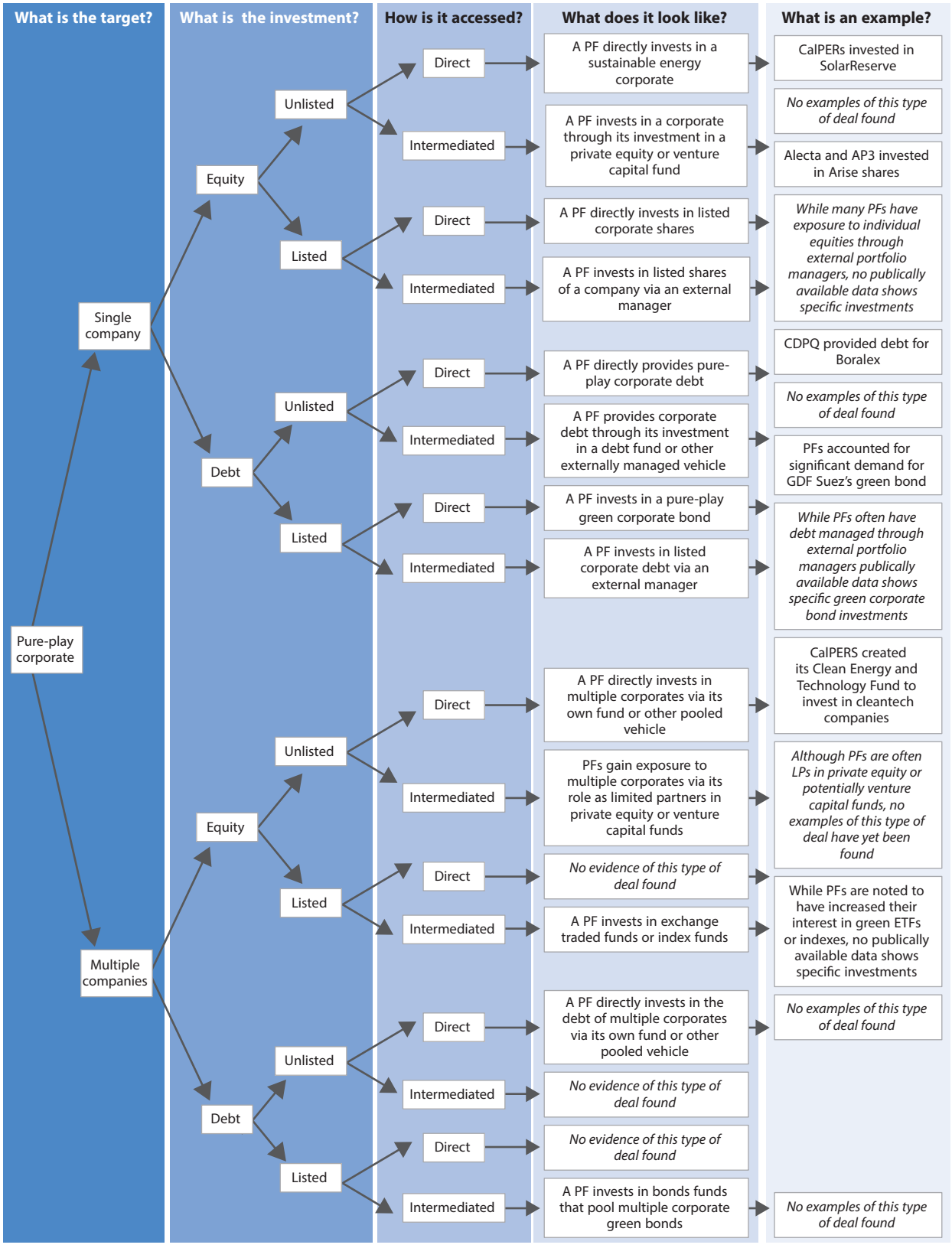
Sustainable energy projects that are "bankable" can offer a form of "pledgeable future income"[13] through stable and predictable cash flows, because sustainable energy (excluding CCS except under certain circumstances) is not subject to fossil fuel price volatility and is backed by long-term contracts with Investment-grade counterparts.[14] Wind and solar projects also generally have an estimated 25-year lifespan, and often involve manufacturer warranties, long-term contracts with power purchasers (PPAs) and government support.[15]

Figure 3.5. **Pathways for investment in projects by pension funds (PFs)**



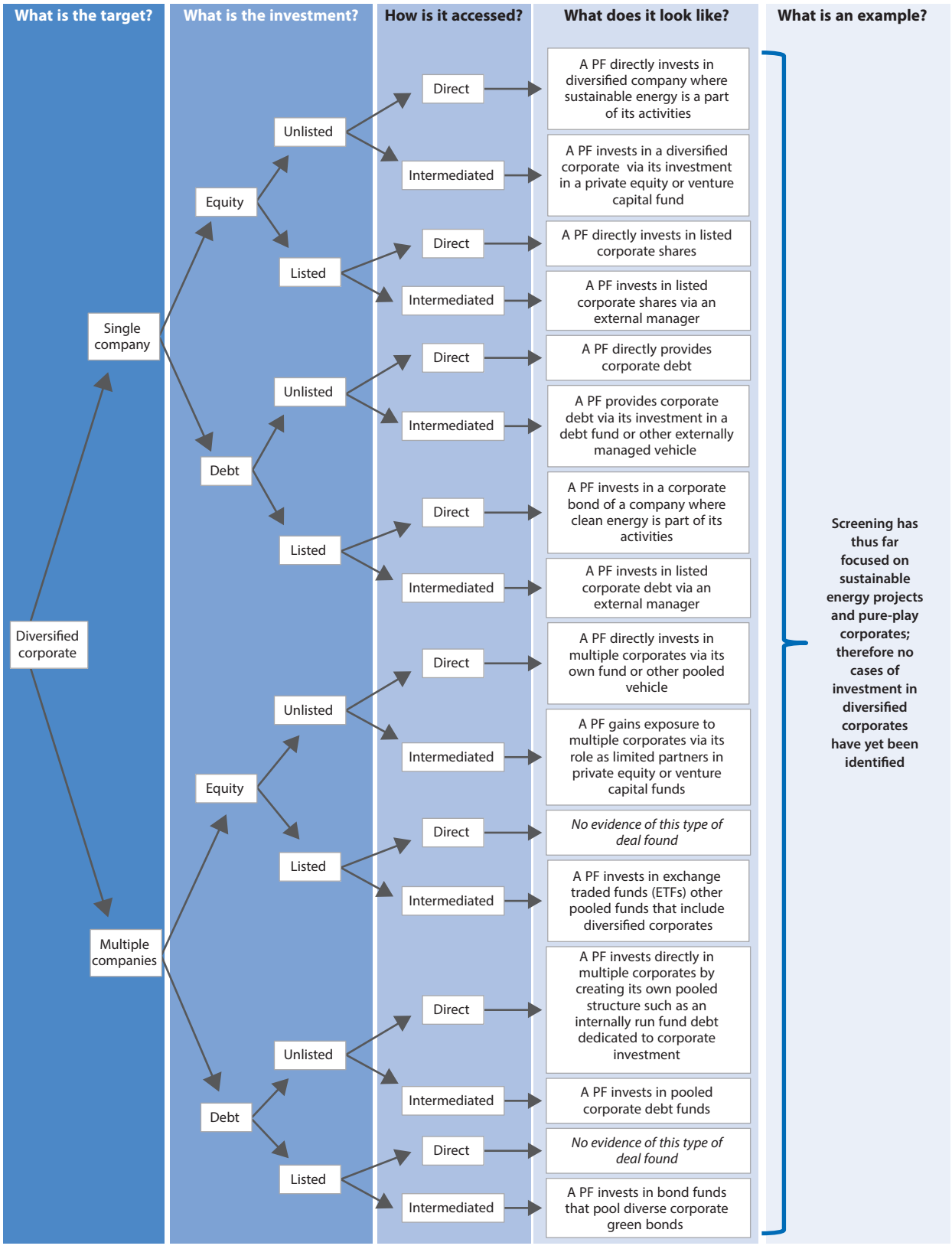
Source: OECD analysis.

Figure 3.6. **Pathways for investment in pure-play corporates by pension funds (PFs)**



Source: OECD analysis.

Figure 3.7. **Pathways for investment in diversified corporates by pension funds (PFs)**



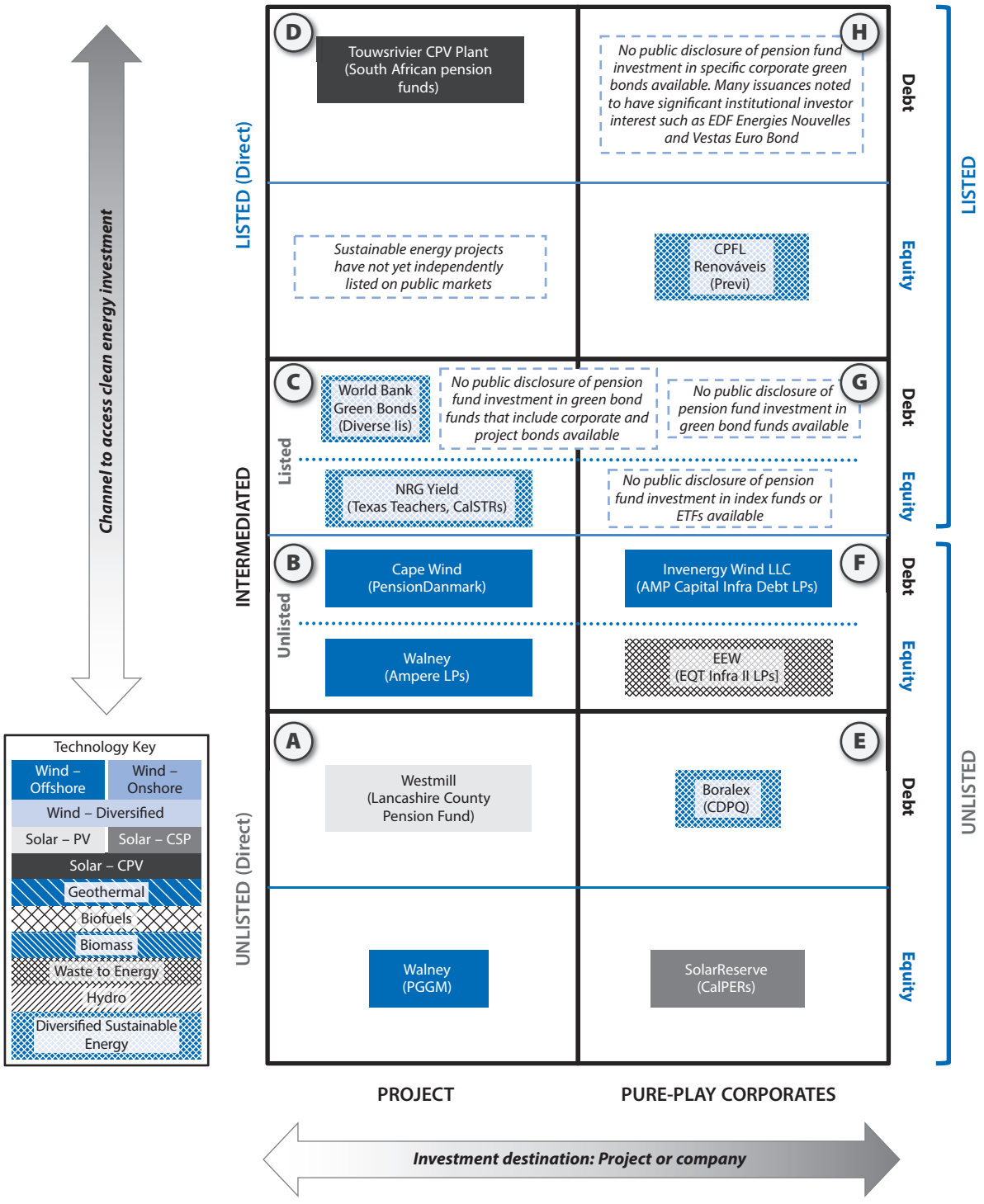
Source: OECD analysis.

Most institutional investors seek long-term certainty. In some electricity markets PPAs are standard for sustainable energy and these can be particularly attractive if the counterparty is a utility with Investment-grade credit or a government. In the United States and the United Kingdom, for instance, long-term PPAs for sustainable energy projects are often driven by state Renewable Portfolio Standards or government Renewable Obligations, mandating utilities to buy a certain share of their power from these sources and encouraging long-term contracting.

Plotting pension fund investments in sustainable energy projects and companies

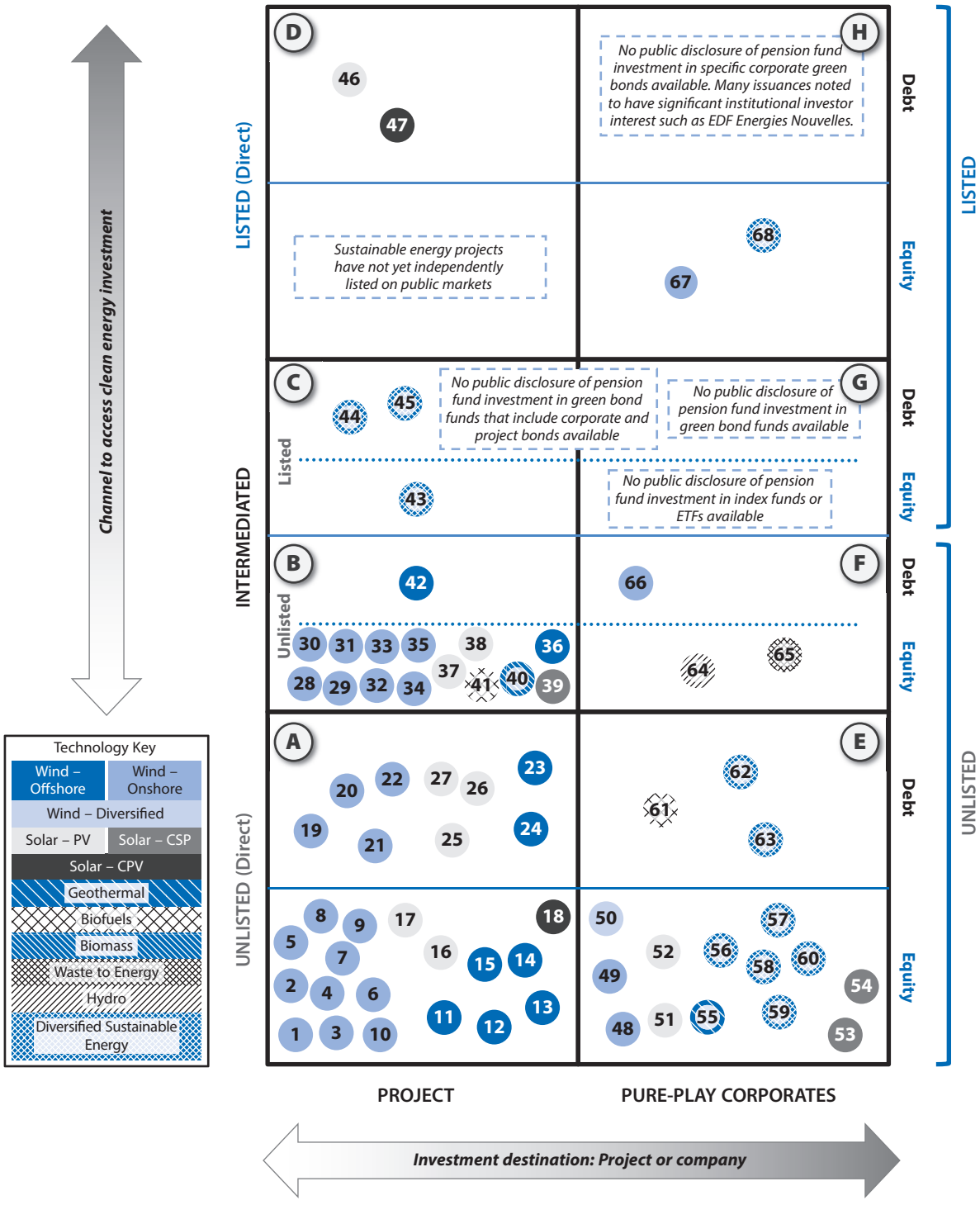
Having constructed the investment pathways to formalise the decision logic, they can then be combined in a matrix which provides a theoretical investment framework for understanding and mapping the transactions. The frame presented in Figure 3.8 plots a single example of where pension fund investment in sustainable energy projects as well as pure-play sustainable energy companies have been observed in the OECD database. Note that not all relevant investments are shown on this figure. Figure 3.9 plots all transactions observed in the OECD Database. An annotated key for these figures follows with additional information on the observations.

Figure 3.8. **A matrix frame for mapping pension fund investment in sustainable energy with single examples**



Note: See key beginning on page 77 and Annex 3.A1.

Figure 3.9. **A matrix frame for mapping pension fund investment in sustainable energy with all observations**



Note: See key beginning on page 77 and Annex 3.A1.

Key for Figure 3.9

A – Equity

1. Parc des Moulins Wind Farms (CDPQ)
2. Budendiek Offshore Wind Farm (PKA, Industriens)
3. Marena Renovables Wind Farm (PGGM)
4. Fallago Wind Farm (BT Pension Scheme, via internal manager Hermes GPE)
5. Braes of Doune Wind Farm (BT Pension Scheme, via internal manager Hermes GPE)
6. Invenergy North American Wind Portfolio (CDPQ)
7. Ulvemosen Wind Farm (Sampension)
8. Akhfennir, Haouma and Foum El Oued Wind Farms (Caisse Interprofessionnelle Marocaine de Retraites [CIMR])
9. Papalote Creek I, Papalote Creek II, and Stony Creek Wind Farms (PensionDanmark)
10. Dong Energy's Onshore Wind Portfolio (PFA)
11. London Array Wind Farm (CDPQ)
12. Nysted Wind Farm (PensionDanmark)
13. Walney Wind Farm (PGGM)
14. Anholt Wind Farm (PKA, PensionDanmark)
15. Gode Wind 2 Wind Farm (PKA, Industriens Pension, Laerernes Pension and Laegernes Pensionskasse)
16. Japan Solar (Qantas Superannuation, LGSuper)
17. German Solar Portfolio (BVK)
18. Touwsrivier CPV Plant (Government Employees Pension Fund [GEPF])

A – Debt

19. Vents du Kempt Wind Farm (CDPQ)
20. Bord Gais Eireann Wind Farm (PKA)
21. Seigneurie de Beaupre Wind Farm (CDPQ)
22. Jädraås Wind Farm (PensionDanmark)
23. Gemini Wind Farm (PKA)
24. Northwinds Wind Farm(PensionDanmark)
25. Westmill Solar Cooperative (Lancashire County Pension Fund)
26. Ashalim Sun Negev PV Plant (Clal Insurance Company, Clal Pension and Provident Funds, Atudot Pension Fund for Employees and Independents)
27. Amherstburg, Belmont, and Walpole PV Plants (CDPQ)

B – Equity

28. Pagupud Wind Farm (APG and GSIS via PINAI fund)
29. Spremberg Wind Farm (PGGM, ABP and other institutional investors via Ampere Equity Fund)
30. Carraig Gheal Wind Farm (PGGM, ABP and other institutional investors via Ampere Equity Fund)
31. German Wind Farm Portfolio (PGGM, ABP and other institutional investors via Ampere Equity Fund)
32. La Souterraine Wind Farm (British Airways Pension Fund, West Midlands Pension Fund, London Pensions Fund Authority and other institutional investors via Impax's NEF II)
33. Koegorspolder Wind Farm (PGGM, ABP and other institutional investors via Ampere Equity Fund)
34. Kuolavaara-Keulakkopää Wind Park (British Airways Pension Fund, West Midlands Pension Fund, London Pensions Fund Authority and other institutional investors via Impax's NEF II)
35. German Wind Project Portfolio (British Airways Pension Fund, West Midlands Pension Fund, London Pensions Fund Authority and other institutional investors via Impax's NEF II)
36. Walney Wind Farm (PGGM, ABP and other institutional investors via Ampere Equity Fund)
37. Puglia PV Plant (PGGM, ABP and other institutional investors via Ampere Equity Fund)
38. Spanish PV Portfolio (PGGM, ABP and other institutional investors via Ampere Equity Fund)
39. Bokpoort CSP Plant (Transnet Retirement Fund via Lereko Metier Sustainable Capital Fund)
40. Brigg Biomass Plant (PensionDanmark via Copenhagen Infrastructure I)
41. Alvorada Biofuels Plant (Funcef, BNDESPar, Fachesf, and Petros via FIP Terra Viva)

B – Debt

42. Cape Wind (PensionDanmark via Copenhagen Infrastructure I)

C – Equity

43. NRG Yield (Texas Teachers, CalSTRs)

C – Debt

44. World Bank Third Green Bond (California Teachers, AP Fonden 2, AP Fonden 3, UN Joint Staff Pension)
45. World Bank Green Kangaroo Bond (SunSuper)

D – Equity

No relevant cases

D – Debt

46. Somerset PV Plant Bond (Pension Insurance Corporation)
47. Touwsrivier CPV Plant Bond (South African pension funds)

E – Equity

48. Ogin Energy (New Zealand Superannuation Fund, AIMCo)
49. Invenergy Wind (CDPQ)
50. Dong Energy (ATP, PFA)
51. Alta Devices (AIMCo)
52. Solibro (AP Fonden 6)
53. SolarReserve (CalPERS)
54. Brightsource (CalSTRS)
55. GeoDynamics (Sunsuper)
56. PacificHydro (30 Australian pension funds)
57. Desenvix (Funcef)
58. BluEarth Renewables (Ontario Teachers)
59. Isolux Infrastructure (Public Service Pension Plan)
60. Boralex (CDPQ)

E – Debt

61. KiOR (AIMCO)
62. Boralex (CDPQ)
63. First Wind (AIMCo)

F – Equity

64. Ondina (APB)
65. EEW Energy From Waste (Alaska Permanent Fund, Ilmarinen, KEVA, Lancashire County Pension Fund, New Mexico Educational Retirement Board, SEB Pension, Skandia, Varma and VER)

F – Debt

66. Invenergy Wind (East Riding of Yorkshire Council)

G – Equity

No relevant cases

G – Debt

No relevant cases

H – Equity

67. Arise (Alecta, AP)
68. CPFL Renováveis (Previ)

H – Debt

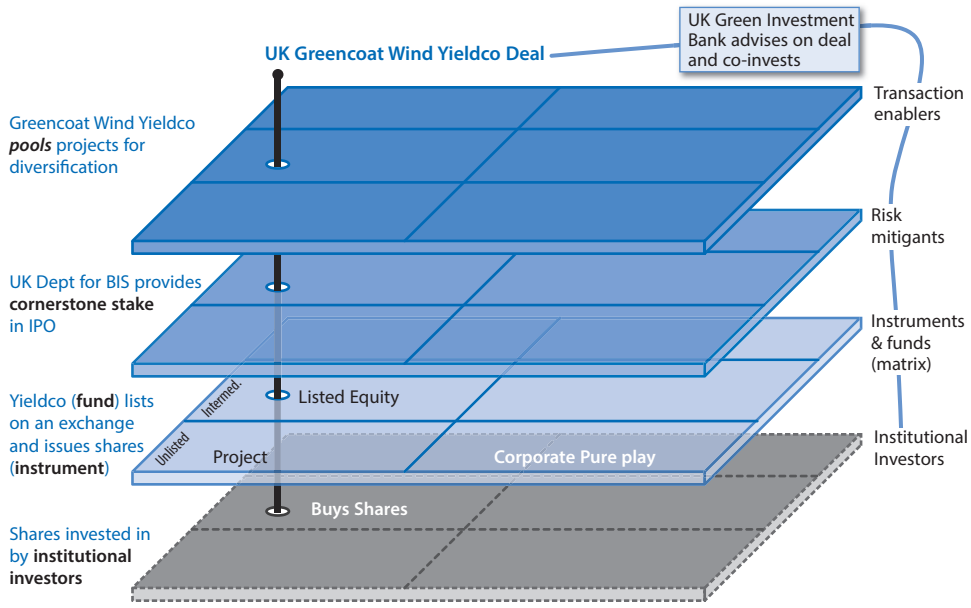
No relevant cases

See Annex 3.A1 for details on the logic underpinning the categorisations and descriptive examples for why deals were classified into each section of the framework.

Breaking down the framework by a single deal

Each of the 47 project investment transactions presented in this chapter involved different combinations of instruments, funds, risk mitigants and transaction enablers. The 3-dimensional wafer displayed in Figure 19 provides a visual construct of how these instruments, funds, risk mitigants and transaction enablers can come together to represent a single final transaction. Institutional investors in the UK Greencoat Wind[16] IPO shown in Figure 3.10 purchased shares (instrument), which involved a YieldCo (fund), that was de-risked by a cornerstone stake purchase from the UK government and benefitted from reduced transaction costs due to pooling (a transaction enabler). While institutional investors are the asset owners and contributors of capital (i.e. the bottom layer of Figure 3.10), the core of the classification framework focuses on the instruments and funds that represent the actual investments made by institutional investors in sustainable energy infrastructure instruments and fund. The UK Green Investment Bank, a special-purpose public financial intermediary made the entire transaction possible by advising on all aspects of the deal and co-investing alongside the YieldCo in the underlying wind farms.

Figure 3.10. **An illustration of the components of the classification framework for institutional investment in sustainable energy of a single deal**



Source: OECD analysis.

In the absence of a level playing field for sustainable energy manifested through elevated costs and risks and in the face of the multitude of barriers described in Table 2.1, a key challenge for policy makers (as well as private and public financial institutions) is to design risk mitigants that effectively address the barriers and increase the attractiveness of sustainable investment to institutional investors. These risk mitigants are discussed in Chapter 4 followed by a discussion of transaction enablers.

Future applications of the framework

The framework provided by the framework and figures in this chapter can be used as the basis for future collection of data and consequent empirical analysis of these issues in a standardised form as more data becomes available on transactions. Future applications of the matrix frame (Figure 3.8) using expanded data could examine institutional investment activity:

- By investor class (e.g. pension fund or insurer)
- Within an investor class (e.g. defined benefit pension funds or life insurers)
- By geography (e.g. individual countries, regions, G20, etc.)
- By single technology (e.g. offshore wind) or expanding to green infrastructure not covered in this report (sustainable agriculture, water, energy efficiency, etc.) or to technologies yet to be commercialised or to attract institutional investment (e.g. CCS and associated infrastructure)
- By technologies linked to specific policy support mechanism (e.g. offshore wind feed-in tariffs)
- Over time (snapshots of latest activity or over time periods)

Key takeaways for policy makers

- The investment pathways and graphics establish a systematic framework for governments to understand the different channels and to communicate better with investors. They show policy makers where activity is and is not happening and provides an update on recent activity.
- Despite the challenges and barriers, pension fund investment in sustainable energy projects and pure-play project developers and other corporates is occurring. While the report identifies 67 instances of investment, it does not make any comment on the financial performance of these investments. Future analysis could usefully examine the risk and return characteristics of investments and how this is changing over time.
- Flows are largely domestic; pension funds are investing in local or regionally-relevant projects. There could be information asymmetry reasons behind this which is an area for potential future investigation and study.
- Examples exist of small pension fund (less than USD 35 billion in AUM) investment in sustainable energy projects, which may start to challenge the notion that only large pension funds are interested or capable of investing in projects on their own. Examples observed of small pension fund investments for local development of sustainable energy were unexpected (e.g. an example was observed of a local pension fund investment in a local community solar co-operative).
- The cases also highlight the diversity of investments and the channels used to access these investments. Consideration of the geography of pension fund diversity (form, size, structure, governance) and national regulatory contexts are just as important and will be vital for shaping activity in general. Every country will be different. These differences will have implications for which investment channel is most logical or accessible for domestic institutional investors to access. More research is needed to match the geography of institutional investors to investment channels.

- The absence of observations in certain investment pathways (e.g. listed single-project equity) can hypothetically be explained by four reasons: *1)* observations exist but adequate data is not available due to lack of publically available investment disclosure *2)* there is a lack of demand due to reasons such as regulatory barriers, lack of investment experience with a particular type of investment or simply because the investment is deemed uneconomic, not accessible for pension funds (due to restriction or regulation), or impractical *3)* pathway has not been explored or pursued by the financial community so the investment pathway exists only theoretically but not in practice, *4)* there is a lack of mandate for a type of investment as asset allocation or risk management practices may not provide a mandate for a given investment type.

Notes

1. Insurance companies are often active in investment in clean energy infrastructure investment as both equity and debt investors while asset managers have shown relatively less activity in this field. In 2013, six major insurance companies in the UK (Legal and General Group, Prudential, Aviva, Standard Life Friends Life and Scottish Widows) agreed to collectively invest GBP 25 million in UK infrastructure (including sustainable energy such as offshore wind) over the following five years (O'Donnell and Jones, 2013). As a recent example, UK insurance company Friends Life provided a GBP 75 million loan to Drax, a UK biomass producer (Osborne, 2013). Kaminker and Stewart (2012) provide additional examples of equity and debt investment in sustainable energy. The research presented in this report could be expanded in subsequent reports to include greater analysis of insurance and investment manager activity in financing sustainable energy projects and corporates.
2. Wind technologies include both onshore and offshore wind facilities.
3. Solar technologies include solar CSP, solar PV and solar CPV. Concentrating solar power (CSP) devices concentrate energy from the sun's rays to heat a receiver to high temperatures. By contrast, photovoltaics (PV) and concentrating photovoltaics (CPV) produce electricity from the sun's rays using direct conversion with semi-conductor materials (IEA, 2011).
4. Due to data limitations, the transaction size reflects the overall deal size for a given debt or equity transaction as the exact pension fund commitments within a given transaction are not known. For example, in the Butendiek offshore wind farm transaction a USD 1.25 billion loan was provided by a public finance institutions and commercial banks and an equity investment of USD 643.1 million was made by Industriens Pension, Marguerite, Siemens Project Ventures and WPD. Only the equity investment of USD 643.1 million is included in the calculation of mobilised finance.
5. All figures converted to USD using average 2012 exchange rates. Relevant exchange rates available here: www.ozforex.com.au/forex-tools/historical-rate-tools/yearly-average-rates.
6. Not all financing for sustainable energy projects is necessarily for greenfield construction. Institutional investors may provide financing that is used to refinance existing sustainable energy projects.
7. For a list of Annex I and Non-Annex I Parties to the Convention see http://unfccc.int/parties_and_observers/parties/items/2352.php.

8. Note that only investments by pension funds are shown in the tables. There are numerous examples of South-North investments, particularly by sovereign wealth funds which are not currently reflected.

9. For example, a defined benefit pension fund that is building its not yet paying out benefits may have a debt-to-equity split that is more heavily weighted toward equities to be able to generate higher returns. In contrast, a pension fund that is paying out benefits, is fully funded, and is not taking on any new pension benefit obligations likely will be more heavily weighted toward debt investments with relatively high credit ratings and lower standard deviation of returns than equity, in order to ensure that defined benefit payments may be made. The debt-to-equity split of pension funds with defined contributions (i.e. that do not guarantee a defined benefit, and for which participants can choose their investments) is determined by the investment choices of participants.

10. If a corporation raises additional capital from institutional investors, it will make an independent decision as to how it deploys this capital internally, i.e. the capital may go to any number of internal purposes or priorities and not immediately or directly be used for the construction of any new sustainable energy projects.

11. Although Power Purchase Agreement (PPA) contract structures vary on a market-by-market basis, in various geographies renewable electricity tariff agreements include protection against inflation. For example, several tariffs in the EU are indexed to inflation and adjusted on an annual basis. In projects where specific inflation protection is not provided, high current cash flows provide a certain level of inflation protection. Finally, the assets provide a hedge to energy inflation as they have long useful lives and potentially benefit from scarcity value in the future (i.e. fewer desirable wind/solar sites).

12. RARE (2009) describes the correlation between the MSCI Global equity index and infrastructure investments between 2002 and 2008. Listed (i.e. publicly traded) infrastructure has a correlation of 0.65, while unlisted (privately held) infrastructure has a correlation of 0.23. Colonial First State Global Asset Management (2010) measures the correlation between infrastructure and other asset classes for the 10 years ending 2010. Listed infrastructure was shown to have a 0.45 correlation with equities, while unlisted infrastructure had a correlation of 0.10 (cited in Kaminker et al., 2013).

13. The attractiveness of infrastructure returns to long-term investors is affected by movements in interest rates. In the post-2008 low-interest rate environment, a gap opened up between the low yields on government bonds and those available on infrastructure investments.

14. This may not be the case in developing countries.

15. Although these are also subject to policy reversal risk. Changing to a feed-in premium can also create electricity price volatility risk in some cases.

16. Greencoat UK Wind PLC is a closed-ended infrastructure investment company (also known as a "YieldCo" fund) that is listed on the London Stock Exchange.

Annex 3.A1

Annotated key for Figure 3.9 providing detail of transactions and logic for classification

This annex details the logic underpinning the categorisations and provides descriptive examples for why deals were classified into each section of the framework.

A) Direct unlisted investments in projects

Direct unlisted project equity

Institutional investors can invest in unlisted clean energy projects by independently acquiring an equity stake in a project or through joint-ventures and consortiums to co-invest alongside other investors.

Deals in the sample under this heading include:

- Dutch pension fund **PGGM** in consortium with the renewables-focused infrastructure fund **Ampere Equity Fund** acquired a 24.8% equity stake from Dong Energy in the UK **Walney offshore wind farm**.[1]
- Dutch Pension Funds **PKA** and **Industriens** each acquired 22.5% equity stakes in the 288 MW **Butendiek offshore wind farm** in Germany (Marguerite, 2013).[2] The Butendiek project benefited from EUR 239 million in debt financing provided by the German development bank KFW and its subsidiary KfW IPEX-bank as part of their special programme Offshore Wind Energy Programme (KFW, 2013).[3]
- The Dutch pension fund **PGGM** and Mitsubishi Corp acquired a combined 67.5% equity stake in the 396 MW **Marena Renovables onshore wind farm** in Mexico, from the Mexican bottling company, Fomento Económico Mexicano SAB de CV, and Macquarie Capital, the corporate advisory arm of the Macquarie Group, which is active in infrastructure investments (LAVCA, 2012).[4]

Direct unlisted project debt

Institutional investors can finance unlisted sustainable energy projects by directly providing debt to project developers, financing alongside a group of lenders, or through purchasing privately placed asset-linked green bonds. Unlike most green bonds issued to date, asset-linked green bonds have credit ratings that are based on the risk that the asset (i.e. the sustainable energy project) will not provide expected levels of return on investment. CRC Breeze Finance Bonds is one example of an asset-linked green bond. It was the first securitisation of wind farms – illiquid investments in wind farm projects were transformed into tradable investment products (asset-linked green bonds). One of the three tranches of bonds was privately placed. The bonds experienced credit downgrades due to

lower-than-expected electricity generation from the projects,[5] among other factors, and have been a disappointment for investors, although they provide useful lessons for future securitisations (Kaminker et al., 2013).

Deals in the sample under this heading include:

- Danish pension fund **PKA** provided EUR 120 million of subordinated loans for development of the 600 MW **Gemini offshore wind project** in the Netherlands (Miller 2013).[6]
- Canadian pension fund **Caisse de depot et placement du Quebec (CDPQ)** provided CAD 50 million term loan of a total CAD 300 million financing package for the **Vents du Kempt onshore wind farm** in Canada.[7]
- The **Westmill Solar Cooperative** refinanced its 5 MW **Watchfield PV plant** in Oxfordshire with a GBP 12 million bond privately placed with UK **Lancashire County Pension Fund** (Lancashire County Council, 2013).[8]

B) Intermediated unlisted investments in projects

Intermediated unlisted project equity

Institutional investors can invest in unlisted clean energy projects through their financial commitments to pooled funds such as infrastructure funds, renewable energy funds or unlisted funds of funds.

Deals in the sample under this heading include:

- **PINAI**, a Philippines-focused infrastructure fund invested USD 85 million in the 81 MW **Pagudpud onshore wind farm**. Pension funds that are limited partners in PINAI include the Dutch **APG** and the Philippines' state-owned pension fund **Government Service Insurance System** (GSIS) (ADB, 2013).[9]
- **Ampere Equity Fund** invested in **Walney offshore wind farm** in the UK. Pension funds that are limited partners in the Ampere Equity Fund include Dutch pension funds **APG**, **PGGM** and **ABP** (Hervé-Mignucci, 2012).[10]

There is a broad range of possibilities on the indirect or fund route in developing countries. Many commercial funds exist, mainly in the form of private equity funds, mutual funds or listed investment trust. Other types of funds are often in some form sponsored by governments, national agencies or multilateral development banks, frequently combining public and private involvement. Some other interesting examples of co-investment exist, e.g. funds jointly owned by pension funds, or dedicated trust funds and structure projects (Inderst and Stewart, 2014).

Intermediated unlisted project debt

Institutional investors can invest in unlisted clean energy projects through their commitments to pooled debt funds such as infrastructure debt funds or renewable energy debt funds. Structured funds are also used to pool projects into one product. Besides the pooling of projects, they also allow for a transformation of maturity, i.e. short-term into long-term, and they can create different risk categories. They are most useful when information is unbalanced and consequently risks are overpriced (Lindenberg, 2014).

Deals in the sample under this heading include:

- Danish pension fund **PensionDanmark** provided a USD 200 million mezzanine loan for the **Cape Wind offshore wind project** in the United States. PensionDanmark provided financing via **Copenhagen Infrastructure I**, an infrastructure fund dedicated to investing on behalf of PensionDanmark (Copenhagen Infrastructure Partners, 2013).

C) Intermediated listed project investment

Intermediated listed project equity (YieldCos)

Equity investment in clean energy projects has most commonly been the domain of private investment funds. However, institutional investors can now access a listed portfolio of projects using new project pooling structures such as YieldCos. Using a YieldCo an investor can diversify risk by owning equity in a portfolio of projects that may include varying stages of development, technology used and geographical location. Despite the promise of YieldCos and strong interest from institutional investors (see Box 2.3 for a discussion of the emergence of YieldCos), there are few examples of specific YieldCo investment by pension funds in our sample. As noted earlier in the methodology discussion in this chapter, investments in listed equity and debt are very difficult to identify as they may be actively traded on the market and holdings can therefore change daily. In addition, most pension funds do not disclose every individual stock or bond holding in their portfolio.

Deals in the sample under this heading include:

- Pension funds including **Teacher Retirement System of Texas, CalSTRs** and **CalPERs** invested in shares of **NRG Yield**, a YieldCo with a diversified portfolio of energy infrastructure assets including natural gas, solar, wind and thermal power generation (NASDAQ, 2013).

Intermediated listed project debt (green bonds)

Institutional investors can invest in a listed project debt through their investment in a green bond issuance that pools debt from diverse projects or a green bond fund that pools green project bonds. An example of a green bond fund is the SSgA (State Street Global Advisors) High Quality Green Bond Strategy which seeks to approximate specific characteristics of its benchmark – the Barclays Capital U.S. Treasury Index (an investment fund index of debt instruments with different durations issued by the U.S. Treasury) – through investments principally in green bonds and other debt instruments.

Deals in the sample under this heading include:

- A diverse pool of institutional investors has purchased green bonds issued by the **World Bank** to fund diverse projects that support climate change adaptation or mitigation. Since 2008, the World Bank has issued approximately USD 4 billion in green bonds (World Bank, 2013). Notable pension fund investors include Sweden's **AP Fonden 2** and **AP Fonden 3**, **CalSTRS**, **New York Common Retirement Fund**, and UN **Joint Staff Pension Fund** (World Bank, 2013).
- The World Bank issued their first AUD-denominated Kangaroo Bond in 2014. Australian superannuation fund **UniSuper** was the cornerstone investor for the

issuance, purchasing AUD 100 million of the total AUD 300 million offering (Fernyhough, 2014).

D) Direct (in-house) listed project investments

Institutional investors that seek investments in traditional equity and fixed income can access clean energy through investments in listed projects or companies.

Listed single-project equity

Clean energy projects have not yet independently listed (i.e. issued tradable equity shares) on public capital markets.

Listed single-project debt

A listed green project bond can provide financing for a single project, a portfolio of similar or standardised projects (such as wind farms or rooftop solar panel installations), or a portfolio of diverse sustainable energy infrastructure projects.

Deals in the sample under this heading include:

- The **Soitec** project bond was issued to finance the **Touwsrivier solar power plant** using concentrated photovoltaic (CPV) technology. The South African bond was issued in local currency and attracted a diverse pool of investors including **South African pension funds** and asset managers (Soitec, 2013).
- A publically listed solar project finance bond was issued by **Solar Power Generation Ltd** to fund two 5 MW solar PV plants in England. The UK **Pension Insurance Corporation** purchased the entire GBP 40 million offering (PIK, 2012).

E) Direct unlisted investments in pure-play corporates

Direct unlisted (private) corporate equity

Institutional investors can take equity stakes in unlisted pure-play energy corporates. For start-ups or clean technology companies, equity stakes may be purchased through venture capital funding rounds in which an institutional investor may participate alone or can collaborate with a group of investors. Due to the risks associated with funding early-stage companies and the poor short-term performance associated with many clean technology company ventures, there has been a retreat in clean technology venture capital funding from pension funds (Maag, 2013). However, other investors have continued to pursue the sector including particular activity from corporates that are establishing their own internal venture capital units or investing in venture capital funds. Other institutional investors such as sovereign wealth funds and family offices have also continued to fund clean technology companies (Maag, 2013). Some institutional investors that seek investments in unlisted companies may create their own in-house unit or fund dedicated to equity stakes in unlisted companies.

Deals in the sample under this heading include:

- California pension fund **CalPERS** has an in-house **Clean Energy and Technology Fund**.

- **CalPERS** also participated in multiple venture capital funding rounds for **SolarReserve**, a California-based solar thermal electric generation project developer (BNEF, 2011).[11]

Direct unlisted (private) corporate debt

Institutional investors can finance unlisted pure-play clean energy corporates by providing debt directly to a company or through contributing a portion of the total financing alongside other lenders.

Deals in the sample under this heading include:

- Canadian pension fund **Caisse de depot et placement du Quebec (CDPQ) and the National Bank of Canada Financial** provided revolving debt for Canadian renewable project developer **Boralex** (BNEF, 2006).
- Two Canadian pension fund clients of **Alberta Investment Management Corporation (AIMCo)** provided USD 50 million of a total USD 75 million term loan for **KiOR, Inc**, a development-stage biofuels company (KiOR, 2012).

F) Intermediated unlisted pure-play corporate investment

Intermediated unlisted equity investment in pure-play corporates

Institutional investors can invest in unlisted pure-play clean energy corporates through pooled funds such as private equity funds or venture capital funds.

Deals in the sample under this heading include:

- EQT Infrastructure II fund invested in **EEW Energy From Waste**, a German operator of 18 waste to energy plants. Pension funds that are limited partners in the EQT fund include **Lancashire County Pension Fund**, **New Mexico Educational Retirement Board**, **Varma** and **VER** (EQT, 2013).

Intermediated unlisted debt provision for pure-play companies

Institutional investors can invest in unlisted pure-play clean energy company debt through pooled debt funds such as infrastructure debt funds, specific renewable energy debt funds or unlisted debt fund of funds.

Deals in the sample under this heading include:

- **AMP Capital Infrastructure Debt Fund II** provided subordinated debt for **Invenergy**, which describes itself as the largest independent wind company in North America with over 25 wind farm projects in operation and under construction. Pension funds that are limited partners in the AMP Infrastructure Debt Fund II include **UK pension funds** and **Australian superannuation funds**.

G) Intermediated listed pure-play corporate investment

Listed pure-play corporate debt

Institutional investors could invest in listed pure-play corporate debt through their investments in green bond funds which invest in a basket of corporate green bonds. Alternatively, a green bond which is linked to an equity index of pure-play corporates

could fit in this category. An example of type of investment could be the 2014 issuance of a EUR 50 million structured green bond by the World Bank which is linked to the Ethical Europe Equity Index (World Bank, 2014). No information is available on this investment channel, as pension funds do not specify in their public disclosures the extent of their investment in corporate green bond funds.

Listed pure-play corporate equity

Institutional investors can invest in listed pure-play corporate equity through their investments in clean energy exchange-traded funds (ETFs) or index funds. These funds may be composed of a basket of clean energy stocks in general or may be narrowed by industry such as a solar-only ETF.

No information is available on this investment channel, as pension funds do not specify in their public disclosures the extent of their investment in index funds or ETFs.

H) Direct (in-house) listed corporate pure-play investment

Direct (in-house) corporate pure-play listed equity

Institutional investors can invest in corporate pure-play equity by purchasing shares in a company during an initial public offering (IPO) or through trading. As in the case of corporate pure-play debt, institutional investors that manage their investments "in-house" directly manage their own equity portfolios and the equity exposure is deliberate, rather than simply being a secondary exposure through investment in a fund or index.

Deals in the sample under this heading include:

- Swedish pension funds **AP Fonden 3** and **Alecta** are among the top ten shareholders in **Arise,** a leading Swedish wind power company (Arise, 2014).
- Brazil's largest pension fund **Previ** holds a significant shareholding (over 7%) in listed renewable energy company **CPFL Renováveis** (CPFL Renováveis, 2013a).[12]

Direct (in-house) corporate pure-play listed debt

Institutional investors can invest in pure-play corporate debt by purchasing corporate bonds. For institutional investors that opt to manage their investments (including their fixed-income – i.e. debt investment – portfolios) "in-house", their corporate bond exposure is deliberate; this contrasts with investments in funds or indexes where an external manager or entity determines the composition of a fund or index.

There is no public disclosure of pension fund investment in green bonds funds available, but there have been many corporate green bond issuances such as the **Vestas Eurobond** and the **EDF (Électricité de France) Energies Nouvelles** green bond that were noted in the press to have significant institutional investor interest.

Notes

1. See Kaminker et al. (2013) and Hervé-Mignucci (2012) for detailed case studies of the Walney transaction.
2. Other investors include Marguerite Fund (22.5%) and Siemens Financial Services (22.5%). WPD (the project developer) retained a 10% stake. The total investment is approximately EUR 1.3 billion and construction will continue through 2015. Project debt financing was provided by the EIB, the Danish export credit agency, KfW and nine additional commercial banks (Marguerite, 2013).
3. KfW IPEX-Bank, together with Bremer Landesbank and Unicredit acted as the mandated lead arranger for the banking consortium of 12 institutes including the EIB and the Dutch export credit agency EKF.
4. The Macquarie Mexican Infrastructure Fund will retain their 32.5% stake in the project (LAVCA, 2012).
5. More specifically according to Moody's, the downgrades reflect the increasing statistical significance of poor wind conditions experienced on the portfolio to date, which have been substantially below the original energy production forecast since 2009, and provide growing evidence that initial wind resource projections were overly optimistic.
6. The total debt investment was EUR 200 million with the additional EUR 20 million coming from Canadian power company Northland Power.
7. Manufacturer's Life Insurance Company and KfW provided the remaining debt financing. The project developers are Eolectric Inc and fund Fiera Axium Infrastructure Canada LP. Pension funds are also significant investors in the Fiera Axium fund.
8. The bond issuance allowed for a refinancing of the original project cost and was entirely purchased by the Lancashire County Pension Fund. The Westmill Solar Cooperative is community-owned and operated as a co-operative. The 23.5-year bond provides the Westmill Solar Cooperative with long-term finance and will guarantee a return of "3% above the retail prices index" for the Lancashire County Pension Fund (Williams, 2013).
9. PINAI's investment (32%) in the project is a joint venture with AC Energy Holdings (64%), a subsidiary of Ayala Corporation and UPC Renewables (4%) (ADB, 2013).
10. See Kaminker et al. (2013) and Hervé-Mignucci (2012) for a detailed case study of the Walney transaction.
11. CalPERS invested through their CalPERs Clean Energy and Technology Fund. Additional investors included Citi Sustainable Development, Bregal Energy, US Renewables Group, Seven Mile Capital Partners, ACS Cobra, Argonaut Private Equity, Nimes Capital, and Credit Suisse.
12. CPFL Renováveis has a portfolio of over 5 500 MW of renewable energy including wind, solar, hydro and biomass with a pipeline to develop an additional 3 800 MW of renewable energy (CPFL Renováveis, 2013b).

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Chapter 4

A stocktaking of risk mitigants and transaction enablers for sustainable energy investment

This chapter advances the discussion beyond the investment channels for sustainable energy that can be used by institutional investors to the interventions that can enable or facilitate these investments, either through mitigating risks or lowering transaction costs. By providing coverage for risks which are new and are not currently covered by financial actors, or are simply too costly for investors, risk mitigants increase the attractiveness and acceptability of sustainable energy projects. These include a range of targeted interventions generally aimed at reducing, re-assigning or re-apportioning different investment risks (e.g. credit enhancements, cornerstone stakes, and tools targeting different challenges across stages of the project lifecycle). As a subset of risk mitigants, techniques facilitate institutional investment in sustainable energy infrastructure projects by reducing the transaction costs associated with these investments while also mitigating risk in some cases (e.g. warehousing, securitisation and supporting co-investment and collaboration among institutional investors).

Risk mitigants

As introduced in Chapter 1, the classification framework presented in this report is based on the instruments and funds that are the channels for investments made today by institutional investors in sustainable energy infrastructure. Although there are important pockets of investment activity, however, investments in sustainable energy infrastructure face a multitude of barriers (described in Table 2.1) and an uneven playing field for sustainable energy in terms of costs and risks. A key challenge for policy makers (as well as private and public financial institutions) is in designing risk mitigants and other interventions that address these barriers. In order to increase the attractiveness of sustainable energy investments for institutional investors, these interventions are key to reduce the perceived risks associated with sustainable energy investment or help to make these transactions *accessible* to institutional investors in the first place.

Role of financial institutions in credit enhancement and risk reduction

The willingness of institutional investors, in particular, to finance major investment projects in any given country will be heavily influenced by perceptions of the country's investment climate. More specifically, it will be influenced by policy settings and institutions that underpin a country's economy and political processes. Investors' perceptions of risks associated with a country or market and the ability to effectively mitigate these risks will play a key role in determining financing flows. Financial institutions and governments can have an impact on these perceptions through the use of risk mitigants. For example, insurance companies, green investment banks and multilateral development banks all play key roles as providers of risk mitigants. Figures 1.1 and 1.2 (in Chapter 1) provide an overview of these diverse public and private actors and their respective focus on sustainable energy investments.[1]

As opposed to instruments and funds, which are essentially types of investments, credit enhancement involves targeted interventions generally aimed at reducing, re-assigning or re-apportioning different perceived investment risks. In the context of investment in infrastructure, including sustainable energy infrastructure, credit enhancement is often used by public and private financial institutions to make such investments more attractive to investors, including institutional investors.

While infrastructure projects in general have the potential to deliver attractive risk-adjusted returns to institutional investors, there is a common mismatch between the long-term, relatively low-risk investment needs of institutional investors and the available financing structures. Investments must therefore be structured to provide risk-return profiles that match institutional investors' liability structures and expectations for steady and long-term income flows. Many of the factors that weigh against institutional investors taking more interest in sustainable energy infrastructure can be broadly described as different types of risk. These risks can make it difficult to sustainable energy infrastructure projects to obtain an Investment-grade credit rating. Rating agencies are naturally conservative, particularly when trying to assess long-term projects or contracts, and especially if there is a limited long-term performance history to evaluate (G20/OECD, 2012; Kaminker and Stewart, 2012; Kaminker et al., 2013). In emerging and developing countries, securing the sufficient investment-grade rating necessary for institutional investors to invest in certain projects is particularly challenging (Inderst and Stewart, 2014).

Sustainable energy infrastructure is becoming less policy-dependent as technology costs continue to decrease and in some jurisdictions is becoming commercially-viable without

support. However, sustainable energy investments are often still perceived as riskier than established carbon-intensive technologies. For example, technology risk – i.e. the risk that a given technology will not work as specified – is often seen by institutional investors as an important obstacle to investment in sustainable energy infrastructure. This is a particular problem for technologies at the pre-commercialisation phase and relevant for technologies such as carbon capture and sequestration which will be necessary for a transition to a low carbon economy (G20/OECD, 2012; Kaminker and Stewart, 2012). Carbon-intensive technologies are also subject to fuel-price risk and stranded asset risk but investors may perceive that these risks are more manageable (for instance through financial hedging using derivatives), more distant or less tangible and material (see Box 2.2).

Some actors have also retreated from their previous roles as providers of risk mitigants. For example, before the financial crisis, monoline insurers played an important role in providing bond issuers with insurance to upgrade the credit-worthiness of their bonds, lowering bond issuers' overall cost by giving confidence that the insured security would be paid in full. The financial crisis led to the disappearance of some significant actors such as monoline insurers that had been active in providing insurance to investors in the infrastructure market (Kaminker et al., 2013).

Credit enhancements discussed in this chapter provide coverage for risks which are new, are not currently covered by financial actors or are simply too costly for investors to insurance against. Sustainable energy infrastructure may not be perceived to be able to provide high enough returns to attract commensurate risk-capital. Credit enhancement can help to stabilise project cash flows which broadens the investment opportunities for domestic and international debt markets (Streeter, 2014). These stabilised cash flows also facilitate longer debt tenors which helps to correct the mismatch between the debt tenor and the life of a given infrastructure asset (Streeter, 2014).

The specific credit enhancement needs will depend on the country context as well as the level of development of local capital markets. Some risks, such as sovereign, currency and regulatory risks will be amplified in emerging and developing countries. The following discussion provides additional details on specific credit enhancement tools and how they have been used in the context of sustainable energy infrastructure investment.

Subordination

Debt subordination is a form of risk mitigant whereby particular classes of lenders are given priority with regard to claims on assets. By offering repayment priority to certain holders of 'senior' debt, a project can enhance its capacity to attract financing from this source. Institutional investors, for example, may find senior debt (made possible by debt subordination) attractive because it reduces repayment risk. However, in some cases institutional investors may be willing to provide subordinated debt for sustainable projects, despite a lower repayment priority and greater risk. For example, in one of the 47 investments in our sample, PensionDanmark provided a EUR 120 million subordinated loan for the Gemini offshore wind project. The decision on whether to take on subordinated debt is made based on an assessment of whether the return on the subordinated tranche makes up for the additional risk, and whether it fits well into an investor's investment mandates.

The EIB and the European Commission have launched the Europe 2020 Project Bond Initiative which provides eligible infrastructure projects with a Project Bond Credit Enhancement (PBCE) in the form of a subordinated instrument – either a loan or contingent

facility – to support senior project bonds issued by a project company. A key benefit of PBCE is the enhancement of senior bond credit ratings by mitigating the risk associated with losses in the event of default throughout the lifetime of the project, including the construction phase.[2] Ultimately, the PBCE is expected to widen access to financing sources, including institutional investors, by minimising overall funding costs, improving market confidence regarding the potential pipeline of transactions, and simplifying and standardising project structures (EIB, 2012). A successful example of the way that the PBCE can facilitate institutional investment is the PBCE (GBP 45.8 million guarantee, representing 15% of the bond issuance) provided for the Greater Gabbard offshore wind project off the Suffolk coast in the UK. The project became the first UK-based sustainable energy infrastructure project to attract finance from institutional investors using the programme (EIB, 2012). This guarantee facilitated a one-notch upgrade in the project's credit rating provided by Moody's (EIB, 2013).

Loan loss reserves

Loan loss reserves set aside capital to cover potential losses and help to reduce repayment risk. If a borrower defaults, the lender is repaid using the reserve fund. By reducing repayment risk, loan loss reserve funds can lower financing costs, motivate financial partners to broaden consumer access to green infrastructure-related loans, and extend loan repayment periods.

Some green investment banks have been active providers of loan loss reserves and often provide a percentage of loan loss coverage for lenders (Eklin et al., 2015, forthcoming). As part of its "Smart-E Loan Program", the Connecticut Green Bank offers distinct residential energy efficiency and renewable energy financing products with corresponding loan loss reserve levels. Every time a lender underwrites an eligible loan under this programme, the Connecticut Green Bank reserves a percentage of the loan principal (between 7.5-15%) for the lender in the event of a default (Energize CT, 2013). In the Connecticut model, to promote sound lending practices and share risks, the lender assumes the "first loss" (1.5%) on its portfolio before it is permitted to access the reserve fund.

Guarantees and insurance products

Guarantees and insurance are core credit enhancement tools that are used to mitigate perceived or actual risks to improve the attractiveness of investments. When discussing credit enhancement, the terms guarantee and insurance are often used interchangeably. While guarantees are often used as a credit enhancement mechanism for debt instruments (bonds and loans), guarantees can also be discussed in the context of guaranteeing the performance of a given technology such as solar panels or wind turbines. Insurance products may protect against a range of risks such as construction or operational risk, market risks such as price changes, weather-related production volatility risks, and political, regulatory or policy issues. Institutional investors are often key purchasers of sustainable energy-related insurance policies and are helping to increase demand for these types of offerings (Gilbert, 2013). Most sustainable energy insurance products provided are risk-transfer offerings supplied to insure against risks related to production, installation, repair, and replacement of wind turbine blades or solar panels. These insurance products may also cover sustainable energy production risks linked to plant construction and operation through to energy and power distribution.

While guarantees and insurance products can be provided by private bank or third-party actors, the public sector often has a key role to play by providing insurance and guarantees through national or supranational bodies which can play an important kick-starting role in driving sustainable energy infrastructure finance (OECD, 2014a). Bilateral or multilateral development banks often act as key providers of insurance and guarantees for sustainable energy investment. For example, the International Finance Corporation (IFC) provides a partial credit guarantee, which represents a promise of full and timely debt service payment up to a predetermined amount if the project does not provide the full repayment. The IFC's objective is to offer the minimum amount of guarantee necessary to facilitate a successful transaction (IFC, n.d.). It helps borrowers to broaden the access to investors of international and local capital markets including institutional investors, reduce borrowing costs, and extend maturities.

Export credit agencies may also play a key role in both commercial and political risk guarantees that can be instrumental in attracting institutional investors. The Danish export credit agency Export Kredit Fonden (EKF) has been particularly active in providing guarantees through their Export Loan Support Scheme which covers up to 90% of commercial and political risks for exporting companies and up to 95% of these risks for banks (Boyd and Hervé-Mignucci, 2013). Multiple export credit agencies may also collaborate on transactions such as the EUR 890 million financing for the Belgian offshore Northwind project which included the Danish EKF as well as export credit agencies from Norway (GIEK) and Belgium (ONDD). Institutional investors for the Northwind project included Danish pension fund PensionDanmark as well as commercial banks.[3]

Credit enhancement for bonds

Third-party guarantees can improve the credit-worthiness of bond issuances. For example, specialised financial guarantee insurance can also be purchased to guarantee financial obligations linked to asset-backed securities. Asset-backed securities are securities that are derived from a pool of loans or receivables. In the case of sustainable energy, energy efficiency loans or solar leases could be pooled, securitised and issued as an asset-backed security. The process of pooling or warehousing these loans or receivables is discussed further in the report. To provide a credit enhancement, a specialised insurance provider guarantees or "wraps" the asset-backed security to insure against losses. The insurance wrap typically increases the credit rating of the issuance. Monoline insurers used to be the key provider of this type of credit enhancement.

A letter of credit is an additional credit enhancement for bonds. A letter of credit is a commitment by a financial institution, usually a bank, to guarantee payments for the principal and interest on debt issuances. If the bond issuer is unable to make payments, the letter of credit is drawn to repay bond holders. For both letters of credit and surety bonds described later, the credit rating will be linked to the creditworthiness of the monoline insurer or bank providing the guarantee. Due to this linkage, if the institution providing the guarantee is downgraded, the relevant bond may similarly suffer a downgrade. Furthermore, overcollateralisation, where the collateral which "backs" the issue is greater than the principal amount of the issue, can be used as a tool for credit enhancement, such that a buffer is created between the value of the assets and the amount of debt raised. This provides additional coverage and a high debt service coverage ratio, and can fund a reserve in case of defaults.

Performance guarantees

A performance guarantee is a risk mitigant provided to give owners confidence that a given technology or system will perform as expected. Project developers in search of investment partners must seek to provide assurances that projects will meet the financial expectations of project investors. Performance guarantees serve to ensure the expected level of guaranteed revenue in the long-term.[4] Project developers often ask the engineering, procurement and construction (EPC) contractor for comprehensive guarantees. For example, almost all large-scale PV projects have performance guarantee contracts (Taylor and Williams, 2011). The provision of a performance guarantee can be also be insured by a commercial reinsurance company to provide solar plant operators and investors with greater planning security, which will give investors, including institutional investors, more confidence about revenue derived from projects (Munich RE, 2010).

Project completion coverage

A surety bond is an example of an insurance product that guarantees completion of a contract or fulfilment of an obligation. In the case of sustainable energy projects, surety bonds are useful to ensure project completion if a contractor defaults. Project contractors purchase these surety bonds from surety companies which assume liability for non-performance. If a contractor defaults, the surety company must find another contractor to complete the project or compensate the project owner for any losses incurred (SBA, n.d.). Surety bonds therefore provide a type of insurance for project completion.

Production risk coverage

An additional type of insurance product provides financial protection against volumetric risk (the risk that electricity delivered by a project is lower than expected). Traditional insurance products and parametric insurance products[5] cover revenue lost due to shortfalls in forecast energy production as a result of insufficient wind, solar or other energy sources. Institutional investors that seek stable, long-term yields are increasingly demanding these types of insurance products to provide stability.

Political risk coverage

For political risk coverage products a relatively established market exists (UNEP, n.d.). Political risk insurance can be especially useful in less developed countries where the risk relating to the country's political and macroeconomic environment is among the key barriers to investment (Venugopal and Srivastava, 2012). The World Bank's Multilateral Insurance Guarantee Agency (MIGA) helps private investors, including institutional investors, by insuring eligible projects against losses relating to: *1)* currency inconvertibility and transfer restriction, *2)* expropriation, *3)* war, terrorism, and civil disturbance, *4)* breach of contract, and *5)* non-honouring of financial obligation (MIGA, n.d.). For equity investment, MIGA guarantees up to 90% of the investment, in principle. For loans and loan guarantees, MIGA generally offers coverage of up to 95% of the principal (or higher, on a case-by-case basis), plus up to an additional 150% of the principal to cover interest that accrues over the term of the loan (MIGA, 2012).

Policy and regulatory risk coverage

Additional insurance offerings have emerged to cover policy risk. Policy risk can include both legal and regulatory changes. Policy risk is frequently highlighted as one of the most significant risks facing investors in sustainable energy and has a significant role in dissuading investors from allocating capital to this sector (Parhelion, 2012; Micale et al., 2013). In particular, retroactive policy change risk is highlighted as a principal concern as it directly impacts expected and historical revenues from projects and lowers investor confidence in the stability of the financial support available over the investment lifetime (Parhelion, 2012; Frisari et al., 2013; Micale et al., 2013). Government could pre-commit to reduce these risks, e,g, through contractual penalties in the case of material policy changes. Retroactive changes to feed-in tariffs have notably been involved in recent years in a series of investor-state disputes (OECD, 2014, forthcoming; IISD, 2012). Foreign investors involved in renewable energy projects could initiate international investment arbitration to seek damages, under provisions included in bilateral investment treaties (BITs) and other multilateral agreements (OECD, 2014, forthcoming; Gaukrodger and Gordon, 2012). There is also a key role for the public sector to provide policy risk insurance products as the private sector will not underwrite these types of risks when there is a lack of alignment of interest between the "risk influencer" (i.e. the government) and the "risk carrier" (i.e. investors or insurers) (Parhelion, 2012, p. 1).

The US Overseas Private Investment Corporation (OPIC) is one of a few public institutions which provide regulatory risk insurance against policy changes, in addition to their political risk guarantees. Its regulatory risk product can protect against regulatory actions impacting on sustainable energy projects, such as *1)* material changes to feed-in tariffs, *2)* critical changes to taxation or other regulations affecting the project's ability to operate, *3)* revocation of licences or permits necessary for the operation of a project, *4)* improper interference with carbon credit generation or sales, and *5)* repudiation of a concession, technical assistance, or forestry-related services agreement by a foreign government (OPIC, n.d). As policy risks are increasingly recognised as a major barrier to investment flows to climate financing, the United Nations Environment Programme has also recently proposed to establish a policy insurance mechanism. This mechanism, which is to be funded by both the private and public sector, will insure policy risks specifically related to sustainable energy investment. The proposed coverage would engage local insurers in developing countries and international reinsurers to facilitate investment in sustainable energy technologies (UNEP, n.d.)

Currency risk protection

Currency risk is a particular concern for infrastructure projects in developing countries due the currency mismatch between project revenues and debt finance. Project revenues are typically denominated in local currencies. However, due to the size and duration of financing and the lack of established domestic financial markets, project financing is usually provided in widely-traded international currency (e.g. US dollar, euro or yen) (Venugopal and Srivastava, 2012). Currency swaps can be used to address these foreign exchange risks for sustainable energy projects which have local currency revenues yet pay debt in a foreign currency.

Public investment funds

Governments can play a pivotal role in facilitating the flow of institutional capital into infrastructure assets including sustainable energy infrastructure by seeding investment funds that can attract outside sources of capital. Equity funds formed as partnerships of public and private institutions could become important sources of finance and providers of organisational capacity and expertise in support of the financing of infrastructure projects including sustainable energy infrastructure projects.

Multilateral development banks, such as the European Investment Bank, have been particularly active in setting up infrastructure or sustainable energy investment funds that attract institutional investors. Green investment banks may also seek to create investment funds. Australia's national green investment bank, Clean Energy Finance Corporation (CEFC), is developing an unlisted sustainable energy fund in partnership with Colonial First State Global Asset Management that would attract institutional investors. CEFC plans to invest much as AUD 80 million for the fund dedicated to sustainable energy and plans to raise up to an additional AUD 500 million from private investors including superannuation funds (Paton, 2014). CEFC CEO Oliver Yates noted that "by providing a new investment option for superannuation funds and other institutional investors, the Fund will attract new sources of investment in renewable energy, unlocking new sources of capital for the market and expanding the investor base for this sector" (Parkinson, 2014). The UK Green Investment Bank is considering the creation of a fund that would invest in multiple projects. The fund is designed to appeal to institutional investors that may seek exposure to assets such as offshore wind but would be unlikely to risk investing in a single project (Shankleman, 2014).

Cornerstone investment

A cornerstone investment refers to a large investment in an offering that occurs early in the investment process so as to play a demonstration role to attract other investors.[6] A cornerstone stake could be purchased in a company or a fund. For example, the Asian Development Bank acted as a cornerstone investor in the Philippine Investment Alliance for Infrastructure (PINAI), an unlisted fund dedicated to investing in infrastructure assets in the Philippines, which subsequently attracted outside investors including APG, a Dutch pension fund asset manager.

The UK Green Investment Bank (UK GIB) and UK Department for Business, Innovation and Skills (BIS) acted as cornerstone investors and played a key role in bringing the recent GBP 260 million Greencoat Wind Fund Initial Public Offering (IPO) to fruition on the London Stock Exchange.[7] The UK GIB and UK BIS also committed to a one year lock-up period in which they were prohibited from selling their Greencoat Shares (London Stock Exchange, 2013). Given that banks were not willing to launch the Greencoat IPO without the UK GIB and BIS as cornerstone investors, the IPO provides an excellent example of a transaction that would not have worked without the involvement of government as an investor. A combination of government (for profit) capital, and the name and reputation of these government entities helped the transaction be successfully completed. The government backing helped de-risk the IPO for institutional investors, but the deal also reflects the extent to which there is appetite for the kind of low-risk infrastructure-style investment in operational wind projects that Greencoat aims to execute.

Transaction enablers for sustainable energy investment

As shown in Chapter 3, institutional investors that would like to invest in sustainable energy infrastructure can either do so directly (in-house) or through intermediaries (out-sourced). While direct infrastructure investments have a number of characteristics which can appeal to institutional investors such as allowing for asset-liability matching and helping hedge the risks for long-dated liabilities, making direct investments in projects is generally complex and resource-intensive. It can be prohibitively expensive due to the costs of developing and maintaining a direct investing team in addition to transaction costs and legal fees. Thus, many investors might consider using intermediaries because they do not have this expertise, or the scale that would justify creating an internal team. However, of these institutional investors, many have decided against investing in infrastructure or have withdrawn from contracts because they have determined that the transaction costs, in particular management fees, are prohibitive. Nevertheless, some firms have started to explore ways to reduce transaction costs for sustainable energy investment or otherwise faciliate or enable these transactions to be made more efficiently. For the purposes of this analysis, these approaches are referred to as transaction enablers.

The traditional institutional investor was almost entirely outsourced, rarely possessing the expertise and competencies to execute even the most basic financial transactions without the help of some external advisors. But, over time, the extended chain of principal-agent relationships became problematic (Kaminker et al., 2013). As alluded above, one of the key areas of tension between investors and fund managers with respect to infrastructure investments is a conflict of interest between investors and fund managers over fund fees and terms and conditions (Kaminker et al., 2013; OECD, 2014d). In addition, the global financial crisis has heightened dissatisfaction among many institutional investors with some of the existing institutions of finance and investment due to the perception of misaligned incentives, poor returns and short-termism embedded in certain third-party management agreements (Kaminker et al., 2013; OECD, 2014b).

Those institutional investors who do not have the scale to "in-source" asset management by building a dedicated team, or who may not have the technical or geographical expertise to execute a transaction, or who wish to bid on assets that are too large for them individually, have started to successfully explore the use of transaction enablers to make these direct investments possible. These transaction enablers such as securitisation and warehousing can be instrumental in reducing the cost of direct investment by pooling information and knowledge across multiple institutional investors.[8]

There are also other types of initiatives led by investors such as co-investment, which enable them to come together informally to collaborate in investment platforms or share knowledge, which serve to reduce transaction costs or otherwise faciliate investments. In addition, there have been a number of regional institutional investor initiatives that have been formed to engage with governments, as well, such as the umbrella Global Investor Coalition on Climate Change (GIC) which comprises multiple regional initiatives and is also involved in collecting data, and the Asset Owners Disclosure Project (AODP) (Kaminker et al., 2013).[9]

Securitisation

Securitisation is a technique whereby illiquid or small-scale assets, such as cash flows from solar leases or power-purchase agreements, are transformed into a standardised and tradable asset. Before it can be sold, the resulting instrument (e.g. an asset-backed security

or collateralised debt obligation) generally needs to be assessed by a credit rating agency (Neil, 2014). By transforming pooled assets into securitised products on the secondary market, securitisation can serve to reduce the cost of financing for the underlying assets while aggregating small-scale and unrated investments into securities that appeal to institutional investors, therein enabling transactions to be made. This is particularly true if the resulting securities receive a high credit rating (Neil, 2013).

In addition, considering that bonds have traditionally been the dominant asset class favoured by pension fund managers in the OECD, securitisation that results in listed bonds can be particularly instrumental to better engage institutional investors. Accessing the capital markets through securitised issuances at scale can also be particularly useful to develop a market for this type of sustainable energy investment. For example, securitised solar issuances are helping to build a solar market that is more liquid and has a lower cost of capital relative to traditional funding sources such as loans (Lowder and Mendelsohn, 2013). Many securitisation efforts are aimed at aggregating small scale assets to create structures of the scale that institutional investors would find attractive, although they do have important risk diversification benefits.

While securitisation can be important to free up funds from the balance sheets of banks and corporates and reach a broader base of capital through security markets, it requires sufficient asset quality and assured cash flows to obtain and maintain a favourable credit rating. A number of issues challenge the development of securitisation and need to be addressed in order to improve access to capital markets. These challenges include limited availability of performance data, lack of standardised contracts, and insufficient volume of existing debt (Lowder and Mendelsohn, 2013). A government or other public sectors actors such as green investment banks can play roles in establish platforms that will help to bring small transactions to scale, as well as in mitigating the perceived risks, to encourage securitisation.[10]

Warehousing

Many potential sustainable energy investments are unattractive for institutional investors because they lack the necessary scale (Kaminker et al., 2013). Through warehousing, smaller projects (such as energy efficiency loans or solar leases) are pooled in order to reach a size where the bundled asset becomes attractive for sell-off to large investors or for securitisation through bond issuances (discussed below). Once its pool of purchased loans reaches a threshold of USD 25-100 million depending on the assets, NY Green Bank proposes securitisation (Booz & Co, 2013). Pooling techniques such as loan warehousing can be useful to reduce transaction costs and facilitate investment in small-scale projects, thereby helping to get them to a commercial scale that is attractive for institutional investors. These could also be considered as risk mitigants in that by pooling multiple loans, they reduce exposure to idiosyncratic project-specific risk. In addition to pooling and securitising commercial and industrial loans, the Connecticut Green Bank has bundled solar leases from a large number of small projects to attract private companies and new investors.[11] NY Green Bank is also interested in purchasing loans that conform to specific green standards.

Standardisation of contracts and reporting and data collection

By promoting standardisation of contracts and reporting templates and improving data collection, policy makers can reduce transaction costs associated with investment in sustainable energy.[12] In the United States, the National Renewable Energy Laboratory's (NREL) Solar Access to Public Capital (SAPC) Working Group is developing standardised contracts for residential solar leases and power-purchase agreements. Their efforts are designed to improve consumer transparency, reduce transaction costs in the solar asset contracting process, and facilitate the pooling of cash flows from solar PV leases so they may be securitised and sold in the capital markets. The SAPC has also developed mock securitisation term sheets for bundled solar PV leases (i.e. legal descriptions of the securitisation structure, managing entities, and cash flow) to illustrate and clarify how solar securitisation works and potentially reduce transaction costs for new securitisations to reach the market (NREL, 2013). Some green investment banks have also shown an interest in standardisation of contracts and reporting processes. For example, NY Green Bank highlights the need for greater standardisation of contracts and the loan underwriting process and improved data collection regarding loan and project performance. Standardisation and greater data availability would then make it much easier and cheaper for securitisation to occur, for private banks to underwrite and for credit agencies to rate a securitisation (Eklin et al., 2015, forthcoming).

Co-investment, joint-ventures and consortiums

Institutional investors may seek to reduce transaction costs by partnering with other investors through co-investment, joint-ventures or consortiums. Co-investment is a form of direct investing whereby institutional investors partner up with other investors to invest in an asset (OECD, 2014b). Institutional investors are increasingly using co-investment as a way to reduce transaction costs, gain access to more potential investment opportunities as well as build relationships with experienced investors such as infrastructure funds. In contrast, a joint-venture is a business arrangement where two or more parties agree to pool their resources and establish a new entity for a specific project or business activity in a way that is separated from the participants' other business interests. A consortium is an association of two or more individual companies to pool their resources and participate in a common project or business activity. In addition to deal-specific co-investment, joint-ventures or consortiums, investors are increasingly organising their own initiatives to support co-investment for a wide range of deals (see Box 4.1).

Box 4.1. **The rise of co-investment platforms**

Co-investing platforms have emerged partly in response to dissatisfaction among institutional investors with respect to high fees associated with infrastructure fund models (OECD, 2014b). The advantages of co-investing platforms include: better alignment of interests with other institutional investors, suitable investment horizons, lower fees, better control of the investment characteristics, larger commitments, local knowledge, and risk sharing (OECD, 2014b). Bachher and Monk (2012) identify additional benefits of collaborating in co-investment platforms including higher returns, access to greater deal flow, greater diversification, improved governance rights, and reduced headline risk. A number of large pension funds and sovereign wealth funds have looked at pooling their financial and internal resources to invest

Box 4.1. **The rise of co-investment platforms** *(continued)*

jointly in infrastructure projects. In Australia, IFM Investors is co-investment platform owned by 30 Australian superannuation funds and collectively represents AUD 52 billion in assets under management across a variety of sectors. IFM Investors invests across a range of sub-sectors including electricity generation, transmission, and distribution, rail infrastructure, and water (IFM Investors, n.d.; Inderst and Della Croce, 2013).

Co-investment platforms also face a number of challenges. Pension funds often have widely varying strategies, diversification targets, and exposure limits. Differences in governance and compensation structures may also create difficulties. Co-investing using co-investment platforms therefore should not be considered as a "short-cut" to direct investing, as a co-investor still needs some in-house capabilities and execution skills (Bachher and Monk, 2013, 2012). In order to overcome these challenges, government support may be required to promote co-ordination between the parties or to provide access to attractive investment opportunities. The UK's Pension Investment Platform (PIP), Canada-based Global Strategic Investment Alliance (GSIA) and the Canada Pension Plan Investment Board (CPPIB)-led syndicate model all provide examples of different co-investment structures that may help institutional investors to access infrastructure investment more efficiently than investing through unlisted equity funds by pooling their financial and internal resources (OECD 2014b). See OECD (2014b) for a detailed review of co-investment platforms.

Source : OECD, 2014b; Bachher and Monk, 2013; Inderst and Della Croce, 2013; Bachher and Monk, 2012; IFM Investors, n.d.

Co-operation and collaboration, and other informal knowledge-sharing

Co-operation and collaboration are more informal techniques that can facilitate sustainable energy infrastructure investment by institutional investors. Collaboration involves a closer working relationship than co-operation, and involves commitment to a project or projects both in terms of the specification of shared objectives and the means of realising those objectives (Monk, 2013). Institutional investors can collaborate through agreeing on expected outcomes, and setting well-defined mechanisms governing entry and exit from such agreements (Clark and Monk, 2013). While investors may come together informally in various ways to collaborate in investment platforms, there is an opportunity for governments to work with these platforms to better understand investor needs and the key barriers that are reducing or preventing investment in sustainable energy infrastructure.

Compared with collaboration, co-operation is less formal way of enhancing senior managers' knowledge and understanding of the investment options available and formulating strategies (Clark and Monk, 2013). When investors find deeper engagement challenging, co-operation can be effective as a means of mobilising and sharing resources and capabilities (Clark and Monk, 2013). For example, institutions can establish partnerships when senior managers of smaller institutions wish to establish cost-sharing and service-sharing agreements with larger institutions with the expectation that larger institutions can claim significant discounts from external service providers due to economies of scale.

Key takeaways for policy makers

Risk mitigants

- In the sustainable energy sector, many risks such as policy risk are not well covered by traditional financial or insurance offerings or are simply too expensive to insure against to attract investor demand. Due to this gap in offerings and the need to scale up investment in sustainable energy infrastructure, there is a clear role for government and other policy actors to develop risk mitigants to promote sustainable energy investments or to pre-commit to reduce these risks.
- In order to attract investors, multiple risk mitigants may be necessary given that sustainable energy infrastructure may not be perceived to be able to provide high enough returns to attract commensurate risk-capital. Risk mitigants can be tailored to the needs and conditions of an individual sustainable energy project if the scale permits.
- Risk mitigants play an important role to enhance the creditworthiness of projects by mitigating perceived investment risk. Reducing, re-assigning or re-apportioning different investment risks, enhance the creditworthiness of projects, de-risks potential investments and increases the attractiveness of investments while stabilising project cash flows. This broadens investment opportunities for institutional investors with long-term investment horizons and relatively limited appetite for risks.
- The importance of risk mitigants is magnified within the context of reduced government financing capacity. As risk mitigants mobilise private capital using limited public finance, they are part of a trend where government has less ability to act as a project financier but rather works as a facilitator by reducing risk to encourage private investment. When considering deploying risk mitigants, governments should also examine and carefully evaluate the contingent liabilities that these responsibilities create for taxpayers.
- The public sector is increasingly aware of the need to reduce risk and many countries are already using and developing risk mitigants to promote increased sustainable energy investment. Some governments have been particularly active in developing and using these risk mitigants to mobilise greater sustainable energy investment and these examples can potentially be applied to other national contexts. The Danish export credit agency EKF is a particular example of an institution that is using their guarantees to encourage institutional investor participation in sustainable energy finance. Green investment banks and other public financial institutions are also actively working to reduce risk by providing guarantees, loan loss reserves, seeding funds and acting as cornerstone investors.

Transaction enablers

- As most institutional investors have limited experience with direct investment in sustainable energy infrastructure projects, the cost associated identifying, executing and managing investments in-house is often prohibitively expensive, partly due to the costs of developing and maintaining the human resources of a direct investing team as well as transaction costs and legal fees.
- Although many techniques have emerged from the private sector as investors work together to reduce transaction costs, there remains a key role for policy action to reduce costs. For example, while investors may come together informally to

collaborate in investment platforms, there is an opportunity for governments to work with these platforms to better understand investor needs and the key barriers that are reducing or preventing investment in sustainable energy infrastructure.

- Government should make sure that regulatory frameworks do not prevent techniques such as securitisation from functioning as intended. For example, financial regulations such as Basel III and Solvency II should be carefully considered to avoid unintended consequences of discouraging long-term investment by institutional investors.
- The relatively small size of many potential sustainable energy investments is often an investment barrier for large institutional investors, who are looking to invest larger sums of capital (partly to justify the due diligence required and also to have a meaningful impact on their portfolios). Governments can play a key role in reducing these transaction costs through promoting contract standardisation, warehousing and securitisation to facilitate institutional investment in sustainable energy projects. As a recent example of securitisation of commercial energy efficiency loan led by the Connecticut Clean Energy Finance and Investment Authority (CEFIA).
- Establishing warehousing and encouraging securitisation creates opportunities for the public sector to play an important co-ordinating role in establishing platforms that will help to bring small transactions to scale, as well as in mitigating the perceived risks. By pooling small transactions, a collection of projects can then be securitised and sold to institutional investors through financial intermediaries.

Notes

1. It is worth noting that much many of the lessons discussed herein are also applicable to other types of infrastructure investment beyond sustainable energy which creates opportunities potentially for knowledge transfer between sectors.
2. See EIB (2013) for additional details on how the EIB provides the credit-enhancing subordinated tranche, and positive impacts for Senior Bondholders.
3. See Boyd and Hervé-Mignucci (2013) for a detailed case study on the development of the onshore Jädraås wind farm in Sweden which included a guarantee from EKF that helped to mobilise institutional investor financing. The report also provides additional examples of export credit guarantees used in financing sustainable energy projects.
4. For example, performance guarantee could include a guaranteed electrical production for 10 years at 90% of rated power output and 25 years at 80% (Energy Informative, 2013).
5. Parametric insurance products are a type of insurance product that pays out when the coverage is triggered by a particular variable, such as the number of inches of rain over a designated time period.
6. The term cornerstone investor is most commonly used in the context of initial public offerings (IPOs) in which an investor agrees to purchase a prominent share of the offering. Cornerstone investors may also commit to holding their shares for a specific time period. By purchasing a large stake of an offering and doing so early in the IPO process, cornerstone investors provide confidence for other investors (West and Piramal, 2013). In this report, the term cornerstone investor can also refer to a prominent investment in an investment fund, debt offering, or equity investment.

7. BIS invested GBP 50 million as a cornerstone investor which enabled the IPO to occur and provided the necessary confidence to utility SSE and major institutional investors to join the offering. Greencoat's plan is to invest in proven operating UK wind farms greater than 10 MW in size on an unlevered basis. It expects to provide investors with an initial dividend yield of 6% on investment, which is evidently a sufficient incentive to attract institutional public investors. The fund closed its first acquisitions alongside the IPO, purchasing stakes in four wind farms from SSE in a deal worth about GBP 140 million. The UK GIB matched Greencoat's investment in the Rhys Flats wind farm, buying a 24.95% stake in the project for GBP 57.5 million in the first time it has contributed direct equity to an offshore wind farm.

8. It is worth noting that many of the lessons discussed herein are also applicable to other types of infrastructure investment beyond sustainable energy which creates opportunities potentially for knowledge transfer between sectors.

9. For instance, at the United Nations Climate Summit in 2014, nearly 350 global institutional investors representing over USD 24 trillion in assets called on government leaders to provide stable, reliable and economically meaningful carbon pricing that help redirect investment commensurate with the scale of the climate change challenge, as well as develop plans to phase out subsidies for fossil fuels (IIGCC, et al., 2014). The statement was co-ordinated by the four investor groups on climate change – Ceres' Investor Network on Climate Risk (INCR) in the U.S., the European Institutional Investors Group on Climate Change (IIGCC), the Investors Group on Climate Change (IGCC) in Australia and New Zealand, and the Asia Investor Group on Climate (AIGCC) along with the United Nations Environment Programme Finance Initiative (UNEP FI) and Principles for Responsible Investment (PRI).

10. The Clean Energy Finance and Investment Authority (CEFIA), Connecticut's green bank, played in a key role in a recent case of securitisation of commercial energy efficiency loan (CEFIA, 2014). The project bond initiative led by EIB is also designed to enable eligible infrastructure projects promoters to attract additional private finance from institutional investors. (See http://srmnetwork.com/wp-content/uploads/Press_Release_C-PACE_Sell-Down_Final_05-19-14.pdf, www.eib.org/products/project-bonds/).

11. Through the Solar Lease II programme, Connecticut's green investment bank aggregated solar leases. A private insurance company was attracted by the scale provided by the programme and has created a new product to provide insurance and warranties for solar leases. In addition, new sources of non-bank investment have been attracted by the aggregated pool of residential solar loans. Mosaic, a solar finance "crowdsourcing" company will provide USD 5 million in "crowdsourced" loans (Business Wire, 2014).

12. Standardisation and co-operation could, on the other hand, erode the first mover premium which may be reaped by investors building expertise in new areas.

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Chapter 5

Mobilising institutional investment in sustainable energy: Recommendations for policy makers

Building on findings from previous OECD reports and conclusions from the preceding chapters, this chapter proposes nine key policy recommendations for governments to address barriers and to facilitate institutional investors' investment in sustainable energy infrastructure. These recommendations are presented in abridged form and Annex 5.A1 provides the foundation for this list with a comprehensive discussion of policy recommendations, annotated and referenced against existing OECD policy guidance and G20 recommendations. Finally, the chapter proposes a map aligning the barriers with the relevant recommendations for government to consider in their efforts to ameliorate or overcome these barriers.

What are the key actions for governments?

To limit climate risks, governments will need to focus attention on the emissions footprint of proposed infrastructure decisions and ensure that the investment environment is one that will enable the allocation of capital to low emission options. Choices made today about the types, features and location of long-lived infrastructure will determine the extent and impact of climate change and the vulnerability or resilience of societies to it. According to the IEA (2012), four-fifths of the total energy-related CO_2 emissions permitted to 2035 in their "450 Scenario", which is consistent with the 2°C emissions path, are already locked-in by existing capital stock, including power stations, buildings and factories. Without further action by 2017, the lock-in would be complete. Given the long lifetime of CO_2 in the atmosphere, stabilising concentrations of greenhouse gasses would then require the costly retirement of infrastructure prior to the end of its economic life.

Governments have a central role to play in mobilising capital through implementing reform agendas that deliver "investment-grade policies" (Hamilton, 2009). In most countries, climate and investment policies have to date functioned quite separately and sometimes at cross-purposes, preventing or slowing investment in sustainable energy infrastructure. Integrating climate and investment policies can help different policy communities work together to achieve the common goal of achieving a low carbon-and climate-resilient (LCR) economy and greener growth.

In view of the diverse ways that policies in different domains create barriers to institutional investment in sustainable energy infrastructure, governments are recognising the need to understand what other policy initiatives are needed to reinforce and support efforts to scale up investment. For energy systems, this implies a more systematic and holistic analysis of the range of policy interventions that are required to undertake this challenge.

A number of efforts are underway, including in the G20 and through the G20/OECD Task Force on Long-Term Investment, to identify approaches for governments to remove barriers to greater infrastructure investment by institutional investors and to address infrastructure funding gaps (G20/OECD, 2014a and 2014b; G20/OECD, 2013; G20/OECD, 2012). Other OECD projects have focused on the challenge of meeting low-carbon climate-resilient infrastructure investment needs, including sustainable energy investments (e.g. Corfee-Morlot et al., 2012, OECD, 2013). These projects, including previous analysis on institutional investors and green infrastructure investment, have aimed to help policy makers create and improve domestic enabling conditions to shift and scale-up private sector investments and financing. These efforts have identified many elements that together provide a more complete view of a domestic enabling environment for sustainable energy infrastructure investments. These interdisciplinary efforts (see Table 5.A1.1) and their associated policy conclusions and recommendations inform this report's recommendations for governments.

A special emphasis is placed on the policy recommendations derived from the G20/OECD High-Level Principles of Long-Term Investment Financing by Institutional Investors (G20/OECD, 2013) and related G20/OECD work including the ongoing work to develop effective approaches to implementing the Principles (G20/OECD, 2014a and 2014b) and previous analysis on the related topic of pension fund financing for green infrastructure (G20/OECD, 2012).

This report proposes nine key policy recommendations for governments to address barriers and to facilitate institutional investors' investment in sustainable energy infrastructure. These recommendations are presented below in abridged form. Annex 5.A1

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; unbundle vertically integrated network operators; establish a wholesale electricity market; and create a level playing field between independent power producers (IPPs) of sustainable energy and incumbent state-owned enterprises (SOEs); and *c)* 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 policies retrospectively; address unintended consequences of policies that impede the mobilisation of institutional investment (e.g. "unbundling" regulation that forces investors to choose between owning transmission or generating assets); 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.
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 CO_2 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 facilitating 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 case for passing or amending legislation allowing for sustainable energy infrastructure to be included in existing vehicles that appeal to institutional investors (e.g. covered bonds, Master Limited Partnerships and Real Estate Investment Trusts).
6. **Facilitate the development and application 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, 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). 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-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.
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, risk mitigants and transaction enablers, and provide technical advice and project preparation and selection.

While the private sector has a major role[1] to play in addressing the barriers presented and discussed in Chapter 2, policy makers have an important role to play in harnessing the opportunities and overcoming the challenges of institutional investor involvement in sustainable energy infrastructure. These policy conclusions address the role of governments. To conclude, Table 5.1 proposes a map aligning the barriers (discussed in Chapter 2) with the relevant recommendations (drawn from Annex 5.A1) for government to consider in their efforts to ameliorate or overcome these barriers.

Table 5.1. **Barriers to institutional investment in sustainable energy infrastructure and recommendations for government**

Barriers			Recommendations
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 > USD 25-USD 50 bn in AUM and dealflow to maintain costly direct investing team with expertise. e. Min USD 100-200 m deal "ticket" size; expensive and time-consuming due diligence; higher transaction costs.	a. 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. Align long-term interests of institutional investors, asset managers, companies and shareholders, thereby incentivising the latter to become more long-term engaged investors. b. Review financial and prudential regulations to ensure that they are compatible with the goals of financing for infrastructure and continue to monitor the possible effects of regulatory reforms on the supply of long-term financing. Facilitate the development of liquid markets for financing instruments and funds and develop a sustainable energy project exchange network which provides a standardised, consistent marketplace for large scale projects. c. Strengthen competition policy through designing open and transparent procurement processes. Publish an infrastructure roadmap and pipeline. d. Consider initiatives and platforms to pool institutional investor assets and transaction enablers such as securitisation. e. See c) and d)
	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.	a. Ensure a stable, transparent and integrated "investment-grade" policy environment. b. See a) c. Review financial and prudential regulations to ensure that they are compatible with the goals of financing for infrastructure and continue to monitor the possible effects of regulatory reforms on the supply of long-term financing. d. See c)
	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.	a. 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. b. 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 (e.g. to allow banks to offload operating projects to institutional investors and recycle their capital). c. Promote efforts to improve data on performance, risks and costs of sustainable energy investments across available channels. 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. d. Support the development of a sustainable energy project exchange network which provides a pipeline and marketplace for investors, improves co-ordination among participants, offers technical advice to local governments to improve identification, analysis, procurement and execution of public-private partnerships and other financing options.[a]

Table 5.1. **Barriers to institutional investment in sustainable energy infrastructure and recommendations for government** *(continued)*

Barriers			Recommendations
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.	a. Put an explicit price on carbon through carbon taxes and emissions trading systems. Identify other cost-effective policy instruments that put an implicit price on carbon. Phase out or reform fossil fuel subsidies and support while addressing potential adverse impacts of subsidies reform. b. 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 while lowering the cost of capital across stages of the project lifecycle. c. Provide an electricity market context that assures a reasonable and predictable return for investors in sustainable energy and associated enabling infrastructure and promote well-designed and time-bound sustainable energy support policies when needed. Tackle regulatory and market rigidities that favour unabated fossil fuel incumbency in the electricity sector and which undermine demand-side options that could empower consumers to choose clean energy. Promote the use of well-designed Power Purchase Agreements or similar measures that achieve cash flow characteristics desired by institutional investors, i.e. stable, long-term cash flows linked to inflation. d. See a)
	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).	a. By better integrating climate and other environmental policy goals into investment policy frameworks and infrastructure planning, establish Green Investment Policy Frameworks in co-ordination with institutional investors, which provide investors with clear and long-term visibility, predictability and incentives. This helps provide the risk-return profile and confidence in future regulatory stability needed for investors to invest in long-term assets. Ensure that support policies are of adequate duration and tied to a technology's level of maturity. b. Analyse, determine and review policy-related barriers to institutional investment and fix unintended consequences of existing policies or issues arising from unrelated policy priorities that impact on the goal of mobilising institutional investment. • Fixes should evaluate the trade-offs between other policy priorities and the benefits of increased institutional investment. Fixes could include, inter alia, regulatory reform, carve-outs (exemptions) for institutional investment or structuring specific policy incentives designed to encourage institutional investment. Review financial and prudential regulations to ensure that they are compatible with the goals of financing for sustainable energy and continue to monitor the possible effects of regulatory reforms on the supply of long-term financing. • Ensure that any restrictions on long-term investment in sustainable energy infrastructure by institutional investors are consistent with diversification and financial regulation objectives. Review restrictions regularly and, where appropriate, ease them subject to necessary safeguards (see Annex 5.A1) being in place, such as strong governance and risk management mechanisms, effective supervision, and appropriate diversification. • Promote the use of well-designed Power Purchase Agreements or similar measures that achieve cash flow characteristics desired by institutional investors, i.e. stable, long-term cash flows linked to inflation.

Table 5.1. **Barriers to institutional investment in sustainable energy infrastructure and recommendations for government** *(continued)*

Barriers		Recommendations
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.	a. Evaluate the case for establishing a "code for responsible investing" which gives institutional investors guidance on how they may execute investment and risk analysis and conduct investment activities to adequately take into account environmental and social considerations, and exercise ownership rights so as to promote sound governance. b. The governing body of an institutional investor should ensure that the institution can properly identify, measure, monitor, and manage the risks associated with long-term assets as well as any long-term risks – including environmental, social and governance (ESG) risks - that may affect their portfolios. The risks associated with long-term investments should also be carefully assessed, including climate and other environmental risks, and exposure to potential future climate regulation. c. Where appropriate (see Annex 5.A1), institutional investors should disclose with sufficient granularity information on the extent to which their investment strategies are in line with their investment horizon and how they address long-term risks associated with climate change.
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.	a. Create stakeholder initiatives to design cost-effective tools to better hedge against technology and volumetric risk. b. Strengthen formal requirements to provide information on investments by institutional investors in sustainable energy, following internationally agreed definitions. This would allow for future monitoring on an international basis. This is necessary for institutional investors themselves to have the necessary data to analyse the performance of these investments and the confidence to then make allocations. It is also necessary for policy makers to be able to understand and monitor such allocations in order to be able to make appropriate policy responses. • Encourage institutional investors to report their recent allocation to and performance of different long-term assets following standardised classifications and methods, while ensuring the confidentiality of any market-sensitive or proprietary information. • Support investor led initiatives such as the Low Carbon Investment (LCI) Registry, a global public online database of low carbon investments made by institutional investors.
2.5 Competition for capital	a. Competition with traditional infrastructure assets and with transmission and distribution infrastructure.	a. No recommendation for government.
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.	a. 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).
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.	a. Create or support existing platforms for dialogue between institutional investors, the financial industry and the public sector to understand the barriers and opportunities to investment in sustainable energy projects.

Table 5.1. **Barriers to institutional investment in sustainable energy infrastructure and recommendations for government** *(continued)*

Barriers			Recommendations
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.	a. No recommendation for government. b. No recommendation for government. c. Establish a national infrastructure strategy and road map with project pipeline. Support regulatory reforms which impact electric utility business models to accelerate deployment of sustainable energy sources and new financing models such as YieldCos.
	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.	a. Establish a national infrastructure strategy and road map with project pipeline. Different levels of government can issue, and support the development of appropriate long-term instruments in line with debt management and capital market development objectives. Such instruments underpin the development of long-dated private sector securities markets and can support asset-liability management by institutional investors and complement long-term investment portfolios. Green bonds and YieldCos are examples of instruments and funds that have the potential to engage institutional investors at scale. b. Support the development of markets for instruments or funds with appropriate risk-return profiles for institutional investors. Such financing options should have an investment horizon in line with those of the underlying projects, should be tailored to investor risk profiles across the project lifecycle, and should be developed in close co-operation with institutional investors. c. Establish the necessary regulatory framework for pooled funds, vehicles and securities channelling financing for long-term investment in a sound and sustainable manner. • Support the development, rigour and adoption of emerging certification standards for green bonds such as the Climate Bond Standard and Certification Scheme and voluntary issuances guidelines such as the Green Bonds Principles. Rigorous standards, guidelines and procedures for verification can allow for straightforward certification and issuance of bond instruments that contribute to a low carbon economy leading to increased market liquidity, comparability and demand from institutional investors. Additionally, they can help prevent risk of so-called "greenwashing" whereby proceeds from bonds issued do not actually contribute to the intended projects or corporate activities.
	3.3 Restricted access to existing vehicles (Covered Bonds, MLPs and REITs)	a. Current national legislation does not enable sustainable energy to qualify for these vehicles.	a. Evaluate the case for passing or amending legislation allowing for sustainable energy infrastructure to be included in existing liquid vehicles that appeal to institutional investors.
	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.	a. Support channels for securitisation of sustainable energy debt to pool projects using a prudent and judicious approach (e.g. supporting efforts to standardise contracts and project evaluation structures). b. Create aggregation or warehousing facilities (e.g. via a Green Investment Bank). c. Support channels for securitisation prudently and judiciously.

Table 5.1. **Barriers to institutional investment in sustainable energy infrastructure and recommendations for government** *(continued)*

Barriers		Recommendations
3.5 Credit and ratings issues	a. Historical lack of ratings data, expensive process. b. Absence of monoline insurers since GFC.	a. Support collection of ratings data and efforts to create "mock" securitisation ratings processes. b. 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 including monoline insurance and credit enhancement.

Note: a. An example of this type of exchange at a regional level is the West Coast Infrastructure Exchange (WCX), comprising California, Oregon, Washington, and British Columbia (see http://westcoastx.com/).

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).

Note

1. While it is beyond the scope of this report to describe all the research efforts and recommendations being provided by the private sector and academia, governments should consider the work done on this topic by, inter alia, Clark and Monk (2013a,b), Global Investor Coalition (2013), B20 (2014), Climate Bonds Initiative (2014), Fulton and Capalino (2014), Nelson (2014) and WEF (2014).

Annex 5.A1

Background to the policy recommendations

The recommendations derive primarily from lessons learned from OECD case studies of institutional investment in green infrastructure (Kaminker et al., 2013), which provided confirmation for a number of the OECD's previous policy recommendations to encourage green investments by institutional investors. For example, the note drafted for the G20 on *Pension Fund Financing for Green Infrastructure and Initiatives* (G20/OECD, 2012) offered recommendations to policy makers which can again be adapted based on the new analysis contained within this report.

From a much broader perspective, at the G20 Leaders Summit in St Petersburg in September 2013, G20 Leaders endorsed the High-Level Principles on Long-Term Investment Financing by Institutional Investors (G20/OECD, 2013), thereby recognising the importance of establishing conditions that could promote the role of institutional investors as sources of long-term investment financing, including for sustainable energy infrastructure. At the same time, G20 Leaders asked their Finance Ministers and Central Bank Governors to identify approaches to effectively implement the Principles, working with the OECD and other interested participants by the next Leaders' Summit, in November 2014 in Brisbane, Australia (G20/OECD, 2014a and 2014b).[1] This report's recommendations are consistent with this broader initiative and draw on some of the analysis and principles of most relevance.

Looking specifically at investment policy for infrastructure, OECD Investment Policy Reviews (IPRs) are an example of work that uses an investment policy lens to assess policy frameworks for sustainable energy investment. The OECD has undertaken IPRs based on the OECD *Policy Framework for Investment* in nearly 30 countries (OECD, 2006) and aim to help host governments assess and reform their investment regimes. In the recent past, they have increasingly focused on green investment at the request of partner countries, and notably on sustainable energy investment.[2]

Drilling down to the sub-category of sustainable energy within infrastructure investment, and building on the OECD *Policy Framework for Investment* (OECD, 2006), on the paper "Towards a Green Investment Policy Framework" (Corfee-Morlot et al., 2012), and on other OECD guidance and policy instruments; the OECD *Policy Guidance for Investment in Clean Energy Infrastructure* is a non-prescriptive tool to help governments – particularly in developing and emerging countries – identify ways to mobilise private investment in clean energy infrastructure (OECD, 2013).[3] The *Policy Guidance* benefited from substantial contributions by the World Bank and UNDP and was annexed to the Communiqué of G20 Finance Ministers and Central Bank Governors at their meeting of 10-11 October 2013. It goes into greater depth on the "investment policy" element of the Green Investment Policy Framework, focusing on energy infrastructure questions and raising issues for policy makers' consideration in key areas relevant to institutional investment.

Another consideration for the development of a robust domestic framework for sustainable energy investment is the prevalence and effects of international trade and investment restrictions. In the post-crisis recovery context, the perceived potential of sustainable energy to promote growth and employment has led several governments to design policies aimed at supporting domestic manufacturers. The OECD report *Overcoming Barriers to International Investment in Clean Energy* aims to take stock of policy measures that could hamper international trade and investment in sustainable energy, with a focus on solar PV and wind energy. These measures include local content requirements, preferential access to financing and technical barriers to trade (OECD, 2015a, forthcoming). The report will assess possible impacts of such measures across the solar PV and wind energy value chains, and discuss policy options.

Cutting through all of these issues, another OECD case study examines the role of Public Finance Institutions (such as the European Investment Bank, KfW and others) in financing the transition to a low-carbon, climate-resilient economy in OECD countries (Cochran et al., 2014). And finally, Eklin, et al. (2015, forthcoming) reviews how "green investment banks" (GIBs) have sought to mobilise capital from institutional investors.

Table 5.A1.1. **OECD and G20 initiatives on long-term investors and infrastructure investment, and contributions to policy recommendations to facilitate investment in sustainable energy infrastructure**

Initiative or report	Description	Contributions
Case studies of Institutional Investment in Green Infrastructure	• The report examines the channels through which institutional investors can access green infrastructure, assesses the extent to which this is currently happening, and identifies the barriers to scaling up these investment flows. • The report examines positive factors that facilitated these deals, how barriers were overcome and draws out broader lessons for governments on the policy settings which may support investment in green infrastructure by institutional investors.	• The report provides policy guidance on a number of key actions which governments can take to address the barriers and facilitate institutional investors' investment in green infrastructure projects. • The report was submitted and annexed to the G20 Finance Ministers and Central Governors' meeting on 10-11 October 2013.
G20/OECD High-Level Principles on Long-Term Investment Financing by Institutional Investors	• The principles address regulatory and institutional impediments to long-term investment by institutional investors and aim to avoid interventions that may distort the proper functioning of markets.	• The principles are intended to help governments facilitate and promote long-term investment by institutional investors, particularly among institutions such as pension funds, insurers and sovereign wealth funds, that typically have long duration liabilities and consequently can consider investments over a long period.
OECD Policy Guidance for Investment in Clean Energy Infrastructure	• The policy guidance raises issues in a non-prescriptive manner for policymakers' consideration in the areas of investment policy; investment promotion and facilitation; and competition, financial market and public governance policies.	• The policy guidance is intended to assist policymakers in developing and emerging economies to address investment barriers and identify ways to mobilise private investment in renewable energy and energy efficiency in the electricity sector. • The report was submitted and annexed to the G20 Finance Ministers and Central Governors' meeting on 10-11 October 2013.

Green Investment Policy Framework	• The report develops elements of a Green Investment Policy Framework to help governments create and improve domestic enabling conditions to shift and scale-up private sector investments in green infrastructure.	• The policy framework can guide domestic reforms to steer use of limited public funds while also enabling and incentivising private investment to simultaneously deliver climate change and local development goals.
Overcoming Barriers to International Investment in Clean Energy	• The report takes stock of policy measures that may distort international competition and hamper international investment in solar photovoltaic (PV) and wind energy value chains, with a focus on local content requirements.	• The report provides policymakers with evidence-based analysis to guide their decisions, with the view of optimising policy support to green energy and levelling the playing field for international investment in green energy.
Public Finance Institutions in Financing the Low Carbon Transition	• The report analyses the role of five public finance institutions (PFIs) in fostering the low-carbon energy transition through domestic climate finance activities.	• The study provides policymakers with analysis on key tools and instruments currently used by PFIs to mobilise private sector investment, principally in OECD countries, in three areas of activity: 1. facilitating access to long-term financing, 2. reducing project and financial risks, and 3. filling the capacity gap.
Green investment banks (Green Investment Financing Forum)	• The green investment bank initiative takes stock of green investment banks, and examine what they do, the reasons for their establishment, what they have in common, and how they vary.	• The green investment bank initiative promotes dialogue and enhance understanding a wide range of countries and institutions interested in mobilising private investment financing for low-carbon and climate-resilient infrastructure.

In light of this wide body of existing and ongoing OECD work, this report presented nine key policy conclusions for governments to address barriers and to facilitate institutional investors' investment in sustainable energy infrastructure. These nine policy recommendations are grouped in 5 categories and referenced according to their roots in OECD policy guidance in the next section.

A) Preconditions for Institutional Investment[4]

Before even considering sustainable energy as a subset of infrastructure investment, investors will only be willing to commit their funds when they have some assurance that financial markets and institutions are safe and sound, and operate according to rules and procedures that are fair, transparent, and free from conflicts of interest and other agency problems (G20/OECD, 2014a). A separate precondition relates to the formation of institutional savings that can be invested in the first place.

1. Establish preconditions for institutional investment and favourable framework conditions for long-term investment financing[5]

- Framework conditions include a stable macroeconomic environment, responsible fiscal management, a strong financial sector, and a well-developed system of channelling public and private savings to longer-term investments (see G20/OECD, 2013, p. 6).

- A favourable business and investment climate and the consistent and effective enforcement of the rule of law are essential for long-term investment. Governments should create predictable, stable, transparent, fair and reliable business regulation and supervision and administrative and procurement procedures. They should also promote an effective framework for fair competition and sound corporate governance, and clear and reliable creditor rights and insolvency regimes (see G20/OECD, 2013, p. 6). The investment regime underpinning infrastructure investment should include, inter alia, sound measures for access to land and protection against expropriation, contract renegotiation, settlement of disputes, and tax policy (see OECD, 2015b, forthcoming).
- Steps can be taken by governments to better align long-term interests of institutional investors, asset managers, companies and shareholders, thereby incentivising the latter (e.g. through performance management) to become more long-term engaged investors (see G20/OECD, 2013, p. 7).
- Licensed administrators of institutional investors have a fiduciary duty to members, beneficiaries and other relevant stakeholders to act in their best interests. This duty supports the adoption of a responsible investment approach to deploying capital into markets that will earn adequate risk-adjusted returns suitable for the institution's specific member profile, liquidity needs and liabilities. The implementation of this fiduciary duty can also be supported by appropriate transparency and reporting on financial indicators as well as on environmental, social and governance (ESG) relevant topics (see G20/OECD, 2014a).
- Governments may establish a "code for responsible investing" which gives institutional investors guidance on how they may execute investment analysis and conduct investment activities, and exercise ownership rights so as to promote sound governance. As such, the "code" may contain sustainability considerations in addition to many other issues. Such a code may serve as a minimum reference point for the institutional investor and should not be deemed to preclude higher standards of behaviour. Governments may also assign different definitions of fiduciary duties to different categories of institutional investors (see G20/OECD, 2014a).
- The governing body of an institutional investor should ensure that the institution can properly identify, measure, monitor, and manage the risks associated with long-term assets as well as any long-term risks – including environmental, social and governance risks – that may affect their portfolios (see G20/OECD, 2013, p. 8). The risks associated with long-term investments should also be carefully assessed, including climate and other environmental risks, and exposure to potential future climate regulation (see G20/OECD, 2013, p. 4).
- Where appropriate, institutional investors should disclose with sufficient granularity information on the extent to which their investment strategies are in line with their investment horizon and how they address long-term risks (see G20/OECD, 2013, p. 10).

B) Investment-grade Policy Environment

The lack of a stable regulatory environment discourages long-term investments. In the case of sustainable energy investment, rapid (and even retroactive) changes to support policies are particularly damaging to investor confidence, especially when they are undertaken without advance notice to allow investors and businesses time to adjust. Existing

incentives often provide limited or no pricing of carbon (i.e. the cost of environmental externalities are poorly reflected or not reflected in prices), subsidise fossil fuel use, or do both. The OECD has developed elements of a "green investment policy framework" to help governments create and improve domestic enabling conditions to shift and scale-up private sector investments in green infrastructure including from institutional investors (see Corfee-Morlot et al., 2012).

2. Ensure a stable, transparent and integrated "investment-grade" policy environment addressing key barriers to investment by institutional investors.

- This policy environment may be developed in co-ordination with institutional investors, which provides investors with clear and long-term visibility, predictability and incentives. This helps provide the risk-return profile and confidence in future regulatory stability needed for investors to invest in long-term assets.
- Governments may ensure that policies are of adequate duration, tied to a technology's level of maturity, and matched to the geography and diversity of markets and institutional investors (see Kalamova, et al., 2011).
- Though prudential regulation is important for protecting pension fund members, policy holders and beneficiaries, it sometimes may have unintended consequences, creating barriers to long-term investments by institutional investors which may need to be addressed.
- Governments should review financial regulations to ensure that they do not unduly hamper financing for sustainable energy (see UNEP, 2014) and they should continue to monitor the possible effects of regulatory reforms on the supply of long-term financing (see FSB, 2013).
- Where applied, restrictions on long-term investment in sustainable energy infrastructure by institutional investors should be consistent with diversification and financial regulation objectives. They should be reviewed regularly and, where appropriate, they should be eased subject to necessary safeguards being in place, such as strong governance and risk management mechanisms, effective supervision, and appropriate diversification (see G20/OECD, 2013, p. 9).
- The use of well-designed Power Purchase Agreements or similar measures that achieve cash flow characteristics desired by institutional investors are particularly important and may be considered by governments (IEA, 2014).

3. Improve risk-return profiles of sustainable energy projects by addressing market failures while improving electricity market design.

- Market failures can create risk-return investment profiles that favour polluting or environmentally damaging infrastructure projects over sustainable energy investments.
- Phasing-out inefficient fossil fuel subsidies and implementing regulations that impose a price on environmentally damaging activities (implicitly through standard setting, or explicitly through carbon taxation or emissions trading while providing a clear policy signal of a rising cost for CO_2 emissions over time) are important elements of improving the risk-return profile of sustainable energy investments (OECD, 2013b).

- Provide an electricity market context that assures a reasonable and predictable return for investors in sustainable energy and associated enabling infrastructure by promoting well-designed and time-bound sustainable energy support policies when needed and the use of contracts such as Power Purchase Agreements which provide institutional investors with revenue stability and certainty(IEA, 2014). Predictability of government programmes is necessary if investors are to initiate a project in clean energy; however, predictability should not be mistaken for permanence. It is important to provide "sunset clauses" for policies which support investment directly, since over time the financial markets will price risk efficiently and learning benefits will be exhausted (Kalamova et al., 2011).

4. Establish a national infrastructure strategy and road map with project pipeline.

- Develop a sustainable energy plan within a national infrastructure strategy with clear break points where further decisions will need to be made on the basis of technological and other developments, and create a credible sustainable energy road map and 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.
- Governments may develop an infrastructure programme tied to a national strategic vision, which may include a comprehensive infrastructure development strategy based on clearly established guiding principles.
- Strategies and road maps would give confidence to investors in government commitments to the sector and demonstrate that a credible pipeline of investable projects will be forthcoming. This will reassure investors that it is worth building up their investment capability and constructing mandates for investment. Governments may establish, publish and deliver credible national infrastructure pipelines that have been rigorously assessed and prioritised by independent infrastructure authorities, and which take full advantage of private sector finance and expertise (see B20, 2014, p. 3).
- Where appropriate, governments should provide opportunities for private sector participation in sustainable energy projects via, for instance, public procurement and public-private partnerships. Investment opportunities should enable the different parties to earn returns commensurate to the risks they take. Proper planning and effective management of such initiatives is recommended in order to ensure a regular, coherent pipeline of suitable projects. These initiatives should be supported by a transparent, sound and predictable regulatory framework and subject to effective monitoring and accountability (see G20/OECD, 2013, p. 7).

C) Investment Channels

5. Facilitate the development of appropriate green financing instruments and funds:

- Governments should consider issuing appropriate long-term instruments in line with their debt management and capital market development objectives. Such instruments underpin the development of long-dated private sector securities markets and can support asset-liability management by institutional investors and

complement long-term investment portfolios (see G20/OECD, 2013, p. 7). Green bonds as a form of long-term instrument have the potential to engage institutional investors at scale.

- Governments can support the development of markets for instruments or funds with appropriate risk-return profiles for institutional investors.
- Governments should establish the necessary regulatory framework for pooled vehicles and securities channelling financing for long-term investment in a sound and sustainable manner (see G20/OECD, 2013, p. 9). This could apply as well to sustainable energy funds and securities described in this report.
- In markets with limited participation by institutional investors, governments, national development banks, and multilateral development agencies should consider the need for establishing and promoting pooled funds and vehicles for long-term investment, and supporting other instruments for long-term investment such as sustainable energy project bonds and securitised assets. Such financing options should have an investment horizon in line with those of the underlying projects, should be tailored to investor risk profiles across the project lifecycle, and should be developed in close co-operation with institutional investors (see G20/OECD, 2013, p. 9).
- Evaluate the case for passing or amending legislation allowing for sustainable energy infrastructure to be included in existing liquid vehicles that appeal to institutional investors (e.g. covered bonds, Master Limited Partnerships and Real Estate Investment Trusts).

D) Risk Mitigants

The expected return and risk of investment projects is a core consideration in the effort to attract private financing. Government intervention may be needed in some circumstances,[6] where the rate of return may be insufficient to compensate private sector investors for the perceived level and/or character of risk or to address key market failures that significantly impede the supply of funds (G20/OECD, 2014a).

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

- Governments may consider providing risk mitigants to long-term sustainable energy investments projects where it would result in more appropriate allocation of risks and their associated returns. Such risk mitigants may include credit and revenue guarantees, first-loss provisions, cornerstone stakes, public subsidies, and the provision of bridge financing via direct loans (see G20/OECD, 2013, p. 9).
- Governments may use public financing mechanisms to provide cover for risks that are new to investors and cannot be covered in existing markets. Such mechanisms may include loan guarantees, insurance-related options, and other credit enhancement tools to improve flow of financing to projects.
- Governments may use debt instruments such as loan and securities to cover the risks in both construction and post-construction phases of sustainable energy projects, while investment guarantees are provided during the post-construction period.

- Public intervention in sustainable energy projects – selected in light of socio-economic and environmental impact assessments – should be decided on the basis of identified market failures, should avoid crowding-out private investments, and should be selected by carrying out appropriate cost-benefit analysis of such interventions and ensuring that any public support is appropriately priced and is subject to fiscal considerations (see G20/OECD, 2013, p. 9).
- Governments may develop a standard methodology for allocating risks – a set of "guiding principles" to determine the level of risk allocation optimal to both deliver value for money and provide investors with an appropriate risk-return (see WEF, 2014, p. 4).

E) Transaction Enablers

7. Reduce the transaction costs associated with sustainable energy investment.

- Collaborative actions and resource sharing amongst institutional investors and with other financial institutions should be encouraged and supported in order to facilitate the exchange of expertise, ensure the effective exercise of ownership rights and to allow sufficient scale and diversification to be reached for investment in large, long-term sustainable energy projects. This will also allow for capacity sharing and provide the scale necessary for smaller funds to participate in these projects.
- 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).
- Governments can consider creating a sustainable energy project exchange network which provides a standardised, consistent pipeline and marketplace for investors, improves co-ordination among participants, offers technical advice to local governments to improve identification, analysis, procurement and execution of public-private partnerships and other financing options.[7]

8. Promote market transparency and standardisation, and improve data

- Governments may create or support existing platforms for dialogue between institutional investors, the financial industry and the public sector to understand the barriers and opportunities to investment in sustainable energy projects. Institutional investors require support and track records to invest in new asset areas. Learning from leading investors and the experience of peers could assist in building their confidence and the capabilities of other institutional investor service providers (Kaminker et al., 2013).
- Governments may consider conducting "market consultation" with potential investors. This interactive process is undertaken early in order to generate feedback on a project, learn more about investor preferences and determine refinements needed prior to the tender process. Market sounding must be carefully managed to generate useful information and prevent probity issues (WEF, 2014).
- Governments could, where appropriate and needed, strengthen formal requirements to provide information on investments by institutional investors in sustainable energy, following internationally agreed definitions. This would allow for future

monitoring on an international basis. This is necessary for institutional investors themselves to have the necessary data to analyse the performance of these investments and the confidence to then make allocations. It is also necessary for policy makers to be able to understand and monitor such allocations in order to be able to make appropriate policy responses.

- Institutional investors should be encouraged to report their recent allocation to and performance of different long-term assets following standardised classifications and methods, while ensuring the confidentiality of any market-sensitive or proprietary information. The reporting should have an appropriate frequency and should include performance measures calculated over sufficiently long periods. Such information should be at least available for members, policyholders and other beneficiaries as well as supervisory authorities. To fulfil those reporting requirements, adequate existing reporting sources should be used as far as possible (see G20/OECD, 2013, p. 9).
- Governments may also support investor led initiatives such as the Low Carbon Investment (LCI) Registry, a global public online database of low carbon investments made by institutional investors.
- Governments may support the development and adoption of emerging certification standards for green bonds such as the Climate Bond Standard and Certification Scheme and voluntary guidelines such as the Green Bonds Principles. Rigorous standards and guidelines can allow for straightforward certification and issuance of bond instruments that contribute to a low carbon economy leading to increase market liquidity, comparability and demand from institutional investors. Additionally, they can help prevent risk of so-called "greenwashing" whereby proceeds from bonds issued do not actually contribute to the intended projects or corporate activities.
- Governments and intergovernmental institutions may organise domestic and international summits and events with the key objective of exchanging ideas and experiences among institutional investors in order to develop best practices for sustainable energy investment.

F) New and Existing Public Finance Institutions

9. Consider the case for establishing a special-purpose, domestically-focused "green investment bank" (GIB) or refocusing activities of existing public financial institutions

- In recent years, at least a dozen special-purpose public "green investment banks" GIBs have been established. They are domestically-focused public institutions that seek to use limited public capital to leverage or "crowd-in" private capital, including from institutional investors, for LCR infrastructure investment (see Eklin et al., 2015, forthcoming).
- GIBs can facilitate the development of financing instruments and funds, risk mitigants and transaction enablers, and provide technical advice and project preparation and selection.
- Governments may consider the case for establishing a GIB, which can be a useful entity for governments to mobilise domestic private capital, including from institutional investors. As they are being used in different ways in different country settings, their varying operational models and focuses suggest a potential for their adaptation and replication at the national and sub-national level (G20/OECD, 2014b, p.18).

- To consider the case for establishing a GIB, governments should conduct a market assessment exercise to reveal market barriers, financing gaps and potential offerings and modalities.
- GIBs are making their place within a broader ecosystem of domestic and international public institutions engaged in catalysing private and institutional investment in LCR infrastructure. Such institutions include broader-scoped international financial institutions (including multilateral development banks and bilateral development banks), climate investment funds, national development banks and other public finance institutions. As such, governments may examine the roles played by those institutions and whether mobilising capital from institutional investors for sustainable energy investment has been sufficiently mainstreamed.

Notes

1. In order to develop implementation approaches for the Principles, the G20/OECD Task Force on Institutional Investors and Long-Term Financing decided to prioritise those Principles which members viewed as most important to focus on in the first instance to enable the Task Force, the OECD and G20 membership and other interested participants to utilise their resources effectively. The Task Force decided in this context to focus its work initially on a few of the principles that relate most closely to G20 priorities for investment. These reports were delivered to and welcomed by the September G20 Finance Ministers and Central Bank Governors Meeting, to be further reported to the subsequent November Leaders Summit.
2. The OECD is working on updating the PFI in the course of 2014, for completion by the MCM 2015, to take into account new policy developments since its inception in 2006, including considerations for governments to promote green investment.
3. The Policy Guidance was developed by the OECD Investment and Environment Policy Committees, with contributions from other policy communities.
4. Note that this chapter draws from the G20/OECD High-Level Principles on Long-Term Investment Financing by Institutional Investors (G20/OECD, 2013) and the Report on Effective Implementation Approaches to High-Level Principles (G20/OECD, 2014a). These G20/OECD Principles are designed to assist OECD, G20 and any other interested jurisdictions to facilitate and promote long-term investment by institutional investors. The High-Level Principles are intended to complement and do not substitute for any existing international principles and/or guidelines that may apply to particular categories of investors. Rather, they seek to foster consistency in approaches for long-term investment across different policies and jurisdictions (G20/OECD, 2014a and 2014b).
5. When evaluating policies to promote long-term investment by institutional investors, policymakers should ensure its consistency with the best interest of members, investors, beneficiaries, policyholders and other relevant stakeholders, and consider its wider potential public impact.
6. N.B. The provision of risk mitigation is not universal. Some governments do not offer risk mitigation as a matter of public policy.
7. An example of this type of exchange at a regional level is the West Coast Infrastructure Exchange (WCX), comprising California, Oregon, Washington, and British Columbia (see http://westcoastx.com/).

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Glossary[1]

450 Scenario

A scenario presented in the IEA's *World Energy Outlook* that sets out an energy pathway consistent with the goal of limiting the global increase in temperature to 2°C by limiting concentration of greenhouse gases in the atmosphere to around 450 parts per million of CO_2.

Alpha (α)

A measure of risk-adjusted performance. Some refer to the alpha as the difference between the investment return and the benchmark return. However, this does not properly adjust for risk. More appropriately, an alpha is generated by regressing the security or mutual fund's excess return on the benchmark (for example S&P 500) excess return.

Annuity

A regular periodic payment made by an insurance company to a policyholder for a specified period of time.

Asset-backed security (ABS)

A financial security backed by a loan, lease or receivables against assets other than real estate and mortgages.

Asset and Liability Management (ALM)

The task of managing the funds of a financial institution to accomplish two goals: *1)* to earn an adequate return on funds invested and *2)* to maintain a comfortable surplus of assets beyond liabilities.

Asset liability matching

Process of managing investing, purchasing, and selling activities to ensure that cash is available for meeting the obligations as they fall due.

Bankable

Projects that have sufficient collateral, probability of success, and predictability of future cash flow, to be acceptable to prospective financiers.

Basel III

The third version of the Basel Accords agreed upon by 27 countries on 12 September, 2010. Among the highlights was the increasing of Tier 1 capital from 2% to 4.5% and the addition of a buffer of 2.5%. The assets that qualify for capital were also redefined. The full implementation of the accord is not due until 2023. Basel I is the Agreement concluded among country representatives in 1988 in Basel, Switzerland to develop standardised risk-based capital requirements for banks across countries. The Accord is also known as

1988 Basel Accord and it primarily focused on credit risk and is now viewed as outdated. Basel II is currently in the process of implementation.

Bellweather stock

A stock in a well-known or highly-regarded company in a given sector. The performance of a barometer stock is considered to be an indicator of the performance of its particular sector or industry.

Benchmark

The performance of a predetermined set of securities, used for comparison purposes. Such sets may be based on published indexes or may be customised to suit an investment strategy.

Beta (β)

The measure of an asset's risk in relation to the market (for example, the S&P500) or to an alternative benchmark or factors. Roughly speaking, a security with a beta of 1.5, will have moved, on average, 1.5 times the market return. According to asset pricing theory, beta represents the type of risk, systematic risk, that cannot be diversified away.

Break-even level

A level at which the volume of sales or revenues exactly equals total expenses, therefore there is neither a profit or a loss.

Capital recycling

Providing refinancing once a project is at the operational stage so that early-stage investors have an "exit strategy", allowing them to free up capital to invest in new projects – i.e. to "recycle" their capital.

Churning the portfolio

Trying to buy projects when they are cheap and sell when they are expensive – enhancing returns, but also increasing risk and distorting the underlying cash flows.

Co-investment

A form of direct investing whereby institutional investors partner up with other investors to invest in an asset.

Corporate bond

Debt obligations issued by corporations.

Cost of capital

The cost of funds used for financing a business. Cost of capital depends on the mode of financing used – it refers to the cost of equity if the business is financed solely through equity, or to the cost of debt if it is financed solely through debt. Many companies use a combination of debt and equity to finance their businesses, and for such companies, their overall cost of capital is derived from a weighted average of all capital sources, widely known as the weighted average cost of capital (WACC). Since the cost of capital represents a hurdle rate that a company must overcome before it can generate value, it is extensively

used in the capital budgeting process to determine whether the company should proceed with a project.

Coupon

The contractual interest obligation a bond or debenture issuer covenants to pay to its debtholders.

Covered bonds

Debt securities backed by cash flows from mortgages or public sector loans. Covered bonds employ a "dual recourse structure" where bond investors have a claim over *1)* a "cover pool" of assets, the quality of which is strictly regulated; and *2)* a general unsecured claim against the issuer. This dual recourse structure enables covered bonds to enjoy superior credit ratings and lower funding costs compared with unsecured debt issued by banks. At the same time, because of strict oversight for what can go into the "cover pool," they generally carry less risk than pure asset-backed securities.

Credit enhancement

Reducing the credit or default risk of a debt, thereby improving its credit-worthiness and increasing the overall credit rating

Credit rating

Credit rating refers to an evaluation of individual's or company's ability to repay obligations or its likelihood of not defaulting. If credit rating is downgraded, it would increase the cost of capital due to the extent that the reward for such risky assets would be necessary as risk-premium.

"Crowding-in"

Occurs when public investment increases the marginal productivity of private capital or labour, or reduces the costs that investing firms incur and induces greater private investment than would have occurred otherwise. "

"Crowding-out"

Occurs when a public intervention directly displaces the efforts of the private sector by undertaking projects the private sector would have otherwise done. Crowding out can also occur indirectly if governments use distortionary taxes to fund public investment.

Crowdsourcing

The process of obtaining ideas, content or funding, usually online, from a large group of people. In the context of this report crowdsourcing refers to attracting small unaccredited investors to provide funding for clean energy projects.

Defined benefit

A defined benefit pension plan refers to a type of plan in which certain benefits are guaranteed when you retire.

Deleveraging

The reduction of the ratio of debt in the balance sheet of an economic entity. In this report, deleveraging refers to the attempt to decrease its financial leverage ratio (value of firm's

debt to the total value of the firm). Banks have been lowering their high pre-crisis leverage levels and are preparing for stricter regulatory capital requirements, and in the process have been reducing their lending (Wehinger, 2012).

Diversification

Dividing investment funds among a variety of securities with different risk, reward, and correlation statistics so as to minimise unsystematic risk.

Dividend yield

Annual dividends divided by current stock price or return on a share of a mutual fund held over the past 12 months.

Due diligence

An investigation or audit of a potential investment prior to signing a contract.

Economic infrastructure

Internal facilities of a country that make business activity possible, such as communication, transportation, and distribution networks, financial institutions and markets, and energy supply systems.

Endowment (funds)

Investment funds established for the support of institutions such as colleges, private schools, museums, hospitals, and foundations. The investment income may be used for the operation of the institution and for capital expenditures.

Feed-in tariff (FiT)

A fixed price per kWh of electricity which is paid to the producer by the system operator.

Feed-in premium (FiP)

A premium which is paid to the producer on top of the electricity market price.

Fiduciary duty

The fiduciary concept for institutional owners generically means that the institutions shall serve the interest of the beneficiaries, rather than their own immediate interest. A common and implicit interpretation of this fiduciary duty is that institutions should monitor and engage with investee companies.

Financialisation

The process by which financial institutions, markets, etc., increase in size and influence.

Financing instrument

A financing instrument is a tradable asset of any kind; either cash, evidence of an ownership interest in an entity, or a contractual right to receive or deliver cash or another financing instrument.

Fund

An investment company that invests the funds which are aggregated and pooled from individual investors for a fee. Investment fund gives individual investors access to a wider range of financial products than investors themselves would have been able to access.

Green investment bank

Broadly defined as a public entity established specifically to facilitate and "crowd-in" domestic private low-carbon climate-resilient infrastructure investments through different activities and interventions.

Grid-parity

Grid parity refers to "an energy source can generate electricity at a levelised cost that is less than or equal to the price of purchasing power from the electricity grid".

Headline risk

The risk that a major event or story will spread throughout the media and will negatively impact a company's stock price or reputation.

Illiquid

In the context of investments the term illiquid describes a thinly traded investment such as a stock or bond that is not easily converted into cash. Illiquid securities have higher transactions costs.

Infrastructure fund

Investment fund that is established to invest in infrastructure assets.

Institutional investor

Institutional investors are usually synonymous with "intermediary investors", that is to say, an institution that manages and invests other people's money. The term institutional investor can be used to describe insurance companies, investment funds, pension funds, public pension reserve funds (social security systems), foundations and endowments among others.

IORP II

IORP comprises solvency rules applicable to Institutions for Occupational Retirement Provision. IORP II is widely known as Solvency II for occupational pension funds.

Investment bank

An investment bank traditionally facilitates transactions of all types in the wholesale financial markets (transactions conducted by corporations, businesses, institutional investors, and high net worth individuals) including mergers and acquisitions (the purchase and sale of businesses and their assets), capital raising or "underwriting" (of equity, debt, etc.) on behalf of corporations or their shareholders. They may provide ancillary services such as market making, trading of derivatives, securities, and other financial instruments, investing and lending, asset management, and FICC services (fixed income instruments, currencies, and commodities). This excludes retail brokerage, retail lending, or any other practice that centres on "unaccredited investors".

Investment-grade

In the context of bond ratings, the rating level above which institutional investors have been authorised to invest. Investment-grade bonds are those that are assigned a rating in the top four categories by commercial credit rating companies. S&P classifies investment-grade bonds as BBB or higher, and Moody's classifies Investment-grade bonds as BAA or higher.

Leverage

The use of debt financing, or property of rising or falling at a proportionally greater amount than comparable investments.

Liquidity

In context of a corporation, the ability of the corporation to meet its short-term obligations. In context of securities, a high level of trading activity, allowing buying and selling with minimum price disturbance. Also, a market characterised by the ability to buy and sell with relative ease.

Long-dated liabilities

A section of the balance sheet that lists obligations of the company that become due more than one year into the future.

Market capitalisation

Market capitalisation refers to the total value of all outstanding shares of a company. This is calculated as the number of shares outstanding multiplied by the current market price per share.

Mark to market

The practice of valuing an asset or a liability, using current market prices. "Mark to market" is referred to as "Fair value accounting" and is the practice of updating the value of an asset or a liability to reflect its real market value rather than the initial cost of the asset or liability.

Maturity transformation

The process of converting short-term sources of finance (e.g. deposits from retail savers) into long-term borrowings (e.g. loans, mortgages, etc.).

Mezzanine financing

Mezzanine financing is senior to common shares (equity) (i.e. mezzanine investors receive returns from the investment before equity holders) but junior to secured debt or senior debt. Mezzanine financing normally includes subordinated (i.e. junior) debt or preferred equity (i.e. equity shares that provide dividends before common stock dividends are paid out) and is usually more expensive than senior debt. It can be used as the stage of financing that follows venture capital.

MLP (Master Limited Partnership)

A publicly traded limited partnership that includes one or more partners who have limited liability.

Monoline insurer

Monoline insurers are financial institutions focused solely on insuring bond issuers such as municipal governments against default. Bond issuers buy this insurance to upgrade the credit-worthiness of their bonds, making the overall cost lower by giving confidence that the insured security would be paid in full. The first monolines were set up in the US in the 1970s, covering municipal and corporate bond issues. These insurers suffered when the financial crisis hit, as some lacked sufficient capital to cover their liabilities adequately. Several had their credit ratings reduced, effectively downgrading them to junk status. (Kaminker et al., 2013).

New Policies Scenario

A scenario in the IEA's World Energy Outlook that takes account of broad policy commitments and plans that have been announced by countries, including national pledges to reduce greenhouse-gas emissions and plans to phase out fossil-energy subsidies, even if the measures to implement these commitments have yet to be identified or announced. This broadly serves as the IEA baseline scenario.

On-bill finance (OBF)

OBF allows utility consumers to invest in energy efficiency improvements and repay the funds through additional charges on their utility bill. Under this approach, a third party (such as an energy provider) provides upfront funding for energy efficiency improvements to an investor (e.g. a tenant in a residential or commercial building). The investor pays back the loan via its energy bill. In many cases, repayments are structured in such a way that the monthly energy savings achieved through the investment equal or outweigh the loan repayments. If structured properly, an OBF programme can substantially reduce the cost of and improve access to financing.

Ownership unbundling

Ownership unbundling is one of the core elements of the European Union's Third Energy Package, which is a legislative package for an internal gas and electricity market in the EU. Its purpose is to further open up the gas and electricity markets in the EU. Ownership unbundling is designed to split generation (production of electricity) from transmission (of electricity from electrical generating station via a system to a distribution system operator or to the consumer).

Parametric insurance products

Parametric insurance products are a type of insurance product that pays out when the coverage is triggered by a particular variable, such as the number of inches of rain over a designated time period.

Pledgeable future income

The maximum amount of income that a firm or project can credibly promise to repay to investors.

Private equity fund

A fund which use their own capital or capital raised from investors (or both) to take companies private with the aim of running them better and later taking them public or selling them at a profit.

Private placement debt

A type of debt that is generated when a bond or some other type of security is sold directly to a limited number of investors in a non-public offering.

Project bond

Private debt issued by a project company to finance a specific off-balance-sheet project. Project bonds are an asset-based form of financing.

Prudent person principle

A principle set forth in the Uniform Prudent Investor Act that states that a fiduciary trustee has the legal obligation to invest and manage trust assets as a prudent person would, taking into account, among other factors, general economic conditions, risk, and liquidity requirements in an attempt to create a portfolio or investment strategy with objectives suited to the trust.

Public finance institutions (PFIs)

Publicly created or mandated financial institutions that have often been created to correct for the lack of market-based finance through the provision of missing financial services.

Pure-play

In financial management, "pure-play" entities are focused on only one industry or product.

REITs (Real Estate Investment Trusts)

A corporation or trust that uses the pooled capital of many investors to purchase and manage income property or mortgage loans. REITs invest in real estate or loans secured by real estate and issue shares in such investments. A REIT is similar to a closed-end mutual fund.

Revolving debt

A type of debt that typically has a variable interest rate, an open-ended term and payments that are based on a percentage of the balance.

Ring-fencing

Practice of financially separating a portion of a company's assets or profits without necessarily being operated as a separate unit. Ring-fencing may occur for regulatory, financing or taxation purposes.

Risk-adjusted return

A measure of valuing return on investment calculated in a way that takes into account the risks associated with the investment. Being able to compare a high-risk, potentially high-return investment with a low-risk, lower-return investment helps to answer a key question that confronts every investor: is it worth the risk? There are several ways to calculate risk-adjusted return. Each has its strengths and shortcomings. All require particular data, such as an investment's rate of return, the risk-free return rate for a given period, and a market's performance and its standard deviation. Risk-adjusted returns can apply to individual securities and investment funds and portfolios.

Risk-profile

An assessment of the degree to which an investor is prepared to accept losses at the expense of potential gain.

Securitisation

The process of transforming illiquid financial assets into tradable products.

Special purpose vehicle

Legal entity created to fulfil a specific and well-defined financial or regulatory objectives. For project finance, a SPV may be created to hold the assets associated with a project therefore keeping the investment off the balance sheets of project developers. Within the securitisation framework, an SPV can be a legal entity which may issue securities or other debt instruments, may legally or economically own assets underlying the issue of the securities mentioned above and be financially and legally isolated from the originator.

Solvency II

A directive developed by European Commission for the European insurance industry. It aims to establish a revised set of EU-wide capital requirements and risk management standards that will replace the current solvency requirements. Solvency rules stipulate the minimum amounts of financial resources that insurers and reinsurers must have in order to cover the risks to which they are exposed. The rules also lay down the principles that should guide insurers' overall risk management so that they can better anticipate any adverse events and better handle such situations. The original Solvency I rule was introduced in 1973. According to the Commission, Solvency II will introduce economic risk-based solvency requirements across all EU Member States for the first time and these new solvency requirements will be more risk-sensitive and more sophisticated than in the past, thus enabling a better coverage of the real risks run by any particular insurer. The Commission also states that Solvency II will also be more comprehensive than in the past, in the sense that whereas at the moment the EU solvency requirements concentrate mainly on the liabilities side (i.e. insurance risks), Solvency II takes account of the asset-side risks.

Superannuation fund

The superannuation system (in Australia) refers to the arrangements of a compulsory occupational pension system which was introduced in 1992. Superannuation systems now have 11.6 million members with a coverage rate of 71% of workers. Total assets have grown to a level of AUD 1.4 trillion (Inderst and Della Croce, 2013).

Transaction enabler

A process or technique which facilitates investment by reducing the associated transaction costs or otherwise enabling the investment to be made.

Term loan

Loan payable in a fixed number of equal instalments over the term of the loan. Term loans are generally short-term (between one and five years) and are usually provided as working capital for acquiring income-producing assets (machinery, equipment, inventory, etc.) that generate cash flows to repay the loan.

Risk mitigant

A targeted financial intervention that is aimed at reducing, re-assigning or re-apportioning different investment risks.

Underwriting

In the case of loans, underwriting is the process by which a lender decides whether a potential creditor is creditworthy and should receive a loan. For securities issuances, underwriting is the procedure by which an underwriter, such as in investment bank, brings a new security issue to the investing public in an offering. In such a case, the underwriter will guarantee a certain price for a certain number of securities to the party that is issuing the security (in exchange for a fee). Thus, the issuer is secure that they will raise a certain minimum from the issue, while the underwriter bears the risk of the issue.

"Valley of death"

This term has been used to refer to the situation in which many seemingly promising renewable energy technologies do not progress along the innovation chain towards commercialisation and diffusion. The "valley of death" has more recently been described as "the place where a technology is too capital intensive for a venture capital firm to continue investing, but too risky for a project financier to bring it to scale" (Lacey, 2010). It has also been described as a scenario in which "investment in renewable productive capacity is required well before the energy price is sufficient to cover the full long run cost of that capacity" (Hartley and Medlock, 2013: 42).

Venture capital

An investment in a start-up business that is perceived to have excellent growth prospects but does not have access to capital markets. It is also a type of financing sought by early-stage companies seeking to grow rapidly.

Volumetric risk

A cash flow risk caused by deviations in delivered volumes compared to expected volumes. The primary cause of these deviations is weather and economic conditions.

Wholesale funding

A method of funding used by banks through short-term borrowing from other banks and financial institutions.

YieldCo

A publicly-traded company that is formed to own operating assets that produce cash flows. The cash is distributed to investors as dividends.

Note

1. Explanations of the terms are very condensed and may not be complete. They are not considered to necessarily reflect the official position of the OECD. Sources used include, inter alia, Duke University's Hypertextual Finance Glossary; Brealey, Myers and Allen (2014) and Investopedia.com.

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Green Finance and Investment

Mapping Channels to Mobilise Institutional Investment in Sustainable Energy

What are the channels for investment in sustainable energy infrastructure by institutional investors (e.g. pension funds, insurance companies and sovereign wealth funds) and what factors influence investment decisions? What key policy levers and risk mitigants can governments use to facilitate these types of investments? What emerging channels (such as green bonds, YieldCos and direct project investment) hold significant promise for scaling up institutional investment?

This report develops a framework that classifies investments according to different types of financing instruments and investment funds, and highlights the risk mitigants and transaction enablers that intermediaries (such as public green investment banks and other public financial institutions) can use to mobilise institutionally held capital. This framework can also be used to identify where investments are or are not flowing, and focus attention on how governments can support the development of potentially promising investment channels and consider policy interventions that can make institutional investment in sustainable energy infrastructure more likely.

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Chapter 5. Mobilising institutional investment in sustainable energy: Recommendations for policy makers

Consult this publication on line at ***http://dx.doi.org/10.1787/9789264224582-en.***

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