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.

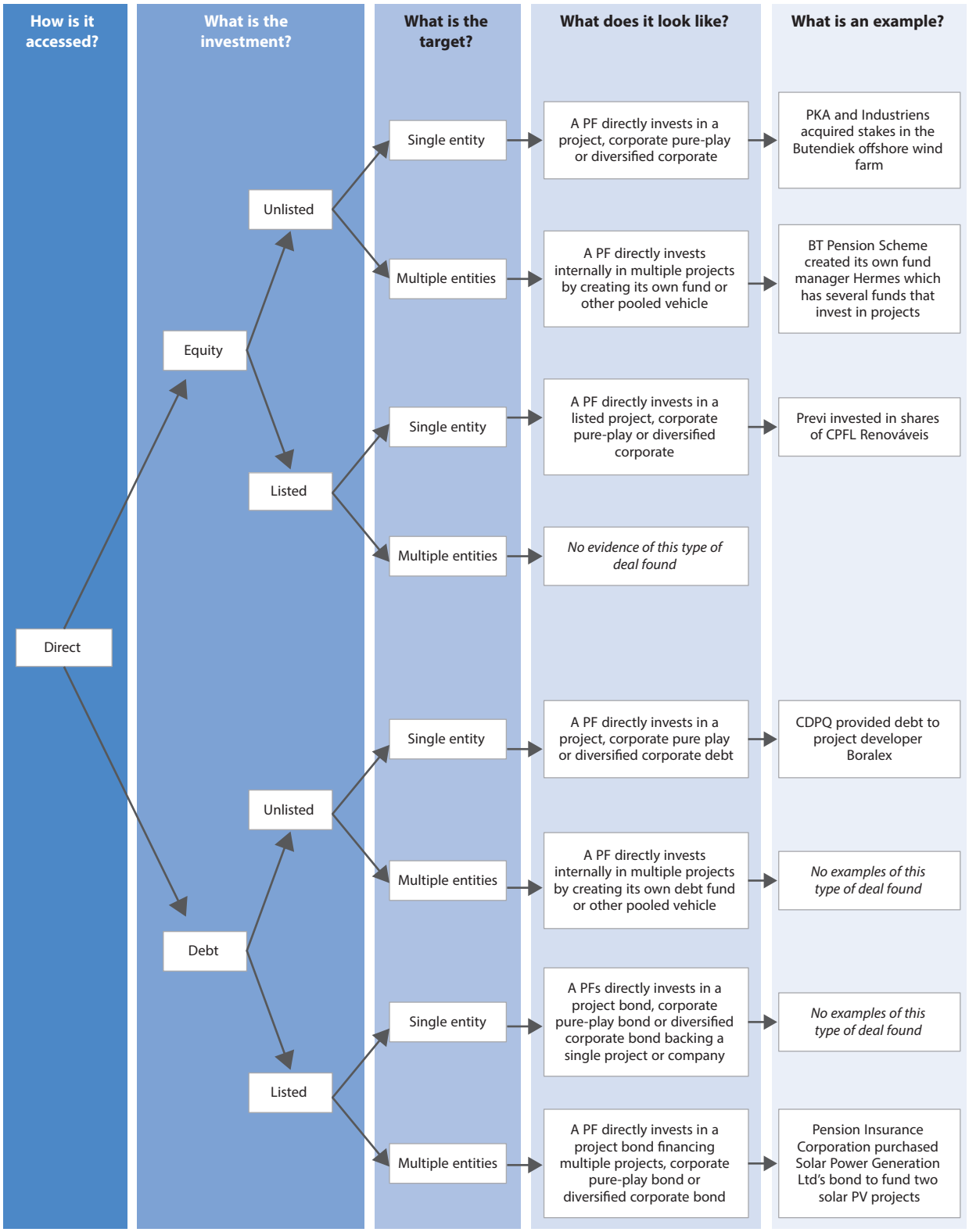
The Transaction Cost Economics (TCE) literature which dates back to at least 1937 (Coase, 1937) suggests that if an institution is sufficiently large to consider in-sourcing asset management and making the investment "in-house", then it will make that decision based in large part on where the transaction 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.

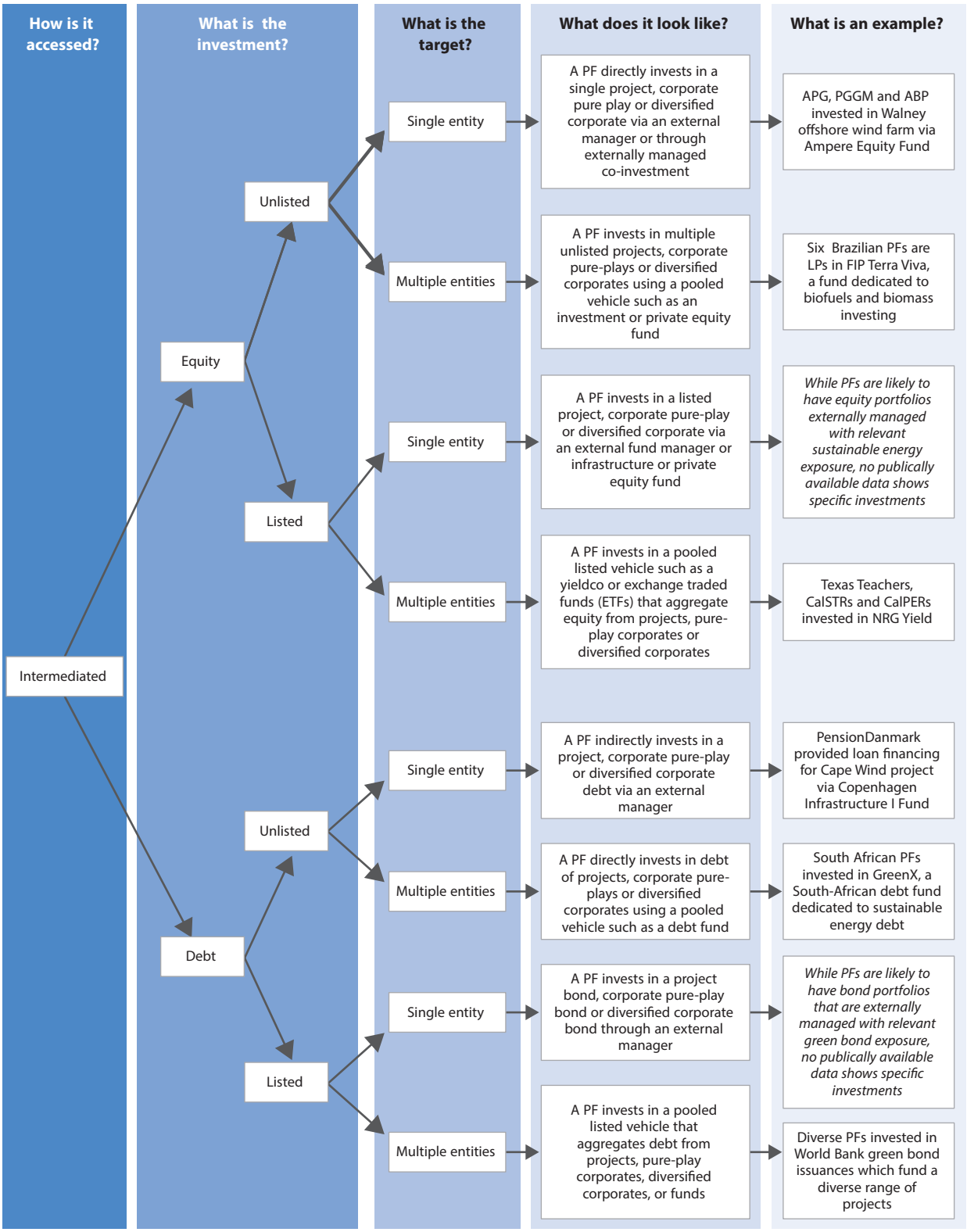
Figures 3.3 and 3.4 provide a visual representation of the sustainable energy classification framework and the various characteristics and examples of investments based on the starting point of the investor's decision between internally managing direct investment or using external managers or pooled 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.

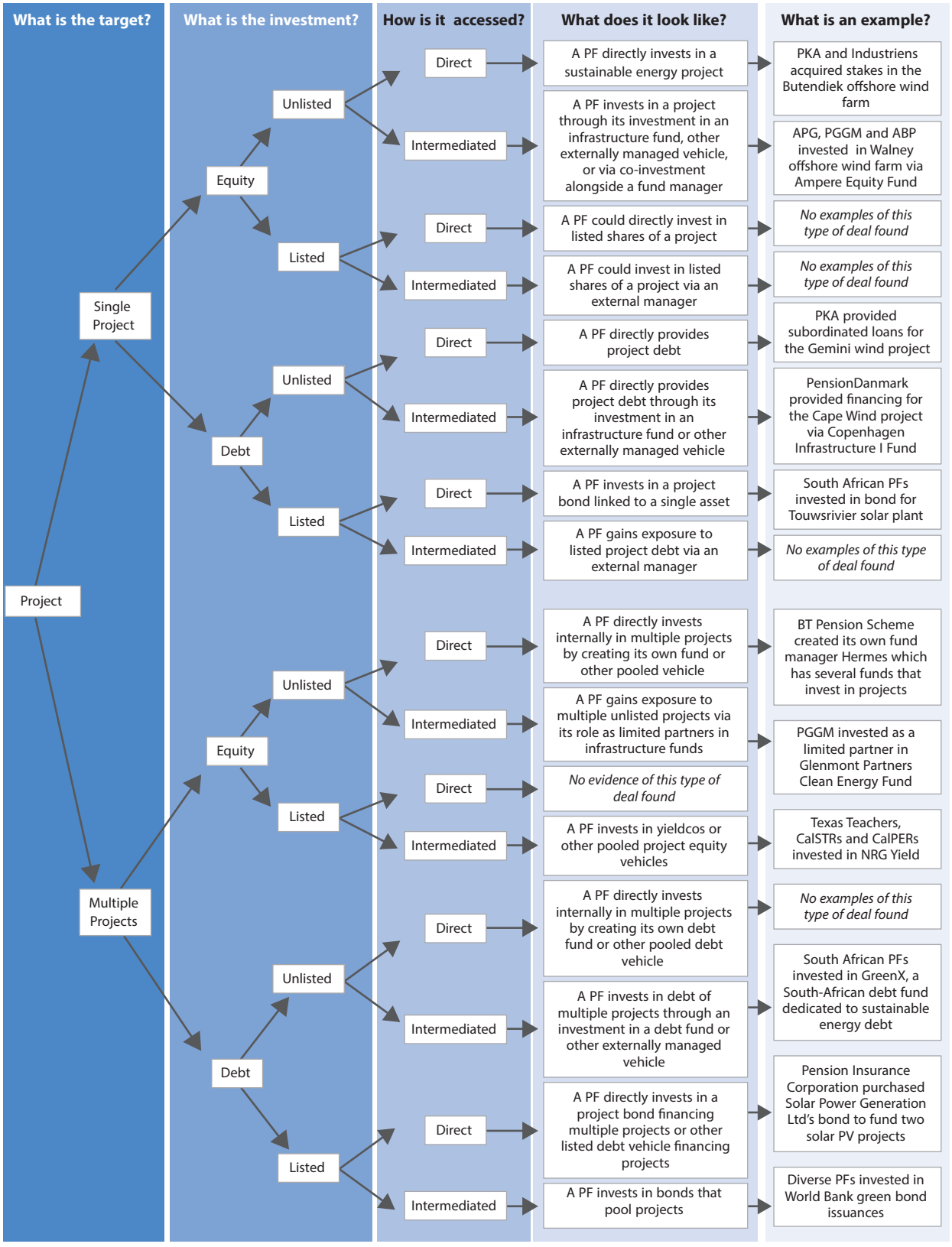
The investment pathways provided in Figures 3.5, 3.6 and 3.7 present alternative taxonomies to reflect the various characteristics and examples of investments if an investor decides to structure their investment decision as a choice between projects, pure-play corporates or diversified companies when 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]

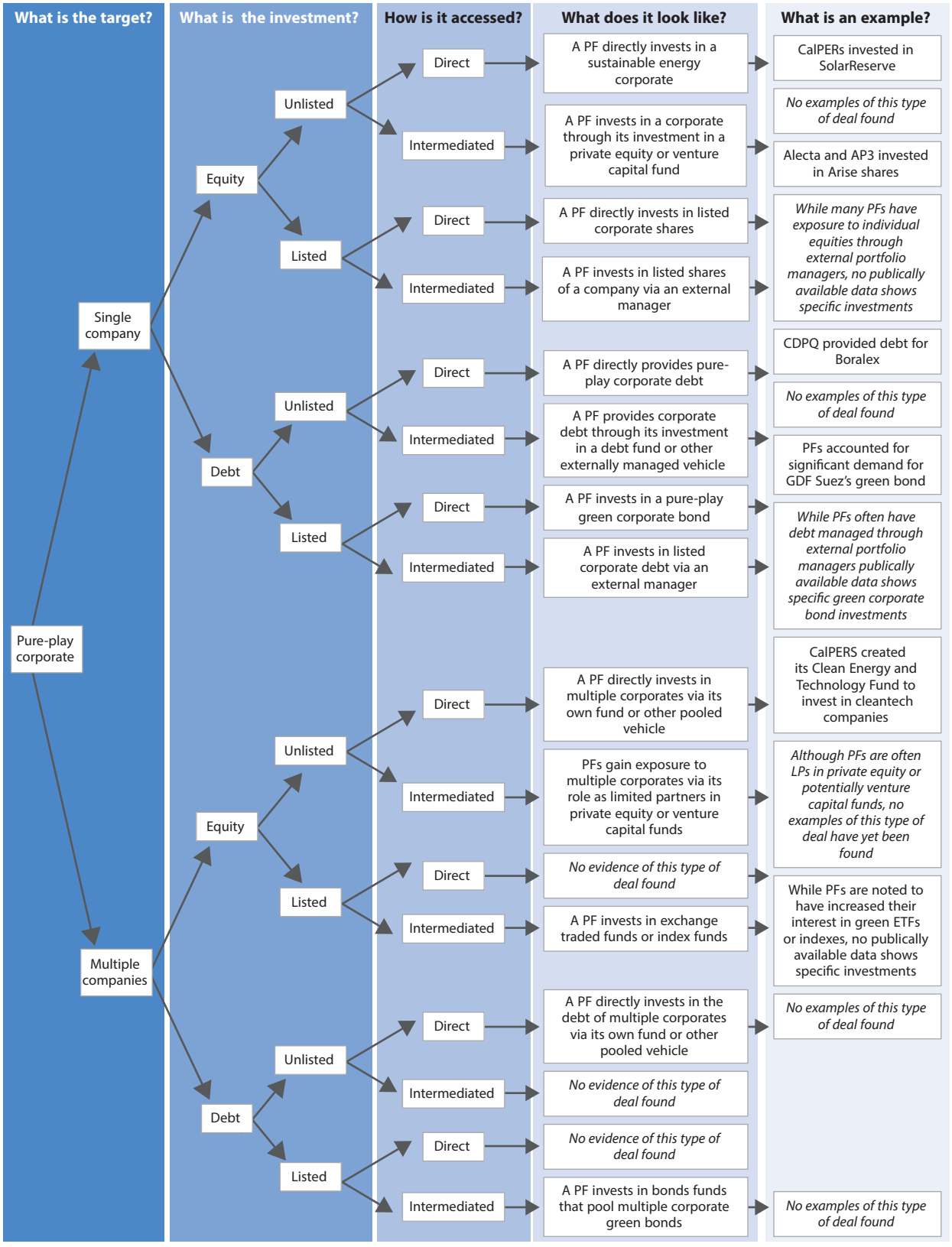
Sustainable energy projects that are "bankable" can offer a form of "pledgeable future income"[13] through stable and predictable cash flows, because sustainable energy (excluding CCS except under certain circumstances) is not subject to fossil fuel price volatility and is backed by long-term contracts 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)**



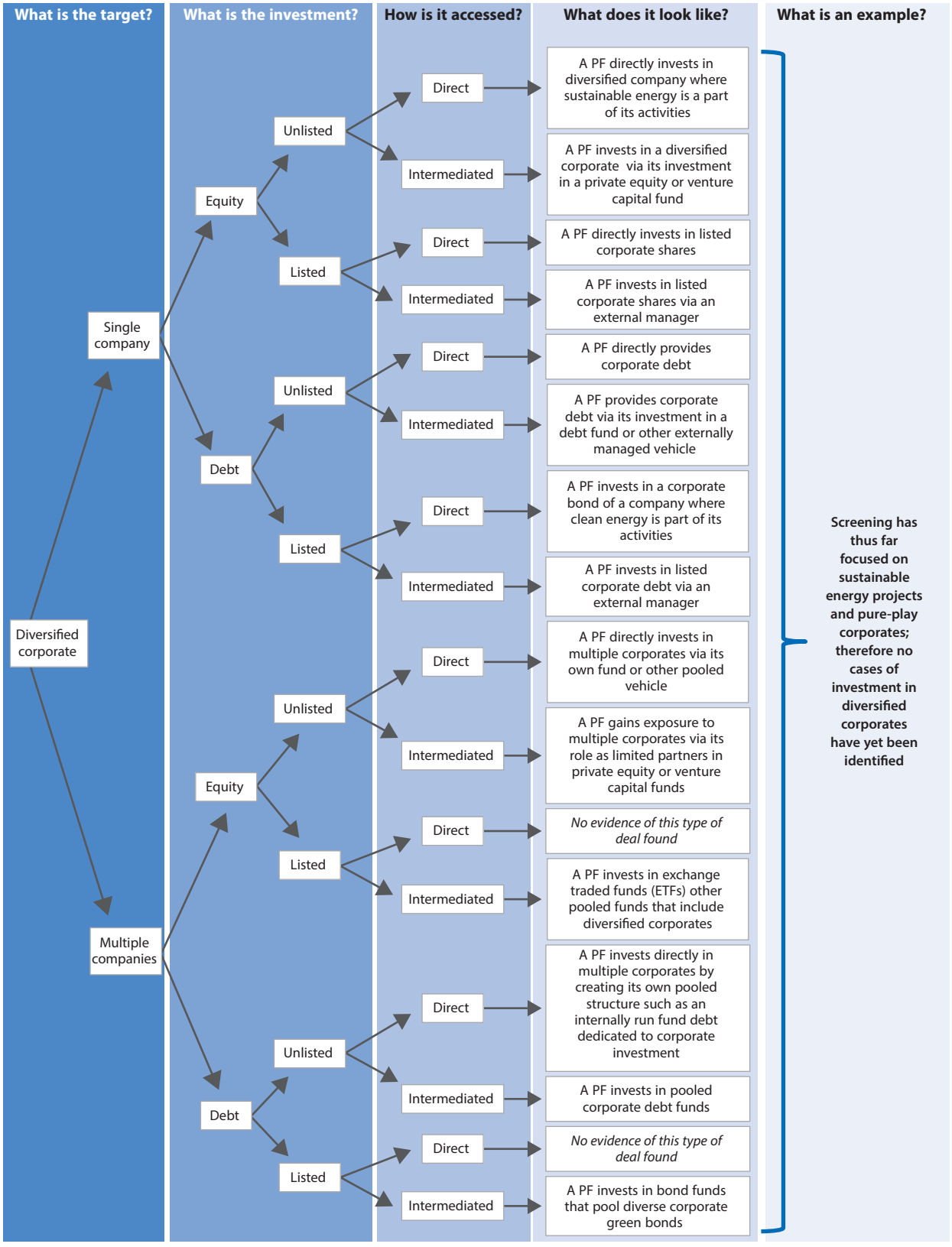
Source: OECD analysis.

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)**



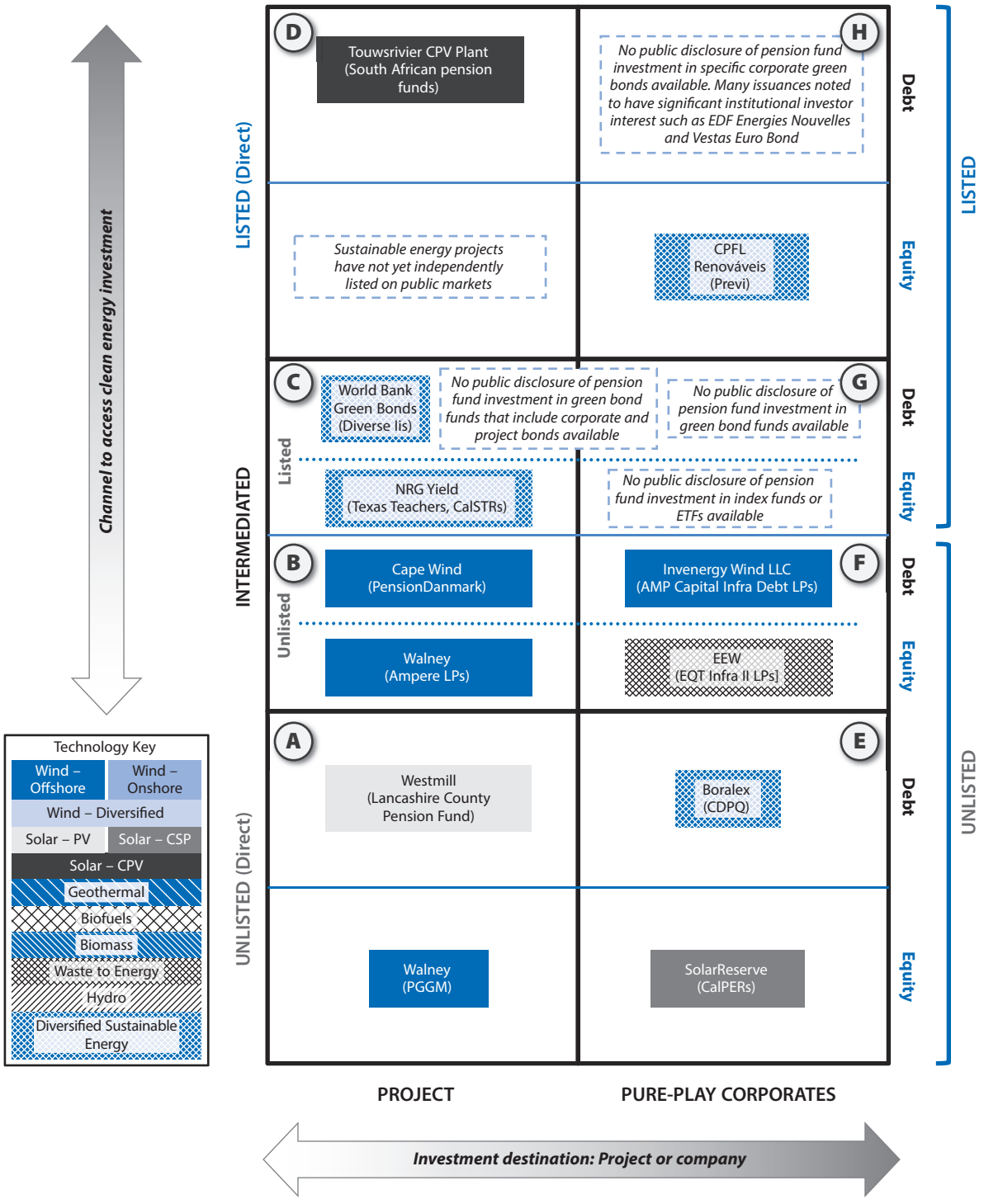
Source: OECD analysis.

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

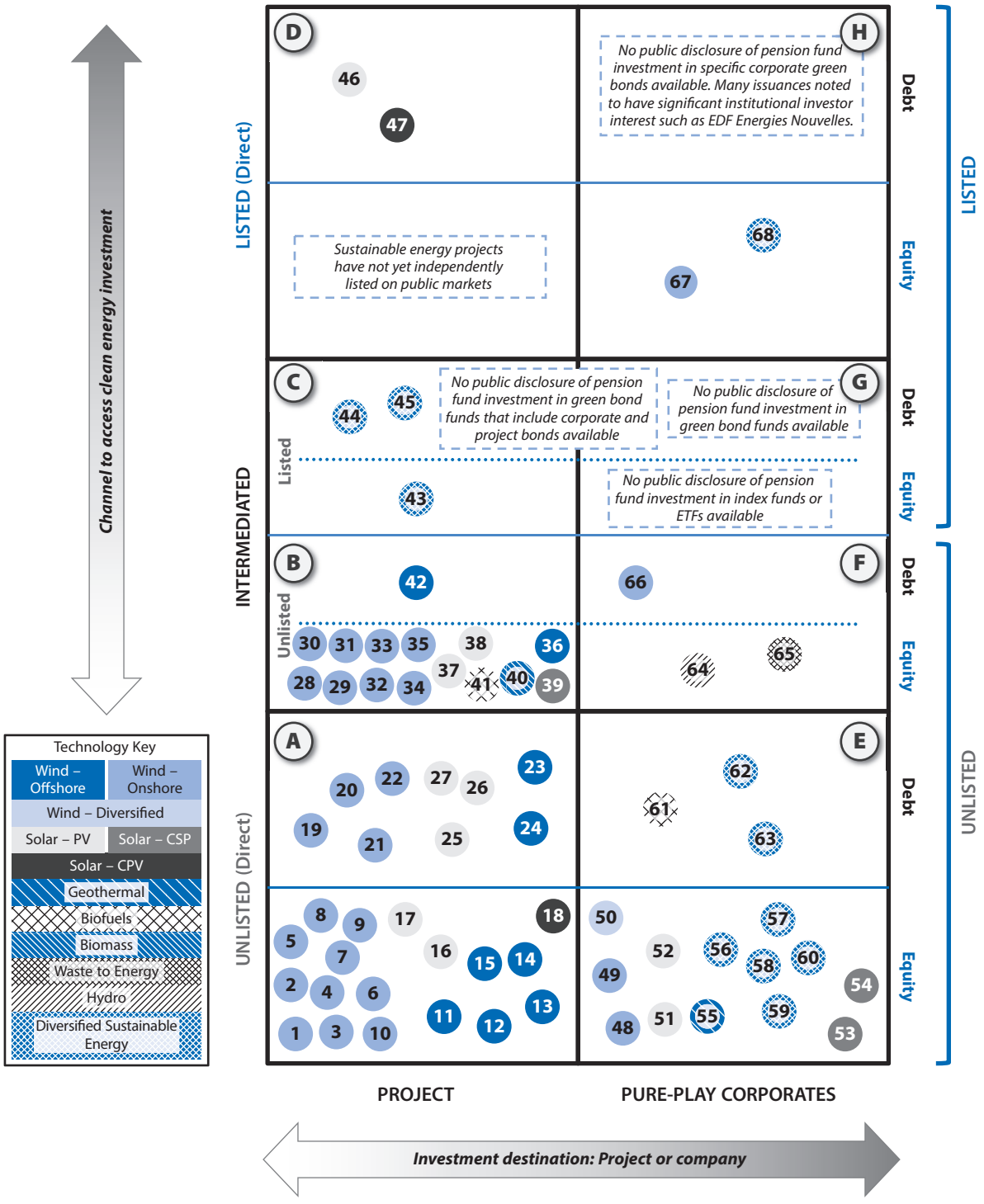
Having constructed the investment pathways to formalise the decision logic, they can then be combined in a matrix which provides a theoretical investment framework for understanding and mapping the transactions. The frame presented in Figure 3.8 plots a single example of where pension fund investment 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

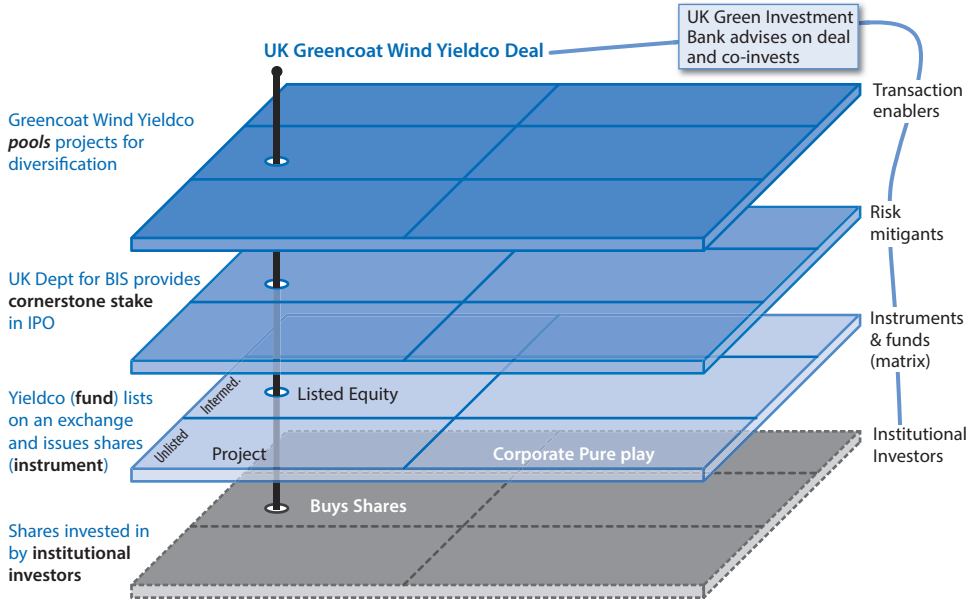
No relevant cases

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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