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Institutional Investors and Green Infrastructure Investments: Selected Case Studies

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ABSTRACT / RÉSUMÉ

INSTITUTIONAL INVESTORS AND GREEN INFRASTRUCTURE INVESTMENTS: SELECTED CASE STUDIES

This report is structured in three chapters. The first chapter 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 second chapter presents four case studies: on utility-scale solar PV power generation in the United States, sustainable agriculture in Brazil, off-shore wind energy in the United Kingdom, and the securitisation of on-shore wind farms in Germany and France. The third chapter uses the conclusions on the case studies to draw out broader lessons for governments on the policy settings which may support investment in green infrastructure by institutional investors. These include, inter alia, ensuring a stable and integrated policy environment, addressing market failures, providing an infrastructure road map, facilitating the development of appropriate green financing vehicles, and promoting market transparency and improved data collection.

JEL codes: G15, G18, G23, G28, J26
Keywords: pension funds, insurance companies, green bonds, infrastructure, green growth

L'INVESTISSEMENT INSTITUTIONNEL DANS LES INFRASTRUCTURES VERTES : ÉTUDES DE CAS

Le présent rapport est divisé en trois chapitres. Le premier étudie les possibilités offertes aux investisseurs institutionnels pour financer des infrastructures vertes, l'étendue de l'expérience acquise à ce jour ainsi que les obstacles à la multiplication de ce type d'investissements. Le deuxième chapitre présente quatre études de cas relatives à la production centralisée d'électricité photovoltaïque aux États-Unis, l'agriculture durable au Brésil, l'énergie éolienne off-shore au Royaume-Uni et les centrales éoliennes terrestres en Allemagne et en France. De ces études de cas, le troisième chapitre tire des conclusions générales concernant la conception de politiques favorisant l'investissement institutionnel dans les infrastructures vertes. Il préconise notamment de créer un cadre d'action stable et harmonieux, d'éliminer les défaillances du marché, d'établir une feuille de route de la construction d'infrastructures, d'encourager la mise au point de mécanismes appropriés de financement verts et, enfin, d'améliorer la transparence des marchés et la collecte des données.

Codes JEL: G15, G18, G23, G28, J26
Mots clés: fonds de pension, obligations vertes, infrastructure, croissance verte

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INSTITUTIONAL INVESTORS AND GREEN INFRASTRUCTURE INVESTMENTS: SELECTED CASE STUDIES[2]

EXECUTIVE SUMMARY

Context

Infrastructure investment needs for 'greening' growth, including addressing climate change, are already significant and will continue to rise in coming years. Some estimates suggest that this may require cumulative investments in green infrastructure in the range of USD 36-42 trillion between 2012 and 2030, or approximately USD 2 trillion or 2% of global GDP per year. Today, approximately USD 1 trillion is being invested annually, leaving a USD 1 trillion investment gap. Given stretched public finances in many OECD countries, private sources of capital will be required to meet the financing requirements for new and replacement infrastructure[3].

Green infrastructure investments not only have the potential to increase productivity, but they also generate various benefits for human health, the environment and economy. For example, the European Union's investment needs in low-carbon energy, energy efficiency and infrastructure are estimated to be EUR 270 billion per year and that, in addition to any energy security and climate benefits, these investments could result in fuel savings of EUR 170-320 billion per year and monetised health benefits of up to EUR 88 billion per year by 2050. However, the achievement of these benefits is contingent on the mobilisation of more long-term capital from institutional investors.

With provision of debt capital[4] in key parts of the global banking sector tightening and utilities and project developers under balance sheet pressure, policy makers are looking to scale up alternative sources of financing for green projects, including in particular from pension funds, insurers and other institutional investors, which manage USD 83 trillion in assets in OECD countries. Traditionally, institutional investors have been seen as sources of long-term capital with investment portfolios built around the two main asset classes (i.e., bonds and equities) and an investment horizon tied to the often long-term nature of their liabilities (e.g., pension benefits provided at retirement and life insurance payouts). Given the current low-interest-rate environment and weak economic growth prospects in many OECD countries, institutional investors are increasingly looking for tangible asset classes that can deliver diversification benefits and steady, preferably inflation-linked, income streams with low correlations to the returns of other investments.

Direct investment, either through equity ownership in the project or through loans or other debt instruments made available directly to green infrastructure projects in OECD countries, has the potential to deliver attractive risk-adjusted returns to these long-term investors. It creates the opportunity to structure the investment to match the profile of the long-term institutional investors' liabilities and can come with

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[2] By Christopher Kaminker (OECD ENV/DIR), Osamu Kawanishi (OECD ENV/CBW) and Fiona Stewart (DAF/FIN) with Ben Caldecott (University of Oxford) and Nicholas Howarth (University of Oxford).

[3] For the purpose of this report infrastructure is defined as energy, power, road, rail, water, waste, buildings and agriculture systems. See Box 2 for a "working definition of green infrastructure".

[4] For example, long-term loans and bond issuances used to provide financing for projects.

many of the other attributes sought by institutional investors. But these investments often come at higher levels of risk, illiquidity and policy dependence.

Institutional investors' asset allocation to direct infrastructure investments in general remains small, less than 1% for OECD pension funds, and the 'green' investment component remains even more limited. This is for a range of reasons — from regulatory and policy uncertainty, to a lack of suitable financing vehicles, investor inexperience with direct investing and with new technologies and asset classes, as well as market and government failures.

Moreover, a number of high-profile recent incidents in the renewable energy space have brought about questions as to whether institutional investors should increase their allocations to these sectors. Observers have witnessed the collapse and defaults of significant numbers of solar panel and wind turbine manufacturing firms due to unexpected price declines amid intense international competition. While good news for consumers of solar modules or wind turbines (such as project developers and owners), these price declines have highlighted the interdependence of the renewable energy manufacturing sector with the domestic policy and international trade agendas.

Project developers and asset owners have benefitted from lower input costs for installation, but have been negatively affected by retroactive cuts to subsidies which directly impact on their project cash flows. Policy uncertainty and overall market framework instability is perceived by developers and financial investors as the main risk that they are unable to manage in the development of solar, wind and other renewable energy projects. Furthermore, the performance of certain 'green' financial vehicles (such as the Breeze Bonds covered in case study 4) has been disappointing.

Despite this uncertainty and mixed performance in the last two years, an increasing number of pension funds and insurance companies from OECD and emerging and developing economies as well as other notable actors in the private sector (including Berkshire Hathaway and Google) have developed in-house asset management capabilities and have made major direct investments in renewable energy infrastructure. Although this dynamic has received relatively little attention, as of July 2013, over 50% of installed wind turbines in Europe were reported to be owned by institutional investors. Academics also have called attention to a larger trend occurring in the financial markets as more institutional investors with long-term horizons are attempting to bypass traditional financial intermediaries by "in-sourcing" asset management.

The IEA states that the underlying fundamentals for renewable energy deployment remain robust and renewables are playing a growing role in the global power mix. Renewables continue to transition from the development stage to deployment in a greater number of markets, particularly emerging markets with fast-growing electricity demand and energy diversification needs. A portfolio of renewables is already becoming cost-competitive with new conventional electricity generation in an increasingly broad range of circumstances, provided that appropriate policy frameworks are in place. As their costs continue to come down, renewables are becoming less policy-dependent.

These apparently conflicting market observations call into question whether institutional investors' reluctance to invest in green infrastructure has been well-founded, or whether they are missing investment opportunities.

This report aims to shed light on the barriers to, and opportunities and risks of green infrastructure investment, to better inform government policies and decisions by institutional investors. It also contributes to an emerging literature on how climate and green-growth policies can best be designed to attract private sector investment and on the use of innovative financial instruments to overcome investment barriers.

The first section of the report examines the channels through which institutional investors can access (i.e., invest in or finance) green infrastructure, assesses the extent to which this is currently happening, and identifies the barriers to scaling up these investment flows. The second section comprises four case studies on utility-scale solar PV power generation in the United States, sustainable agriculture in Brazil, off-shore wind energy in the United Kingdom and the securitisation of on-shore wind farms in Germany and France[5]. The case studies assess whether the projects delivered the necessary returns to investors, and if not, what led to the poor performance. Country context matters and the performances of the individual investments in the case studies are sensitive to the policy mix and related institutions and resources available in each project country. However, regardless of country context, some hallmarks of good practice can be identified from the case studies. The final section uses the case study conclusions to draw out some broader lessons for governments and investors on how to structure successful 'green' (projects/transactions) and the policy settings which may support investment in green growth projects by institutional investors.

Policy conclusions

A key to increasing institutional investor allocation to green infrastructure is to make sure that green investments compete on a risk-return basis over different time horizons, because institutional investors have varying risk appetites, investment preferences, and constraints. This is an indispensable and essential condition. Investors with fiduciary responsibilities will not make an investment just because it is green — their primary concern is its (risk-adjusted) financial performance. Pension funds and insurers 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.

In this report, several domains are identified where policy makers can improve the business conditions for green infrastructure projects and enhance investment conditions in the economy generally. Removing investment barriers in order to stimulate productivity enhancing investment is a particularly urgent matter given many countries are still suffering from unemployment above their economies' long-run natural rate. Providing the right policy signals will help ensure that the installation of new long-lived infrastructure is appropriate for a century which will increasingly value lowering pollution, enhancing inclusiveness as well as increasing prosperity. Exposing investors to strategic policy uncertainty is likely to reduce investment, increase financial short-termism and increase the potential risk of stranded assets at some time in the future.

[5] The case studies and background focus strongly on renewable energy generation due to prior OECD research in this area. However, other significant areas of green growth investment include: energy efficiency in rental property portfolios; sustainable land management in farmland and timberland portfolios; climate smart agriculture; and investment in transport and water infrastructure.

With regard to institutional investors' investment in green infrastructure, four barriers to investment were identified, including:

1. **Economic business case: weak, uncertain or unstable environmental, energy and climate policy and regulation:**

   - Lack of an integrated domestic green investment policy framework[6];
   - Existing regime of incentives either subsidises fossil fuel use, or does not appropriately take into account environmental externalities through carbon pricing or other efficient and effective support policies which are targeted, tailored and time-limited;
   - A dynamic economic landscape where renewable energy costs have fallen faster than policy makers anticipated and where diffusion occurred faster than anticipated has led in some cases to retroactive policy changes to control the costs of support mechanisms, which has damaged confidence in some markets;
   - Absence of, or unpredictable change to, feed-in tariffs or other support programmes to help immature technologies achieve competitiveness with incumbent technologies;

2. **Regulatory policy that may unintentionally discourage some investors or advantage others:**

   - Investment restrictions applied to illiquid asset classes (such as infrastructure) are often in place to encourage financial solvency of institutional investors. However, this can reduce investor appetite for long-term green investment.
   - The accounting, reporting and reward cycle in financial markets tends to reward short-term over longer-term investment (i.e., it encourages financial "short-termism"). Policies that help investors focus on longer-term returns, at no economic cost or even economic benefit, may stimulate investment.
   - To benefit from tax credits, institutional investors must first have a tax liability. Tax-exempt pension funds or sovereign wealth funds and other foreign entities therefore are excluded from this type of incentive, except in the case of foreign investors that already have a domestic business presence with sufficient local tax liability.
   - Competition policy designed to protect electricity markets from manipulation or other anti-competitive actions by "unbundling" or prohibiting simultaneous ownership of both transmission lines and electricity generators force institutional investors to choose between owning transmission assets or generation assets.
   - Potential unintended consequences of financial regulations on the availability of long-term capital (Basel III and Solvency II).

3. **A lack of suitable financial vehicles covering longer-term investment horizons that provide the liquidity, risk-return profiles and aggregation investors need:**

   - The emerging green bond and asset backed securities markets face the challenge of too few issuances that meet the investment grade requirements of institutional investors.

[6] See OECD (2012c) '*Towards a green investment policy framework: the case of low-carbon, climate resilient infrastructure*'.

- The investment space for green infrastructure is quite limited and currently does not include access to existing highly liquid vehicles (e.g., Master Limited Partnerships and Real Estate Investment Trusts).
- The current dominant infrastructure fund model of financing faces issues of insufficient liquidity, a disconnect to specific projects, high fees and excessive leverage.
- Investors' inexperience with direct project investment (expensive to build internal team with right skill set).

4. A general shortage of objective information and quality data to assess infrastructure transactions and underlying risks.

- A foundation of any well-functioning market is transparent information and data which can act as a signal to investors, without which there are significant barriers to entry into a sector. Currently there is little systematic collection of industry data on investment in the green infrastructure space and infrastructure generally. This would be a key element in stimulating investment conditions and building confidence in and track-records for new technologies, markets and financial products.
- Given the numerous challenges inherent to any infrastructure investment, and the additional barriers specific to green infrastructure investments, it also can be useful to group the challenges into three categories as follows.

Figure 1. Summarising challenges to scaling up institutional investor participation in green infrastructure[7]

Barriers to institutional investment in green infrastructure

1 Issues with infrastructure investments

- **Direct investing challenges**
  - Short term investment horizon and need for liquidity (illiquidity risk)
  - Difficulties with bidding process and timing; lack of investor best practice and expertise
  - Asset and liability matching (ALM) application issues; diversification and exposure limits
  - Need scale >$50Bn AuM and dealflow to maintain costly team
  - Min $100M deal size; expensive and time consuming due diligence; higher transaction costs;
- **Regulatory and policy issues**
  - Political uncertainty
  - Illiquidity and direct investment restrictions e.g. capital adequacy rules (Solvency II, IORP II)
  - Uncertain new policy application e.g. Solvency II for pension funds?
  - Accounting rules e.g. mark to market for illiquid assets
- **Lack of project pipeline and quality historical data**
  - Compounded by exit of banks (Basel III/deleveraging)
  - Little historical pricing data or indices for investments such as private placement debt

2 Issues particular to green investments

- **Risk/return imbalance**
  - Market failures: insufficent carbon pricing and incentives; presence of fossil fuel subsidies
- **Unpredictable, fragmented, complex and short duration policy support**
  - Retroactive support cuts, switching incentives (FiT to FiP) or start and stop (PTC)
  - Use of tax credits popular with insurers can discourage tax exempt pension funds
  - Unrelated policy objective discouragement e.g. EU unbundling preventing majority ownership of both transmission and generation/production
  - Fiduciary duty debate
- **Special species of risk,** e.g. technology and volumetric require expertise and resources
- **Competition for capital** with other traditional infrastructure assets

3 Lack of suitable investment vehicles

- **Issues with fund and vehicle design**
  - High fees to support fund structure
  - Liquidity trade-off with connection to underlying asset and associated benefits: difficult to offer liquidity without asset disconnect, churn and leverage in fund
- **Nascent green bond markets, no indices/funds, restricted access to liquid vehicles** (MLPs & REITs)
  - Small pipeline of projects, high transaction costs, minimum deal size and definition uncertainty
- **Challenges with securitisation**
- **Credit and ratings issues**
  - Historical lack of ratings data, expensive process
  - Absence of monoline insurers since financial crisis

Source: OECD authors' analysis based on OECD (2012a/b) CPI (2013), BNEF (2013).

The case studies outlined in this paper show that, while the returns in some green investment sectors have been disappointing (notably around equity investments in solar power manufacturing, corporate and asset-backed bond investments in wind farms and early-stage venture capital investments), there appear to be some important opportunities for pension funds and insurance companies to derive the returns they need from green investments — ***if these deals are properly targeted and structured***. This condition is an important one, particularly for policy makers. In order to deliver the required risk-adjusted returns, the right policy framework will need to be put in place. Policy support mechanisms and the overall market framework can also be structured so as to create cash-flow characteristics that institutional investors might find attractive.

It is also clear from the case studies that institutional investors cannot be viewed as a homogenous group with identical characteristics and investment approaches. The economic geography of institutional investors is incredibly diverse and ranges from small university endowments to global life insurers and pension-fund managers with assets under management in the hundreds of billions of dollars. These investors rely on a plethora of trustees, investment consultants and asset managers to make investment

[7] Note here that the potential review of the IORP Directive should be taken into account.

decisions. As a result, introducing newer asset classes and establishing track records and benchmarks takes time to institutionalise. This has implications for what type of 'green' investment is accessed and how.

The investment channels for institutional investors have not been well described outside of specialist financiers where the knowledge resides. There are wide differences between how these investors can participate: through indirect investment (i.e., investment in listed corporate stocks and bonds), direct project investments, or semi-direct (i.e. bridge) investments such as funds or vehicles. This report illustrates these three principal channels, the benefits thereof, the issues with scaling up investment through each route and the target returns investors aim for.

In designing their policies, policymakers need to consider the specific role of different types of institutional investors and their duties towards their members and beneficiaries and policyholders, the priority channels through which investment could most usefully be scaled up and at which stage of the financing value chain the investors may participate. Governments can shape the general regulatory and investment policy environment to facilitate long-term green investments by institutional investors while ensuring prudential goals.

Factors and options for governments to consider include the design of efficient and prudent policy frameworks and regulation, the creation of effective pooled investment vehicles, and interventions by green investment banks or other public financing institutions, such as taking "cornerstone stakes" in private vehicles such as the Greencoat UK Wind listed vehicle. With respect to policy and regulation, the research and case studies reflect the particular value of Power Purchase Agreements (PPAs) to institutional investors, which provide certainty for long term revenue streams. Further research into whether there is a possible role for policies in promoting or requiring the use of PPAs or other measures that achieve the cash flow characteristics desired by investors may be warranted. In summary, the lessons learned from the case studies include the need for:

1. Policy stability that provides investors with clear and long-term policy frameworks;

2. Financial vehicles, investment structuring and policy support that serves to create steady and predictable cash-flows and allocate project risks such as construction, maintenance and operation to the parties best capable of managing them;

3. Better governance and education of institutional investors to enable them to use a longer term investment horizon and: a) understand the different channels available as described in the report (indirect, semi-direct, direct) and their associated risks; and, b) build the necessary capabilities to manage the risks associated with these investments; and,

4. Better standardisation of contractual documents and project evaluation procedures.

Based on lessons learned from the case studies and this report's review of recent policy and investment trends in the renewable energy sector, **governments can take seven key actions** to address these barriers in order to facilitate institutional investors' investments in green infrastructure projects.[8] Several of these

[8] For a more general overview focusing on long term investment, see also The High-Level Principles of Long-Term Investment Financing by Institutional Investors, prepared by an OECD Taskforce working together with G20 members, to establish a framework for encouraging institutional investment in long-term assets. They set out the preconditions to long-term investment, such as the need for stable macroeconomic conditions, a clear and transparent government plan for projects, as well as opportunities for private sector involvement via public procurement and public-private partnerships investment.

actions apply to green infrastructure as well as other forms of infrastructure investments, while others respond to the additional challenges faced by green infrastructure investments:

1. **Ensure a stable and integrated policy environment,** developed in co-ordination with asset allocators, which provides investors with clear and long-term visibility and incentives. This helps provide the risk-return profile and confidence in future regulatory stability needed for investors to invest in long-term assets. Though prudential regulation is important for protecting pension fund members, it sometimes may have unintended consequences, creating barriers to long-term investments by pension funds which may need to be addressed.

2. **Address market failures** which create risk-return investment profiles that favour polluting or environmentally damaging infrastructure projects over green infrastructure investments. In the energy sphere, Power Purchase Agreements or similar measures that achieve cash flow characteristics desired by institutional investors are particularly important. 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) is also an important element of shaping the risk-return profile of green investments.

3. **Provide a national infrastructure road map**. This would give investors confidence in government commitments to the sector and demonstrate that a pipeline of investable projects will be forthcoming. This will reassure investors that it is worth building up their investment capability.

4. **Facilitate the development of appropriate green financing vehicles**. Governments can issue financing vehicles (e.g., green bonds) or support the development of markets for instruments or funds with appropriate risk-return profiles for institutional investors. They can also provide first loss cover, cornerstone stakes, risk mitigation and credit enhancement tools where appropriate.

5. **Reduce the transaction costs of green investment.** Governments can foster collaborative investment vehicles between investors and help to build scale and in-house expertise among institutional investors. This will also allow for capacity sharing and provide the scale necessary for smaller funds to participate in these projects.

6. **Promote public-private dialogue on green investments**. 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 green infrastructure 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. International organisations such as the OECD can also play a role through creating a platform for dialogue to assist this.

7. **Promote market transparency and improve data on infrastructure investment.** Governments could, where appropriate and needed, strengthen formal requirements to provide information on investments by institutional investors in infrastructure and green projects, 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.

The OECD continues to work in these areas and it is hoped that this report will provide a platform to spark further ideas and debate on the topic.

SECTION 1: THE ROLE OF INSTITUTIONAL INVESTORS IN FINANCING GREEN GROWTH[9]

Investment requirements and economic context

1. Transitioning to a low-carbon and climate-resilient economy, and more broadly "greening growth" will require shifting significant amounts of capital from fossil fuels, and resource-intensive and polluting technologies to newer, clean technology and infrastructure. Some estimates suggest that achieving this economy-wide transformation may require cumulative investments in green infrastructure in the range of USD 36-42 trillion between 2012 and 2030, or approximately USD 2 trillion or 2% of global GDP per year.[10] Today, only USD 1 trillion is being invested annually, leaving a USD 1 trillion investment gap.[11] However, the deployment of capital for infrastructure investment, and particularly for green investment, is constrained by policy, market and technology uncertainties and risks. Furthermore, this is reinforced by a broader reluctance of investors to take a long-term view in financing the relatively illiquid assets associated with infrastructure development.

2. Green infrastructure investments generate various benefits for human health, the environment and economy. For instance, the European Commission (2013b) estimates that the European Union's investment needs in low-carbon energy, energy efficiency and infrastructure are at EUR 270 billion per year, but that these investments would result in fuel savings of EUR 170-320 billion per year and monetised health benefits of up to EUR 88 billion per year by 2050. Further, they cite the achievement of these benefits as being contingent on the mobilisation of more long-term capital.[12]

3. Such levels of investment cannot be financed by traditional public sources alone (OECD, 2012d). The impact of the financial crisis and global deleveraging[13] has exacerbated the situation, further reducing the scope for public investment in infrastructure within government budgets. Since the crisis, European banks accounting for two thirds of the global market in this sector have significantly scaled back new lending and financial intermediation.[14] The result has been a widespread recognition of a significant

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[9] This report is a contribution to OECD's broader work on institutional investors. The OECD has launched a project on "Institutional Investors and Long Term Investment". As part of this project further studies will follow: see www.oecd.org/finance/lti. Though the term 'institutional investor' covers a wide range of organisations (including endowments, and foundations, sovereign wealth funds) the focus of this paper is on pension funds and insurance companies as the OECD is the leading organisation collecting statistics and analysis on these institutions.

[10] OECD (2012d) *The Role of Institutional Investors in Financing Clean Energy*, B20 Task Force on Green Growth Recommendations to the G20 Los Cabos Meeting: Calculation based on World Economic Forum Analysis; HSBC, *Sizing the climate economy*, 2010; HSBC, *A Climate for Recovery*, 2009; BCG, *The Global Infrastructure Challenge*, 2010.

[11] Ibid.

[12] European Commission (2013 b), Staff Working Document, Long-Term Financing of the European Economy.

[13] Bridgewater Associates: http://www.bwater.com/Uploads/FileManager/research/deleveraging/an-in-depth-look-at-deleveragings--ray-dalio-bridgewater.pdf

[14] Broadly speaking, the pool of users and sources of funds are primarily linked through financial intermediation. Through this process of intermediation, savings from households, for example, are channelled to corporate entities and governments as well as other users who need the funds. Savings can be pooled in collective investment vehicles such as those offered by institutional investors and can flow to fiduciaries or asset managers, who in turn will manage these assets on behalf of the ultimate owners

infrastructure investment gap and the need for greater recourse to private-sector finance in the OECD (OECD, 2013a).[15]

4. The situation is different in the large emerging economies and other developing countries where a significant amount of investment in green infrastructure will be needed. As Benoit (2012) notes, in countries such as China and Brazil, state-owned enterprises (the "quasi-public" sector) operating in the power, cement, steel, banking and transport industries will have a central role to play in funding and implementing these investments, and domestic financial resources will be a key source of capital. Yet even in China, these actors are looking to foreign investors as sources of additional capital for their green infrastructure investment plans.[16] Greater attention needs to be given to this quasi-public sector that will be central to our efforts to achieve a low-carbon future; and how investment plans may be met through a partnership of Foreign Direct Investment (FDI) and state-driven policy and investment.

Box 1. A closer look at "green" growth investments

There is no universally agreed definition among investors of what a green investment entails.[17] However, for the purpose of this report green investments refer broadly to low carbon and climate resilient investments made in companies, projects and financial instruments that operate primarily in the renewable energy, clean technology and environmental technology markets as well as those investments that are climate change specific or ESG[18] screened.

In terms of the OECD's Green Growth Strategy, these would include energy-efficiency projects, many types of renewable energy, carbon capture and storage, nuclear power, smart grids and electricity demand side-management technology, new transport technologies (electric vehicles), floodplain levees and coastal protection as well as sustainable agriculture[19] and water infrastructure.[20]

Choices of infrastructure or selected features of infrastructure will affect the greenhouse gas emission-intensity of service provision (e.g. water, electricity, transportation, shelter, trade, sanitation services) as well as the exposure and vulnerability of businesses and people to climate change itself.

Despite the risk of lock-in into high emission and high vulnerability development pathways, infrastructure decisions are not irreversible, yet it can be costly to change them and there is potential for stranding of legacy assets. Infrastructure investment typically has high capital expenditure requirements and altering infrastructure post-construction can be difficult and more costly than if it were designed to integrate climate change consideration from the start. Greening infrastructure investment may be directed at renovation of physical infrastructure (also referred to as "brownfield" investments), such as retrofitting power plants or energy efficiency projects, or when building new infrastructure ("greenfield" investments), such as renewable-energy projects or new public transport infrastructure systems. Investment to support green infrastructure may also take the form of service sector activity (e.g. information provision, engineering or management advice).

Source: adapted from OECD 2012a.

[15] European volumes continued to weaken and stood at USD 63.5 bn in 2012, down 38% from 2011 (USD 102.9bn). Prior to the crisis, EU banks were substantial financiers of long-term assets such as infrastructure and property assets. As they are more reliant on wholesale funding (such as overnight interbank loans as distinct from retail deposits), EU banks have been under particular pressure.

[16] Reuters (2013) Beijing invites foreign bids for USD 55 billion in infrastructure projects.

[17] For an in depth discussion, see Georg Inderst, Christopher Kaminker and Fiona Stewart (2012g), *Defining and Measuring Green Investments: Implications for Institutional Investors' Asset Allocations*, OECD Publishing, Paris.

[18] Screened by investment analysts as having met Environmental, Social and Governance (ESG) criteria.

[19] OECD (2011d), *A Green Growth Strategy for Food and Agriculture*

[20] A broad definition of "climate change themes", such as that adopted by Deutsche Bank and the Climate Bonds Initiative could take into consideration rail, water and electricity infrastructure that is not specifically dedicated to clean energy.

5. In financial markets, banks traditionally play a role as a financial intermediary in channelling funds from those who want to lend or invest to those who want to borrow.[21] However, the financial crisis has affected the maturity transformation process in financial markets and the ability of banks to channel long-term financing. Banks have been prompted to reduce investments across illiquid asset classes, because of newly exposed funding vulnerabilities and new regulations aimed at improving their capital and liquidity positions. As a result, banks are less willing or able to meet the long-term funding needs of borrowers and their new investments.[22]

6. The EC (2013b) points out that the increased challenges facing banks create an opportunity for institutional investors, because they tend to have long-dated liabilities which match the part of the lending market from which banks are retreating. This situation arises from the economics of the insurance and pension markets. For instance, life insurance companies and defined--benefit pension funds can manage long-term liabilities through investments in long-lived infrastructure that provides steady and predictable returns.

7. Financing for green infrastructure such as renewable energy comes in a variety of forms. In the OECD in 2011, 62% of new investment in renewable energy came from project finance or financial arrangements specific to individual projects, which are common for power and infrastructure investments in general. The remaining 38% was invested by companies, using their balance sheets. Within project finance, roughly 63% was financed through debt, including loans from commercial and public banks, as well as debt finance provided for projects by institutional investors and publicly traded companies (CPI, 2013a). These debt investments are accompanied by equity investments, from project developers, banks, asset managers, and others. As previously mentioned, the situation is different in emerging and developing economies where the "quasi-public" sector plays a much larger role.

8. Despite the important role played by banks in financing green infrastructure, current expectations are that conditions for bank loans and refinancing will likely become much less favourable and more expensive (Box 6). Structural weaknesses in the banking sector are leading to "bad" deleveraging, particularly in Europe, in the form of restrained credit growth. New banking regulations such as Basel III could also affect negatively the ability of banks to provide long-term financing (OECD, 2013a). Those banks that remained have had to offer shorter tenors, and in some cases, higher cost of capital, compounding the challenges of financing green infrastructure. This is causing a growing mismatch between the amount and time horizon of available capital and the demand for long-term finance. A further consequence of the financial crisis was the disappearance of some significant actors active in the infrastructure market such as monoline insurers[23] for the capital markets.

[21] Financial intermediaries refer to banks, insurance companies and other institutional investors that channel funds from those who lend or invest to those who borrow. In modern financial markets, more and more funds now flow indirectly into financial markets through financial intermediaries rather than direct savers.

[22] Ibid.

[23] 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.

9. With over USD 83 trillion in assets, institutional investors are frequently cited as an alternative source of financing long-term investment, yet direct infrastructure investment only accounts for around 1% of the asset allocation of the average OECD pension fund (OECD, 2012c), and some estimates suggest that green infrastructure accounts for around 3% of that amount — a tiny proportion of assets available worldwide for investment (BNEF, 2013a).

What is the role of institutional investors in financing green infrastructure?

10. Institutional investors comprise the primary layer of capital in the investment value chain, and are commonly referred to as "asset owners" or "allocators". Given the low interest rate environment and weak economic growth prospects in many OECD countries of recent years, institutional investors are increasingly looking for new sources of long-term, inflation protected returns. Direct investments in real, productive assets, such as green infrastructure, could potentially provide the type of income which these investors require, therein supporting investment and driving growth (OECD, 2013a).

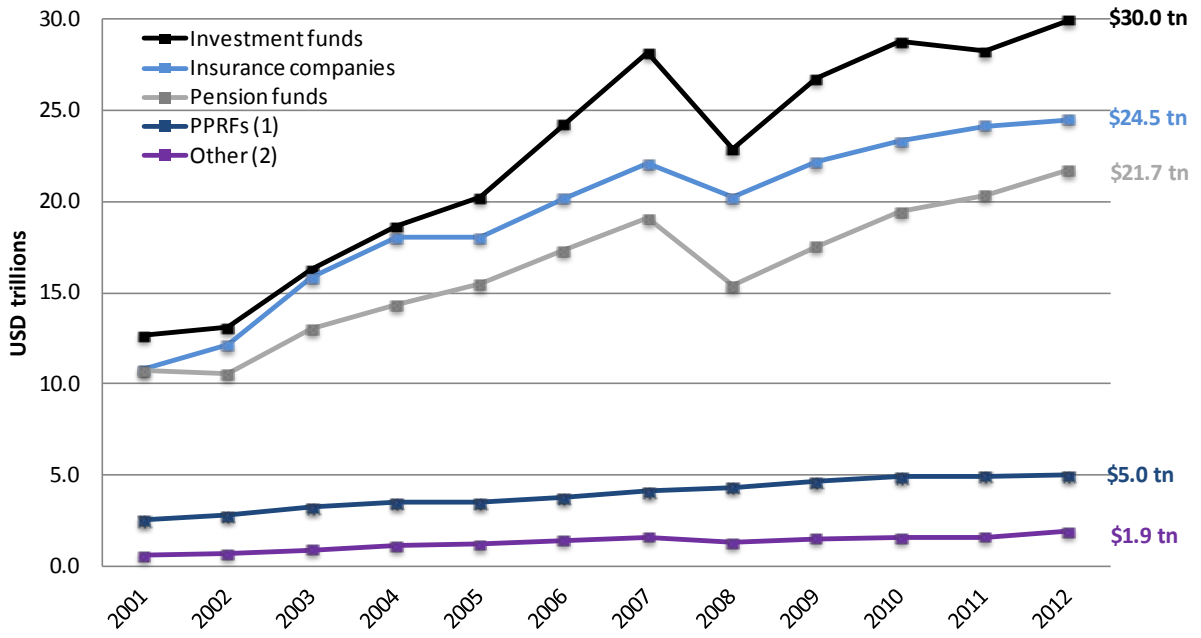
11. Institutional investors – particularly, pension funds, Public Pension Reserve Funds (PPRFs), insurance companies, investment funds such as mutual funds and other forms of institutional savings (see Figure 2, footnote 2) – are increasingly important players in financial markets. With around USD 22 trillion of assets under management and USD 1 trillion of new capital inflows in 2012 in the OECD, pension funds play an important role in the economy (Figure 2).

12. Pension funds are responsible for delivering steady, preferably inflation-adjusted returns to support their members' retirement income needs. As populations age pension fund managers provide an increasingly vital social function, working in partnership with governments to provide retirement income support, improving living standards for citizens in OECD countries and throughout the rest of the world.[24]

13. Although Sovereign Wealth Funds (SWFs) have less available capital compared to other institutional investors, with assets under management of approximately USD 6 trillion (SWF Institute, 2013). They are increasingly being approached for funding green ventures — particularly in emerging and developing economies.

[24] For example, see OECD Better Life Index.

Figure 2. Growth in total assets under management by type of institutional investor in the OECD area, 2012



Note: This chart was prepared with data available on 23 September 2013. 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.

(1) Data include Australia's Future Fund, Belgium's Zilverfonds (2008-2012), Canada Pension Plan Investment Board, Chile's Pension Reserve Fund (2010-2012), France's Pension Reserve Fund (2003-2012), Ireland 's National Pensions Reserve Fund, Japan's Government Pension Investment Fund, Korea's National Pension Service (OECD estimate for 2012), 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, Unites 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 estimates.

14. Despite financial crisis, the growth prospects for institutional investors looks very positive, especially in countries where private pensions and insurance markets are still small in relation to the size of their economies (OECD, 2013a). Emerging and developing economies generally face an even greater opportunity to develop their institutional investors' sectors as, with few exceptions, their financial systems are largely bank-based. Whether such growth materialises will depend on some key policy decisions, such as the establishment of a national pension system with a funded component which is nowadays a common feature in most OECD countries. Indeed, emerging economies are also home to some of the largest SWFs in the world.[25]

15. OECD insurance companies manage USD 25 trillion in assets and work to help societies manage and adapt to risks. Insurers can materially engage in green growth in several ways. Most importantly, they can help spread the costs of everyday as well as catastrophic losses, which if left un-insured would significantly hinder the willingness of agents in the economy to engage in the risk-taking that is essential to economic growth. Insurers also play an important role in evaluating and communicating risks to inform

[25] OECD, "*The Role of Banks, Equity Markets and Institutional Investors in Long-term Financing for Growth and Development*", (2013a).

public and private decision making, and in directly investing some of their substantial assets in green infrastructure.

16. Being a long-term manager of assets, and also in the business of quantifying and responding to the major risks faced by society, the insurance industry plays a major role in quantifying climate risks and assisting in adaptation strategies for those exposed such as cities, farmers, companies and individuals.[26] For example, research by MunichRe shows how the frequency of catastrophic meteorological and hydrological events has significantly risen over the last 60 years relative to other natural catastrophes such as earthquakes and volcanic eruptions.[27] During the three decades from 1980 to 2011, the number of violent storms, floods, droughts, heat waves and wildfires has increased more than three-fold. They also estimate that the financial losses have increased from USD 40 billion to USD 170 billion per year over this time. Most of those losses were not insured – resulting in significant losses to businesses and individuals and often necessitating costly state intervention. The tracking of natural catastrophe losses by the insurance sector is also playing an increasing role in the emerging field of legal liability for climate change damage (e.g. Lord et al., 2012).

17. Insurance companies, also invest money for external clients as well as their own parent insurance company funds and the assets arising from the life insurance and annuity business. Availability of proprietary and internal historical data on the performance of green infrastructure from their insurance (underwriting) side may also give some insurers a particular information advantage. While these twin roles in the green infrastructure space can make it difficult to obtain a clear picture of the investments an insurance company has exposure to, the OECD (2012d) estimated that insurance companies[28] have *taken part* in around USD 10 billion of clean energy asset financing deals to date — mainly in wind power (USD 7.9 billion) and geothermal power (USD 1.6 billion). More broadly, over the past decade, 25 insurers have collectively made USD 40 billion in investments relevant to climate and environmental concerns, spanning venture capital, private equity, public equity, and debt. Of the total, USD 23 billion was directed to climate change mitigation (IFC, 2013).

18. Increasingly, institutional investors in emerging and developing economies (EMDEs) are being seen as a potential source of private infrastructure investment. In fact, EMDE-based institutional investors may be better suited than some foreign investors to take on local risks, such as currency risks. Some countries such as South Africa have recently adopted legislation to prompt their institutional investors to consider environmental and social governance in making investment decisions. Further, an OECD report (2013a) submitted to the G20 Finance Ministers and Central Banks Governors found that there is scope for some sources of long-term financing, including local currency bond markets, domestic capital markets, and institutional investors to play a larger role for investment. [29]

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[26] For example, the estimates of damage from hurricane Sandy, which hit New York in October 2012, range from USD 7 to USD 15 billion for private sector insurers, with broader costs to the economy estimated as high as USD 45 billion www.ft.com/cms/s/0/d946c830-236c-11e2-a66b-00144feabdc0.html

[27] See:www.munichre.com/app_pages/www/@res/pdf/NatCatService/great_natural_catastrophes/NatCatSERVICE_Great_1950_2011_number_en.pdf

[28] E.g. Allianz, Aviva, Manulife (John Hancock), MetLife, MunichRE, Prudential.

[29] G20 http://www.g20.org/load/781222043

Box 2. How much is available for long-term investment by institutional investors?

The main institutional investors in the OECD — pension funds, insurance companies and mutual funds — held over USD 83 trillion in assets in 2012. Sovereign Wealth Funds are also a driving force as they manage approximately USD 6 trillion in assets (SWF Institute)[30] and are currently among the most important sources of institutional capital in developing countries. The OECD's latest survey in 2012 found that less than 1% of OECD pension fund assets are allocated directly to infrastructure projects, and an even smaller percentage of this goes to green infrastructure.[31]

McKinsey Global Institute estimates that if institutional investors reached their current target allocation to infrastructure of around 6% on average from 3% today, it would result in an additional USD 2.5 trillion in infrastructure investment capital through 2030, out of the USD 57 trillion of the estimated amount of the needed global infrastructure investment over the next 18 years through 2030.[32]

The Climate Policy Initiative (CPI) focuses just on renewable energy and narrows the universe of institutional assets available for long term investment to USD 45 trillion.[33] The principal reason for this is that short-term investment horizons and liquidity requirements of some institutional investors preclude investors from entering into illiquid assets that may include a lockup period or otherwise require long-term investment horizons. This constraint eliminates many classes of institutional investors including most defined contribution[34] pension funds (although the analysis makes exceptions for such funds in Australia, Chile, Denmark, Mexico, the Netherlands, and Switzerland given the structure of these countries' pension systems) and most property and casualty insurance companies. CPI estimates that under exceptionally good circumstances (i.e. with no policy barriers and all institutional investors adopting aggressive investment strategies with respect to renewable energy and illiquid assets) institutional investors could meet 24% of project equity investment needs, and 49% of project debt needs. CPI's work suggests that institutional investors have the potential to invest USD 689 billion via corporate investments, USD 257 billion via project investments and up to USD 562 billion via pooled investments depending on the structure of the funds on offer.

The Trade Union Advisory Committee to the OECD (TUAC) and the International Trade Union Confederation (ITUC) estimate that the total amount of pension funds' net contribution to financing of climate change projects could reach USD 3.7 trillion for 2013-2030. This is based on the assumptions that only the larger public and private pension schemes (accounting for approximately half of worldwide pension assets) would have the flexibility and capacity to reallocate their funds towards green infrastructure and secondly, that portfolio exposure per asset class would remain within prudential norms throughout the period.[35]

The state of green investing

19. Between 2004 and 2011, global annual investment in clean energy has increased sixfold, to reach USD 302 billion (REN21, 2012; BNEF, 2013a). Yet, there exists a perception in the market that green investments are performing poorly. Reasons cited for this include the fact that green equity indices have

[30] http://www.swfinstitute.org/fund-rankings/

[31] OECD (2012d) 'The Role of Institutional Investors in Financing Clean Energy'.

[32] McKinsey Global Institute (2013) 'Infrastructure productivity: How to save USD 1 trillion a year'.

[33] Climate Policy Initiative [CPI] (2013a), The Challenge of Institutional Investment in Renewable Energy.

[34] An investment in the infrastructure asset class with a long-term horizon and inflation linked, volatility-protected cash flows thus provides an attractive proposition for Defined Benefit (DB) plan administrators looking to match liabilities. In a Defined Contribution (DC) plan, a DC participant values an infrastructure investment in a similar way to a DB sponsor but without the pressing need for matching liabilities. Another concern for DC plan providers is the illiquidity of infrastructure assets. DC plan providers prefer to make more liquid investments to be able to trade out of their assets quickly in accordance with customer requests. For these reasons, DB plan providers with longer effective terms have invested more in infrastructure assets than DC plan managers.

[35] TUAC and ITUC CSI IGB (2012), 'What role for pension funds in financing climate change policies?'

underperformed the market average (such as the S&P500) recently, high profile renewable energy manufacturing companies have been in financial trouble, the price of carbon emission allowances in the EU ETS has fallen dramatically, regulatory support has been reduced or remains very uncertain in many markets, and venture capital firms have not been as successful as expected in the clean-technology industry (Deutsche Bank, 2012a; McKinsey, 2013a). Furthermore, there is an on-going debate focusing on whether the advent of unconventional sources of tight oil and shale gas in North America has negative or positive implications for the future of renewable energy.[36]

20. A more thorough and nuanced assessment of whether green investments have delivered risk-adjusted returns requires a consideration of performance in different investment channels. This is an important point to illustrate because the channels of institutional investor involvement are generally not well described in the literature, and this knowledge does not reside outside of specialist financiers (we elaborate on these issues in this report).

21. For instance, in the market for green investments there exists confusion around which sections of the value chain have been under stress. It is important to distinguish between manufacturers (such as for solar and wind) and project developers and owners. The former have experienced significant losses with the decline in input costs and reduction of subsidies. The latter group have in many cases benefitted from lower input costs, but have been negatively affected by retroactive policy changes and associated uncertainties.

22. Renewable energy, a key part of the green infrastructure industry, has been the subject of much concern, but many developments can be better understood as the dynamics of a burgeoning and changing market. Significant segments of the renewable energy industry are currently going through a painful consolidation process due to dramatic price declines in clean-energy technologies and intense international competition, especially in the solar photovoltaic (PV) sector. This consolidation and shake-out follows an inflated and subsidy-driven era (2005-2008) of investment in some clean energy technologies. Due to the entry of low-cost subsidised Chinese manufacturers and the formation of a global supply glut, as well as a dramatic decline in the price of polysilicon, the price of solar PV power equipment tumbled more than 80% from 2008 to 2012, surprising industry and policy makers (BNEF, 2012c) .[37]

23. In Europe, some governments struggled to reduce feed-in tariff subsidies for solar-based electricity in step with rapidly declining production costs (UNEP, 2012a). Initial support became perceived as being overgenerous as the prices dropped, resulting in greater-than-expected returns for PV project developers, and driving a boom in installation of panels, especially in Italy and Germany, which both saw more than 7 GW installed in 2011.

24. One high-profile case affected by this price decline was the bankruptcy of solar PV technology manufacturing company Solyndra, which had received USD 538 million in United States Federal Government loan guarantees. Another high profile corporate failure was Q-Cells, one of Germany's largest solar companies, which filed for bankruptcy in April 2012 and was later sold to Korean competitor Hanwha. However, such anecdotes of corporate distress should be put in perspective. For instance, through the American Recovery and Re-investment Act, the U.S. Department of Energy made grants and loans to

[36] For a more comprehensive discussion, see: U.S. National Renewable Energy Laboratory (2012), 'Opportunities for Synergy Between Natural Gas and Renewable Energy in the Electric Power and Transportation Sectors'.

[37] http://www.bloomberg.com/news/2012-03-21/grid.html

more than 1 300 companies, and only one percent of the companies funded went bankrupt (U.S. Department of Energy, 2013)[38].

25. With many renewable energy companies facing low market capitalisation[39], poor-debt-to equity ratios, fierce competition, and uncertain policy outlooks, institutional investors are wise to be wary of the sector. [40] Doubts as to manufacturers' continued viability affect investor faith in their ability to provide technical support and the real value of their product warranties. One manifestation of this wariness is the required investment return (hurdle rate) for renewable-energy investments, which is often higher than for traditional corporate investments (Grantham, 2013).

26. The impressions the average investor has of an industry tend to be a moving average of the last five years' information. When there is a sudden shift in a year or two, this average can become misleading, and recent developments in solar energy and to a lesser extent, wind power, illustrate this dynamic. The rapid deployment of renewables in recent years, working in combination with the high learning rates[41] enjoyed by some technologies[42], has produced a positive cycle that is leading to significant cost declines. The levelised cost of electricity[43] (LCOE) is declining for on-shore wind, solar PV, concentrated solar power (CSP) and some biomass technologies, while hydropower and geothermal electricity produced at good sites are still competitive ways to generate electricity in many countries, even compared with fossil fuels (Figure 3).

27. It is important to note that levelised cost calculations make multiple assumptions, not least about capacity utilisation, and do not include the cost of managing variability. In practice, LCOE should be compared with the price of electricity (low under base load, high under peak load). There is currently a debate around how to re-think markets and technologies so that they pull in the same direction. As the share of variable renewables like wind or solar rises in electricity generation, integration challenges may need to be managed through increased power system flexibility, which could include investments in power storage, demand response, electric vehicles, and mandated back-up.[44]

28. Measures that increase grid flexibility and transmission capacity are keys to ensuring an efficient use of the intermittent renewable capital stock. Grid flexibility can be achieved through the use of dispatchable power plants, but also energy storage facilities and advanced grid management. Increased

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[38] http://energy.gov/articles/letter-secretary-steven-chu-energy-department-employees

[39] Market capitalisation refers to the total market value of all of a company's outstanding shares. Market capitalisation is calculated by multiplying a company's shares outstanding by the current market price of one share.

[40] National Renewable Energy Laboratory (NREL) (2012), '*Mobilizing Public Markets to Finance renewable Energy Projects: Insights from Expert Stakeholders*'

[41] The learning rate is the percentage reduction in costs for a technology that occurs with every doubling of cumulative installed capacity.

[42] Evidence of high learning rates is mixed when it comes to wind turbines, at least in the US. One recent paper finds such learning-by-doing is small and limited. See http://www.stanford.edu/~jwanders/Papers/Anderson_JMP.pdf

[43] The LCOE of a given technology is the ratio of lifetime costs to lifetime electricity generation, both of which are discounted back to a common year using a discount rate that reflects the average cost of capital.

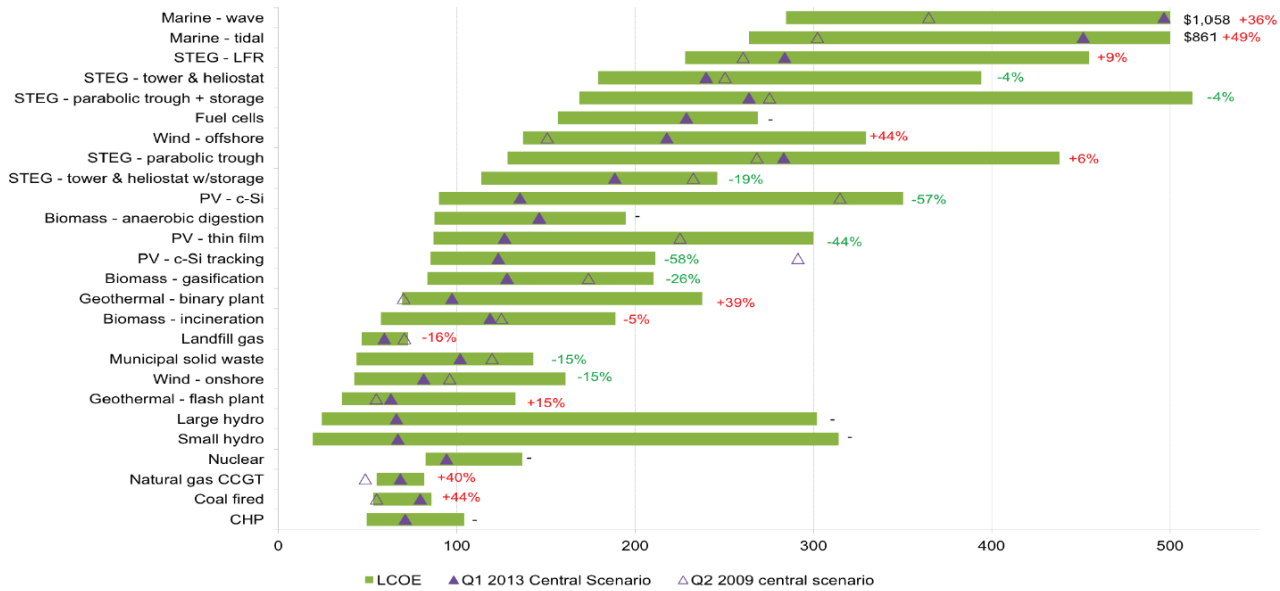
[44] For a more comprehensive discussion of these matters, the OECD reviews options for managing the intermittency of variable renewable power generation in Benatia, D., N. Johnstone and I. Haščič (2013), "Effectiveness of Policies and Strategies to Increase the Capacity Utilisation of Intermittent Renewable Power Plants", OECD Environment Working Papers, forthcoming, IEA (2012) Energy Technology Perspective, IEA (2011), Harnessing Variable Renewables 2011

transmission capacity through investment in high-voltage transmission lines allows for more efficient exploitation of widely-dispersed generation sources.

29. In addition, large market and balancing areas can reduce the cost of integrating variable generation, especially when these include different kinds of renewables generation. A larger balancing area can capitalise on geographic diversity and aggregate renewable resources, thereby helping to smoothen the variability of renewable energy power production per-unit and increase forecast accuracy as well as aggregate greater amount of variable generation and load.[45]

30. Cross-border trade of electricity can also play a role as it enables countries to gain access to a more diversified portfolio of plants (OECD, 2013b; IEA, 2012). Today's reality is that wholesale electricity markets sometimes see their prices driven down when surplus variable electricity is made available owing to favourable meteorological conditions — which partly benefits consumers, but hurts utilities and those renewable energy generators that are exposed to wholesale market prices. In this regard, the long-term electricity supply contracts for variable renewable energy will be a key element in providing revenue certainty for electricity generators.

Figure 3. Global levelised cost of electricity (LCOE), Q2 2009 vs. Q1 2013 (USD/MWh)



Source: Bloomberg New Energy Finance, Q1 2013 Levelised Cost of Electricity Update (reproduced with permission of BNEF). Note: LCOE excludes the effects of subsidies. Carbon Forecasts from the BNEF European Carbon Model with an average price to 2030 of USD 48/mt. Coal and natural gas prices from the US EIA and BNEF. Percentage change represents change from Q4 2012. PV = Photo Voltaic, c-Si = Crystalline Silicon, STEG-LFR = Solar Thermal Electricity Generation, Linear Fresnel Reflector, CCGT – Combined Cycle Gas Turbine, CHP = Combined Heat and Power

31. The end result of steep cost declines is that many types of clean energy are trending towards becoming competitive with other sources of conventional energy and therefore less policy dependent. Analysts at Deutsche Bank (2013), UBS (2013) and Macquarie have predicted that the global solar PV

[45] A balancing area is designed to control transmission flows and voltages, and ensure that frequency is held within the limits that ensure reliable operation of the power system (US Department of Energy, Solar Energy Technologies Programme, http://www1.eere.energy.gov/solar/pdfs/50059.pdf)

sector will transition from a subsidised market to a sustainable market by 2014, citing the arrival of "grid parity" in a number of key markets, unexpectedly strong demand and rebounding profit margins.

32. According to Deutsche Bank (2013), key markets such as India, China and the US are experiencing strong demand and solar projects are now being developed with minimal or no incentives. McKinsey (2012) states that the solar industry will enter a mature stage by 2015 where corporate success will be driven by competitive performance as opposed to subsidies, returns will 'normalise' and stable investment plans and supply side industries will coalesce. IEA estimates that over 2012-2018 solar PV generation should grow on average by 24% annually as capacity rises from 98GW to almost 310 GW. The spread of deployment to an increasing number of countries and the emergence of competitive market segments should guide strong deployment of solar PV systems (IEA, 2013).

33. Onshore wind power is even closer to commercial maturity, with many examples of unsubsidised wind power already competitive with conventional energy (in specific locations), and many projections of further technology evolutions and cost reduction (REN21, 2013). In some markets with good resources, the levelised cost of electricity (LCOE) for onshore wind is competitive or close to competitiveness versus new coal- and natural gas-fired power plants.

34. For example, in Brazil, onshore wind competes well with new gas-fired plants and other historically less expensive renewable sources, such as hydropower and bioenergy. In Australia, wind is competitive versus the generation costs of new coal- and gas-fired plants with carbon pricing, and the best wind sites can compete without carbon pricing. In Turkey and New Zealand, onshore wind has been competing well in the wholesale electricity market for several years. With long-term power purchase agreements (PPAs), onshore wind costs are approaching that of new coal-fired plants in South Africa. In Chile and Mexico, onshore wind competes – or is close to competing – with new gas-fired plants. In the United States, although onshore wind remains more expensive than new gas-fired generation, long-term PPAs for wind power can provide cost-effective hedges against rising fuel prices over the long term, even without federal tax incentives (IEA, 2013).

35. Offshore wind power is more expensive than onshore, but has large (although uncertain) potential for cost reductions, not just for turbines, but also for logistics and long-term operations and maintenance costs. However, overcapacity, demand and price declines and reductions in incentives in the global wind turbine market have caused enormous difficulty for manufacturers in recent years.[46] At the same time, there has been a large rise in resource costs between 2002 and 2008; prices for steel, cement, and aluminium from which wind towers are built (and all of which are highly energy-intensive) have risen between 200% and 300% (Grantham, 2013).

36. Most turbine makers suffered heavy losses in 2012, as margins shrank to barely break-even levels and new orders plummeted (BNEF, 2013c). Gamesa is expecting to report a net shortfall of about EUR 640 million in 2012 after one-time expenses of EUR 585 million from its cost-cutting programme which includes pruning offices and staff. Denmark's Vestas is also on a cost-cutting drive after having lost money for two years and 90% of its market capitalisation since 2008 as of March 2013. Asian manufacturers, which have traditionally enjoyed higher margins, are now experiencing margin convergence. Xinjiang Goldwind Science & Technology, China's biggest maker of wind turbines, saw its profits fall 75% in 2012 as turbine sales declined in its home market. Indian wind turbine maker Suzlon Energy reported a loss of 11.6 billion rupees (USD 212 million) in the last quarter of 2012 and failed to repay USD 209 million in what was India's biggest convertible bond default to date.

[46] Price declines and general volatility are normal features of a relatively young industry in a transition phase towards a sustainable end-state.

37. On the positive side, IEA points out that the diffusion of renewable power technologies continued in 2012, driven by increasing competitiveness. Hydropower and geothermal in areas with good resources are already generally competitive versus new fossil-fuel power plants. Large-scale bioenergy plants are also competitive depending on feedstock prices and availability, while co-firing with biomass in coal and gas power plants has increased. Levelised costs for other renewables generally remain higher than new fossil fuel generation; as such, these sources often require policy support to remain economically attractive. Yet the most dynamic technologies – onshore wind and solar PV – have reached, or are approaching, competitiveness in a number of markets without generation-based incentives, though the maintenance and continuing realignment of policy frameworks to support this diffusion will stay important (IEA, 2013).

38. Reflecting the positive outlook for the diffusion of renewable assets, project developers (as distinct from manufacturers) have managed to attract direct investments by institutional investors in recent years. In February 2013, AMP, an Australian pension provider, invested USD 100 million in the North American wind energy developer Capistrano Wind Partners LLC. Capistrano was formed in 2012 by another pension manager, TIAA-CREF (the feature of case study 2), Edison Mission Energy and Cook Inlet Region Inc. to develop and own North American wind energy projects. The company owns five operating wind farms in Nebraska, Texas and Wyoming with 413 megawatts of generating capacity.47 Institutional investors are increasingly significant financial investors in renewable energy project development in certain countries, although this dynamic has received relatively little attention. According to Scott Mackin, Managing Partner and Co-President of Denham Capital, over 50% of installed wind turbines in Europe are owned by institutional investors.[48]

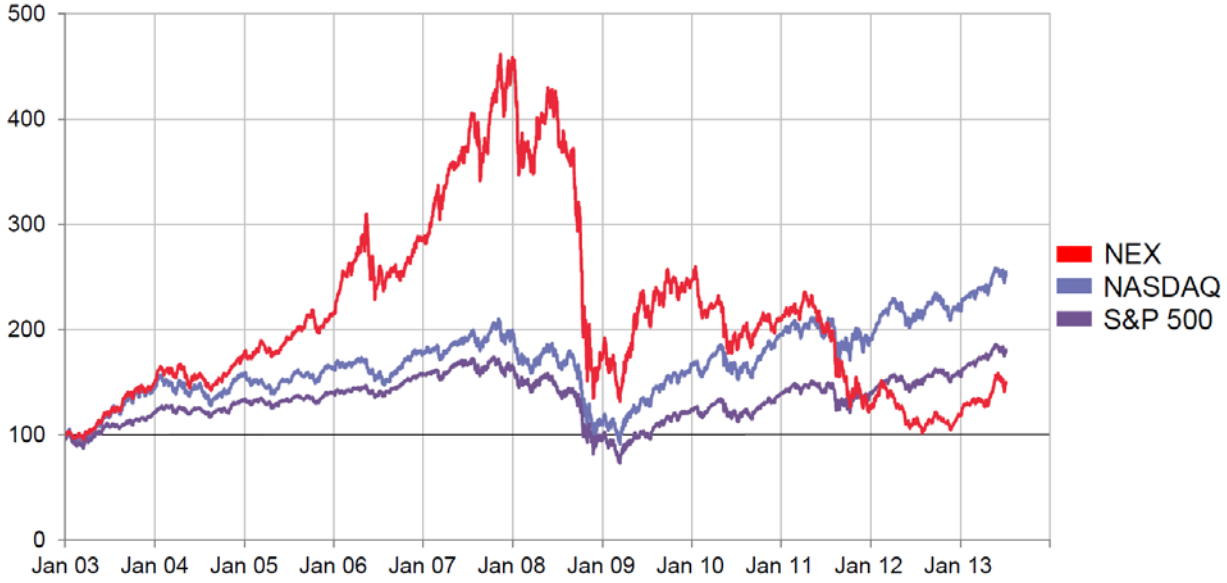
39. However, policy uncertainty in many markets has had a negative impact on investment and made many institutional investors question whether it makes economic sense in the long-term to build a team with the capacity to invest directly in green infrastructure. Some governments bear the cost of the feed-in-tariffs directly but in others, such as Germany, the costs are passed on to consumers. Some of the sudden shifts or uncertainties in support policies include the Spanish Federal Government's decisions to stop subsidies for any new renewable power projects not yet approved and, in 2010, the retroactive reduction of pre-agreed tariffs by 30%. The start-stop nature of incentives in the U.S. (such as the Production Tax Credit for wind, which has repeatedly been at risk of not being extended by the U.S. Congress) has also undermined confidence in the predictability of revenue streams for projects. Such policy shifts and associated uncertainty are likely to be adding to the interest rate required on debt issued to such projects from investors.

40. In 2011, the negative impacts of policy changes on project developers and losses in the manufacturing segment resulted in poor performance across the industry. The "bellwether" index for the renewable energy industry suffered a 40% crash in 2011.[49] The weak business performance of renewable energy sectors led to liquidity problems as well as falling share prices. This is in contrast to the NASDAQ and S&P500, which ended the year approximately where they started (Figure 4). As context, oil and gas company share prices have increased 17.2% since the inception of the NEX index in 2006 (which has fallen by 48% over this time). In general, the renewable energy industry has yet to mature in financial markets and the relative shortage of liquidity can make the share prices related to renewable energy industry more susceptible to market volatility.

[47] Bloomberg LP, "AMP invests $100 million in TIAA-CREF's wind power venture", February 13, 2013.
[48] http://www.cohnreznick.com/sites/default/files/2013energyreport/CohnReznickGreenEnergy2013.pdf

[49] The WilderHill New Energy Global Innovation Index (NEX) is frequently cited as an indicator of the strength of clean energy industry equity values

Figure 4. Green equities (NEX index) have underperformed in recent years



Source: BNEF; value as of 1 July 2013, NASDAQ and S&P500 rebased to 100 on 01 January 2003

41. Green indices are down because they include a disproportionately[50] greater number of non-diversified "pure play"[51] clean energy companies that have been most affected by the industry consolidation. Since clean energy share prices hit bottom in late July 2012, they have rallied some 28% according to the NEX. At the level of 130 points, it remains far below its November 2007 peak of 469. BNEF posits that the modest recovery in industry equity valuations may be a sign of the solar sector getting closer to the point where excess capacity gives way to something closer to a balance between supply and demand (BNEF, 2013c).

42. This backdrop contributed to a fall in value of listed green assets under management by around 34% in 2011. This was driven by falling share prices as investors redeemed shares in the funds. Compared with 2007 when there were 45 launches of new clean equity funds, in 2011 there were just three.[52] Funds in this area with green assets of more than USD 100 million lost on average around 31% of their value in 2011. The Guggenheim Solar Fund was the worst performer, declining 65% in value, driven down by the fund's biggest shareholding, First Solar, which fell 75% in value over the year (UNEP, 2012).

43. Early stage venture capitalists have also reportedly struggled to capture returns commensurate with their enthusiasm for the clean technology sector (Clean Energy Pipeline, 2012). In March 2013, Joseph Dear, the Chief Investment Officer of the California Public Employees Pension Fund (CalPERs) disclosed that their USD 465 million Clean Energy and Technology Venture Capital Fund had a -9.75% return.[53]

[50] The indices are "overweight" "pure play" companies, in financial industry terminology.

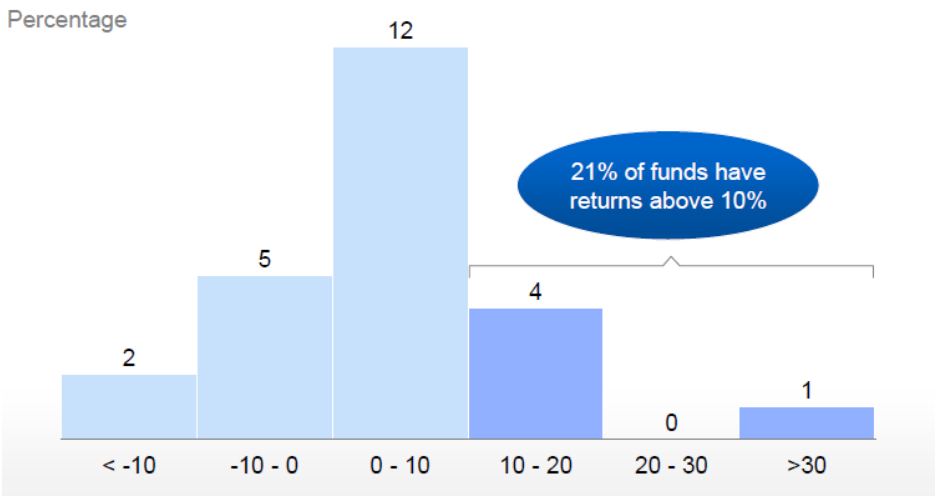
[51] Pure-play clean energy companies focus their activities exclusively in this sector and differ from more general energy or utility companies that have clean energy in their business lines.

[52] Note that this was a period of financial and economic crisis making overall fund raising particularly challenging.

[53] Siliconbeat, March 2013

44. Despite the massive decline in the NEX from 2008 to 2012, and the contrast to the significant gains achieved since 2009 in the S&P500 index, some analysts are optimistic about the future of green investment. The 2012 Deutsche Bank Climate Change Advisors (DBCCA) meta-analysis of over 100 academic studies of sustainable investing finds that sustainable investing can be a clear win for investors and companies, with superior risk-adjusted returns (2012c). Many fund managers have historically struggled to capture these benefits, but DBCCA states that there is compelling academic evidence that at the underlying security/market index level, the strong Environmental, Social and Governance (ESG) or Corporate Social Responsibility (CSR) factors are correlated with corporate financial outperformance both market and accounting based. Prequin (2012) points out that the top 20% of investors in green private equity funds have done very well as is the case for private equity investors in other industries (see Figure 5).

Figure 5. Distribution of Internal Rates of Return (IRR) of 24 Private Equity funds investing in green private equity



Source: Data from Prequin, 2012 Global Private Equity Report (2012).

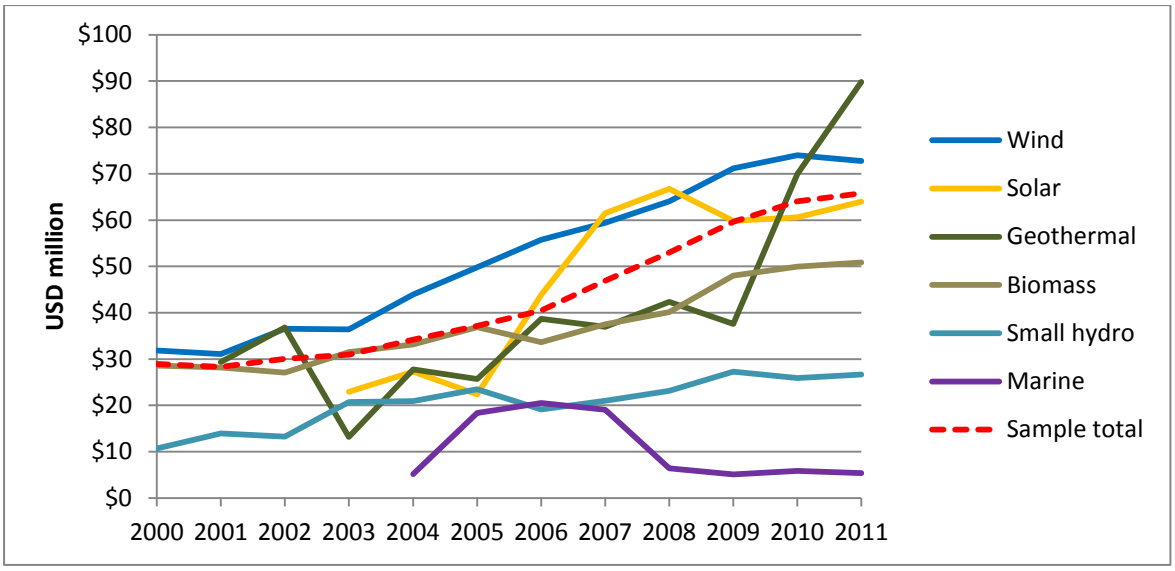
45. Another concern facing investors is that carbon pricing mechanisms, which under normal conditions should be a key driving force towards green investments, have in recent years faced persistently low price levels. Permit prices in the EU Emissions Trading Scheme (ETS) have fallen dramatically since a peak in 2008, mainly due to the Scheme's permit allocation system, in which allocations do not adjust to changing macroeconomic factors. While some would argue that this inbuilt flexibility is an important element of a market-based approach which has reduced the cost of the scheme to polluters, it has nevertheless led to an oversupply of permits which is expected to endure for several years. Reform measures are being discussed, aiming to alter permit supply in the short-term and tighten caps in the longer-term, whilst maintaining sufficient predictability to not further deter investors. However, these discussions have not significantly changed the EU ETS market outlook.

46. Despite these problems, emissions trading can be a key climate policy instrument for many countries. California's cap and trade program went live in 2013, with recent permit auctions clearing at around USD 13. Elsewhere, Quebec's cap-and-trade program is live and may soon link with California through the Western Climate Initiative, and South Korea is expected to make an announcement on the design of its cap and trade scheme that was passed by its parliament. China is also moving towards national carbon pricing, with the rapid implementation of seven pilot trading systems over 2014-2015. Significantly, California and Quebec all have incorporated mechanisms in their trading programs to ensure a minimum permit price that rises over time. Such mechanisms should strengthen the impact of the carbon

price signal on investment in renewable energy, particularly in situations where renewable energy generation is approaching or has reached grid parity.

47. Another promising dynamic for future investment in renewable energy is that the monetary value of average renewable energy asset finance deals has been increasing, which is an important factor for institutional investors with their large minimum direct investment size requirements. The average value of a (private) deal has risen over time starting from below USD 30 million in 2000 to almost USD 70 million in 2011 (in current prices) (OECD, 2013 forthcoming). On average, deal values are lowest in marine energy and highest in solar and wind energy, although in 2011 geothermal came first (Figure 6). The highest (private) deal values are in Spain, followed by the US and the UK.

Figure 6. Average value of asset finance deals by year and sector (3-year moving average)



Source: Using public policy to induce private finance for renewable energy projects: Evidence from microdata" (OECD, 2013 forthcoming). The Figure shows trends based on a sample of deals analysed therein.

Possible channels for institutional investment in green infrastructure[54]

47. There are wide differences in how institutional investors can access infrastructure investments, through debt and equity markets, indirect corporate investment through stocks and bonds, direct project investments, or investment through funds or vehicles as a bridge. It is therefore useful to illustrate the three principal channels[55] through which an investment can be made, the benefits thereof, the issues with scaling up and the target returns (Figure 7).

48. Analysis of the unlisted infrastructure investor universe indicates that investors can be segmented by size, governance capability and method of investment. Smaller, inexperienced investors are greatly

[54] While this overview of the role of institutional investors focuses strongly on renewable energy generation due to prior OECD research in this area, other significant areas of green growth investment include: energy efficiency in rental property portfolios; sustainable land management in farmland and timberland portfolios; climate smart agriculture; and investment in transport and water infrastructure.

[55] The OECD has described these channels in detail in (2012a, b *etc*).

reliant on and influenced by financial intermediaries for their investment decisions in infrastructure, including asset allocation and type of assets. Larger investors with greater in-house asset management capability will usually have a clearly defined investment mandate and benchmarks for infrastructure and deploy their capital accordingly. All investors in search of stable, predictable, low-risk returns must ensure that the underlying asset invested in through the various vehicles reflects the specific definition that they have associated with the asset class.

49. From an institutional investor perspective, the differences in the financial and market characteristics of these three channels have a profound effect on how the investments fit within the portfolio and how much of their portfolio they can dedicate to these investments. The debt side typically exemplifies the most secure tranche of investment, often guarantees a lower level of yield with limited upside, and the investment risk is primarily default risk and market price risk if listed. Equity exemplifies the high-risk, high-reward tranche of investment for investors seeking greater returns which also are accompanied by greater volatility and risk, particularly when there is added leverage. Investments in privately held renewable energy companies (i.e. private equity investments) entail no market risks, as there are no publicly traded shares. In addition, depending on how these investments are structured, volatility may be low as well. For example, when such investments are unlevered (i.e. not funded by borrowing), and when they combine investment in the renewable energy company's debt and equity, the mix would have higher risk and return than debt, but lower than equity (CPI, 2013a).

50. Corporate investment (indirect) involves investment in publicly traded shares (equity) or bonds (debt) issued by corporations active in the green infrastructure sector. This is the easiest investment channel for most institutional investors but has no connection to the infrastructure assets themselves. It therefore does not bring the associated benefits of direct investing (as described in Figure 7), does not necessarily contribute to directly[56] filling the investment gap, and does not necessarily help lower financing costs for green infrastructure, in contrast (potentially) with direct investment.

51. Utilities could serve as a vehicle for indirect investment in green infrastructure by institutional investors, but several obstacles exist. The scope for utility companies to expand their balance sheets to increase the capacity of investment in green infrastructure is constrained by the willingness of institutional investors (and others) to purchase new debt and equity issued from the utility companies. This willingness depends on fundamental considerations about the risk-return characteristics of new green infrastructure, as well as appetite for credit risk reflected in a utility's credit ratings. If a utility company increases leverage by issuing new bonds, this may increase its ratio of debt to equity and could weaken its credit rating, reducing the desirability of its debt to institutional investors.

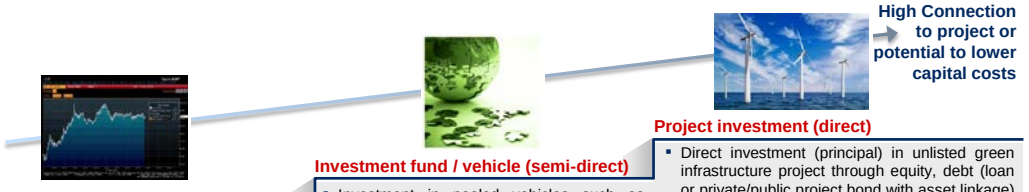
52. If a utility company wishes to issue new equity to fund extended development of renewables, investors will ask whether this will improve or dilute the company's earnings per share (OECD, 2012a). Low-risk, high-return projects may justify further capital-raising, while higher-risk projects (e.g. offshore wind) may not. If utility companies are to come to the market asking for large-scale new financing for renewable energy projects, the projects will have to offer investors the prospect of enhanced risk-adjusted returns. Currently, their balance sheets are under pressure and filled with existing portfolios of projects. What is needed is a way to recycle capital (i.e., gain access to new external sources of capital for

[56] 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. it may go to any number of internal purposes or priorities and not immediately or directly be used for the construction of any new green assets.

investments at the operational stage of projects, and thereby free up internal capital to finance new projects). One option to free up capacity is securitisation, as described in case study 4 (OECD, 2012a).[57]

[57] The depreciation of existing projects and plant does also provide a material level of capital for new investment

Figure 7. Channels for institutional investment in green infrastructure[58]



	Corporate investment (indirect)	Investment fund / vehicle (semi-direct)	Project investment (direct)
Low/No Connection to project or potential to lower capital costs			High Connection to project or potential to lower capital costs
Description	▪ Publicly listed equity / corporate bonds, funds, private placement corporate bonds / mezzanine finance.	▪ Investment in pooled vehicles such as infrastructure VC/PE funds that invest in companies (indirect) or projects (direct); asset backed securities; covered bonds; aggregator bonds; MLPs, REITs	▪ Direct investment (principal) in unlisted green infrastructure project through equity, debt (loan or private/public project bond with asset linkage) or mezzanine; PPPs and export order facilities
Benefits	▪ Highly liquid markets, low transaction costs ▪ Well understood investment by Iis, available investment research, established benchmarks, historical data ▪ Higher risk / higher return ▪ Easy access for even smallest Iis; investment managers as conduit	▪ Wide range of fund design and customization ▪ Liquid vehicles possible if listed with secondary markets for bonds, illiquidty premium if gated fund ▪ Well understood investment by Iis; ▪ Access for smaller Iis, aggregation benefits; private equity or asset manager as conduit	▪ Reasonably steady, lower risk, predictable returns with potential illiquidity premium of 1-3% for project fin debt (potentially more for equity) ▪ Direct link to (and control of) asset - potential to lower cost of capital ▪ Asset/Liability Matching (ALM); inflation hedge; lowest market β if held to maturity (protection from market volatility) ▪ Large deal size; some 'tag along' value for smaller Iis; hybrid equity structure can give bond-like payments
Issues to scaling up	▪ Few 'pure play' green infrastructure companies ▪ Low/no connection to project and associated benefits; scaling up won't lower cost of capital for green infrastructure ▪ Additional corporate and market securities risk (lower for debt) ▪ Sector diversification limits ▪ Smaller companies face ratings and index restrictions to issuance (particularly for debt) ▪ Increased issuances tied to balance sheet fund raising capacity	▪ High fees needed to support fund structure high transaction costs for bonds ▪ Difficult to structure liquidity in funds; low connection to project and associated benefits if liquidity offered; no secondary markets ▪ Traded funds take on market risk; portfolio & sector diversification limits; bonds need to secure adequate ratings; lack historical data ▪ Competition for capital within asset class; returns not as high/stable as traditional infra. ▪ Autonomous PE funds can create churn (buy/sell) and leverage risk – asset disconnect	▪ Short term investor horizons; illiquidity biases ▪ Iis need size >$50Bn AuM and dealflow to maintain costly team (with a few exceptions) ▪ Min $100M deal size; expensive and time consuming due diligence; higher transaction costs; competition for capital w/ other traditional infrastructure assets ▪ Lack of project pipeline; diversification restrictions and financial regulation illiquidity restrictions; tax incentive complications ▪ Traditional ALM may not recognize benefits; benchmarking difficulties; mark to market acct
Examples	▪ 02/11 BrightSource (US Solar Thermal) sold Series E preferred shares to **CalSTRS** after raising $150M Series D VC financing partly from CalSTRS and Alstom ▪ 04/12 Esval (Chilean water utility) sold $46M of inflation-linked corporate bonds to **Ontario Teachers' Pension Plan**.	▪ 01/10 **BT Pension Scheme** invested £75M in Hermes Private Equity ▪ 10/07 Dutch pension funds **ABP** and **PGGM** invested €500m in Ampere (private equity fund investing in wind parks and biomass projects) ▪ CRC Breeze Bonds (case study 4)	▪ 08/13 **PensionDanmark** invested $200 m in mezzanine finance to CapeWind Nantucket Offshore Wind ▪ 02/11 **PGGM** invested equity in Walney Offshore Wind (case study #2)
Target Return Range	**Target equity returns: 5-20% debt: 3-6%; actual returns N/A**	**Infrastructure fund target returns 7-20%+; actual returns: -51% to 106%**	**Project equity target returns 12-18% debt 6-10%; actual returns: -13 - 21%**

Source: OECD authors' analysis based on OECD (2012a) CPI (2013), DBCCA, 2011, 2012.

[58] Note abbreviations: Iis = institutional investors; VC/PE = venture capital / private equity; MLP = Master Limited Partnerships; REIT = Real Estate Investment Trusts; PPP = Public Private Partnerships; β = Beta, a number describing the correlated volatility of an asset in relation to a benchmark; AuM = Assets under Management.

53. Work by CPI (2013a) suggests that institutional investment in corporations (i.e. indirect investment) will do very little to change the current renewable energy financing dynamics, and therefore is unlikely to significantly lower financing costs for renewable energy *per se*.[59] Nonetheless, their study predicts that institutional investors could "easily provide corporations with all of the corporate equity and debt that corporations would then use to fund their share of renewable energy over the next 25 years". That is to say, there is potentially enough institutional capital in the world to finance the transition required indirectly through corporations if the share of investment in renewable energy projects coming from corporate balance sheets rather than project finance stays the same. But corporations make investment decisions based upon their own strategy and financial considerations, and furthermore as previously described with respect to indices, there are relatively few "pure-play" green infrastructure companies. Investment in pure play companies would very likely translate directly to increased investment in renewable energy projects, but investment in other companies will have a much more variable and unpredictable impact on renewable project investment. Scaling up capital provision in this manner therefore requires much further analysis and debate.

54. Direct infrastructure investments have a number of characteristics which can appeal to institutional investors. 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 linked to inflation could hedge institutional investors' liability sensitivity to inflation[60,61]. Another benefit of green infrastructure projects to institutional investors is that, if held through the life of the project, there should be low correlation of returns with the general market.[62]

55. Renewable energy and other types of green infrastructure projects that are 'bankable'[63] can offer a form of "pledgeable future income"[64] through stable and predictable cash flows, because renewable energy is not subject to fuel price volatility and is backed by long-term contracts with investment grade counterparts.[65] Wind and solar projects also have an estimated 25-year lifespan, with manufacturer

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[59] The cost of capital for corporations set by many market participants and the cost of capital for projects will be determined by the corporations' ability to manage project risks appropriately.

[60] OECD(2011e) *'Pension Funds Investment in Infrastructure: A Survey'*,

[61] 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).

[62] RARE (2009) describes the correlation between the MSCI Global equity index and infrastructure investments between 2002 and 2008. Listed infrastructure has a correlation of 0.65, while unlisted 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.

[63] Specifically, a project/technology that has obtained a high level of confidence from lenders and project developers and is at a suitably advanced stage of development to be ready to enter into commercial production.

[64] 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 yields on government bonds and those available on infrastructure.

[65] This may not be the case in developing countries.

warranties, long-term contracts with power purchasers (PPAs) and government support.[66] Most institutional investors seek long term certainty. In some electricity markets PPAs are standard for renewable energy and these can be particularly attractive if the counterparty is a utility with investment grade credit. In the United States, for instance, long-term PPAs with renewable power plants are often driven by state renewable portfolio standards, mandating utilities to buy a certain share of their power from renewables and encouraging long-term contracting.

56. As long-term investors, institutional investors also have interest in themes such as climate change which can have a long-term impact on economic growth, on which their investments depends, as in the long-term fundamentals drive investment returns. Case study 2 shows that TIAA-CREF's farmland investment in Brazil can be an attractive asset class for institutional investors due to the structural drivers of increasing demand for food and biofuel, the opportunity to diversify outside of public markets and the low covariance with other investments. For instance, direct investment in farmland for TIAA-CREF provides: (a) access to a key driver of food production, (b) excellent portfolio diversification given its low correlation to traditional asset classes like stocks and bonds, and (c) a hedge against inflation within a portfolio.

57. Since the financial crisis, numerous large institutional investors have developed in-house asset management capabilities and have made major direct investments in renewable energy infrastructure. This is described by academics as part of a larger trend occurring in the financial markets as a growing number of institutional investors with long-term horizons are attempting to bypass traditional financial intermediaries by "in-sourcing" asset management (Dixon and Monk, 2013).

58. The traditional institutional investor was almost entirely outsourced, rarely possessing the expertise and competencies to execute even the most basis financial transactions without the help of some external advisor. But, over time, the extended chain of principal-agent relationships became problematic. In particular, the injection of new incentives and motivations at each link of the chain served to distort the original motives of the asset owners. Too often the ultimate investment decisions made by asset managers maximised the utility of the asset managers and not the asset owners (Clark and Monk, 2012). The global financial crisis has heightened dissatisfaction among many institutional investors with some of the existing institutions of finance and investment due to the perceptions of misaligned incentives, high fees, poor returns and short-termism embedded in certain third-party management agreements. The ways in which large investors have traditionally deployed assets are being remade, and co-investment vehicles are expected to play an increasingly important role in the new era of institutional investment (Bachher and Monk, 2013).

59. In addition to allowing investors better control of the cash flows from a project and exit from the project while avoiding the two-and-twenty fees charged by investment managers, the direct investment of institutional investors in green infrastructure is also cited as being significant because they may be able to provide capital at a lower cost than alternative sources, thereby lowering the weighted average cost of capital (WACC) of green infrastructure projects if financing is scaled up (CPI, 2013a). This is based on the key assumption that the alignment of institutional investors' unique characteristics with the desirable attributes of infrastructure creates a "value gap", making this type of investment more valuable to institutional investors than to the rest of the market. In theory, if enough institutional investors are willing to take a lower return and provide capital at lower cost to projects and they compete amongst each other, then there is the possibility that they will collectively bid down the cost of capital. The lower the cost of capital, the more likely it is that longer-term and inherently risky projects pass the hurdle rate and get

[66] 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.

financed. As lowering the cost of capital for green infrastructure is a goal of many countries, these issues may warrant further exploration and analysis.

60. In general, making direct investments in projects is difficult and resource intensive. It can be 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. While direct investments should have higher risk-adjusted returns than investment in publicly traded shares or bonds, the additional return must be high enough to justify both the higher transactions costs and the possible illiquidity of the investment (OECD, 2012a, CPI, 2013a). For example, CPI (2013a) suggest around USD 50 billion of assets under management are required to justify building a dedicated management team, focussed on renewable energy investments. Clark et al (2011) estimate there to be approximately twenty established direct institutional investors in the market.

58. CPI (2013a) suggests that globally there are around 45 pension funds and 70-100 insurers large enough for direct investing, representing USD 25 trillion in assets under management. When such teams are formed, investors may prefer direct equity investment to generate the higher returns to justify the costs of the team, though only a small number of large pension funds (only as many as 45) have significant capacity for undertaking direct investment in green infrastructure projects, but several investor groups have been established to pool their information and knowledge, and to engage with governments (see Box 3). For pension funds, one of the most significant costs of direct investment is the bidding process for the asset which is a time and resource consuming process especially if the pension fund loses consecutive bids, the costs can add up precipitously.

59. Traditionally, institutional investors diversify their investment portfolios in order to lower the risk and avoid excessive exposure to any single sector, theme or trend. At the portfolio management levels, institutional investors often explicitly or implicitly establish maximum sector limits. As a result investors tend to keep their portfolios close to benchmarks[67], unless they have a high conviction that a particular sector will outperform. Therefore, investors are likely to stay near renewable energy sector weights unless renewable energy investment proposition is made extremely attractive relative to other sectors (CPI, 2013a).

60. As CPI (2013a) and OECD (2012a) illustrate, pooled investment vehicles or investment funds can fall anywhere in between corporate investment and direct project investment.[68] These structures are significant for a number of reasons. On the demand side they can offer access to smaller investors without the expertise in project risk assessment and due diligence, to those investors with liquidity or diversification constraints. On the supply side, they are scalable if successful, could aggregate small scale projects to the size where they become attractive to large investors with minimum investment requirements or combine with public capital (first loss provisions) to alter risk and return profiles.

61. So far, the experience with pooled investment vehicles (in infrastructure investment generically) has been mixed, with institutions complaining about high fees and the uncertain cash flow profiles on offer. As Sharma (2013) discusses, the model has drawn criticism because of complex financial structures including high levels of debt and potential overpaying for assets in order to inflate fees payable by investors. In the infrastructure market, some funds paid dividends and fees greater than the total profits of

[67] In fact many long term investors do not use benchmarks in this way – but with investors with a shorter time horizon the use is almost universal.

[68] A Green Paper released by the European Commission in March 2013 stated that the Commission has committed to make proposals on possible forms of long-term investment funds as a vehicle helping institutional investors with diversification and risk spreading.

the companies invested in, i.e. paying dividends out of new debt (Hall 2009, RiskMetrics 2008, O'Neill 2009). These excesses were exposed with negative consequences by the 2008 global financial crisis. At least eleven infrastructure funds that were listed on the Australian Stock Exchange in 2007 are no longer listed (RiskMetrics, 2008).

62. The fees charged by managers have sometimes been excessively high, resembling private equity fees, despite lower returns. This has typically involved a base management fee of 1 to 2 percent and performance fees of 10-20 percent, with an 8 to 12 percent hurdle rate (Inderst, 2009). This is exacerbated by the addition of another layer of transactions or intermediaries with high costs of doing business, resulting in a loss of opportunity to reduce financing costs and a bias to the higher-margin end of the business that may not be where institutions can really have an impact. Investors have also been concerned over the short time-horizon of fund managers, with most funds offering closed-end models around 10 years. In a recent survey of investment consultants by data provider Preqin (2011) it was found that management fees and other fund terms and conditions were the greatest concern for investors in the infrastructure asset class.

63. In fund design, there appears to be a trade-off between liquidity and connection to the underlying project and the associated benefits sought by direct investors. A fund which offers liquidity to investors has to be able to free up capital by selling assets or through other means if an investor wishes to withdraw capital quickly from the fund. This is problematic as it can reduce the connection to the underlying project cash flows or introduce funding liquidity as a risk variable for investors. New fund designs could offer a better connection to the underlying assets — for instance by offering a "buy and hold to maturity" strategy, where the fund agrees to hold an asset for its life in order to deliver predictable cash flows — but this would need to be accomplished without sacrificing their ability to offer liquidity.

64. In 2012, the Real Asset Energy Fund (RAEF) III was launched with exactly this goal. By March 2013 it had raised EUR 100 million from pension funds and Sovereign Wealth Funds (out of a EUR 500 million target). As per its investment description, RAEF invests in one class of Real Assets (power plants generating energy from renewable sources), and hold the assets until the end of their industrial life (typically 20 years). The Fund aims to invest in 25-30 medium sized power plants in 5 to 6 key strategic markets (including Germany, USA and Italy) to diversify risk and optimize returns.

65. Investments are focused mainly on fuel independent, mature technologies (such as wind and solar) that have stable revenues and limited operating complexity. RAEF's team "actively manages the assets" to obtain a stable flow of distributions that will be passed on to investors and aims to pay an annual dividend of 8-10% whilst protecting the principal investment, which will be returned to investors through the Fund's life. Due to its long term strategy RAEF claims it is not forced to sell assets after 7-10 years therefore is almost entirely uncorrelated with the market. Importantly, RAEF also offers an annual window of liquidity to meet unexpected needs of investors over the 20-year period.[69]

Box 3. Institutional Investor Initiatives

The Global Investor Coalition on Climate Change (GIC) is a global coalition formed in December 2012 by the four

[69] Recently, new pooled vehicles have been launched. In the US in July 2013, a unit of utility NRG Energy raised $431m in an initial public offering priced above its target range, with a business plan to own wind, solar and natural gas-fired plants. In Canada, in August, TransAlta Corporation raised CAD 200m via the sale of its renewables offshoot, a "yieldco" entirely made up of operating projects backed by power purchase agreements, in order to lure institutions. London has seen fundraisings aimed at institutional investors such as, Greencoat UK Wind harnessing GBP 260m in March in an IPO, then Bluefield Solar Income Fund raising GBP 130m in July.

regional climate change investor groups IIGCC (Europe), INCR (North America), IGCC (Australia and New Zealand) and AIGCC (Asia). The coalition represents the international investment community on climate change policy and investment issues at a global level. The GIC represents 285 investors with more than USD 22.5 trillion in assets under management and stresses the urgent need for policy actions which stimulate private sector investment into climate change solutions, create jobs and are essential for ensuring the long-term sustainability and stability of the world economic system. As their collective action for the UN climate change conference (COP18) in Doha, they issued an open letter calling for a new dialogue with the governments of the world's largest economies on climate policy and the development of workable frameworks that will reduce climate risk and support low carbon investment.[70]

The Asset Owners Disclosure Project (AODP) is an independent global not-for-profit organisation whose objective is to protect members' retirement savings from the risks posed by climate change. It is aimed at protecting them by helping funds to redress the huge imbalance in their investments between high-carbon assets and low-carbon assets through improving the level of disclosure and industry best practice. AODP released the first survey result report of the climate risks held by asset owners, where the survey was sent to the world's largest 1 000 asset owners including pension funds, insurance companies and Sovereign Wealth Funds (SWFs), (over USD 60 trillion of asset under management) in late 2012. The AODP argues that an average of over 55% of a portfolio was invested in high-carbon assets or sectors greatly exposed to climate change physical impacts and climate change-related regulation, and that the only realistic method for asset owners to manage climate risks is to hedge their portfolios by investing in low-carbon assets so that when carbon is re-priced, either directly or indirectly, the destruction of value in their high carbon investments is offset by an increase in value in their low-carbon investment. [71]

ClimateWise is a global insurance industry's leadership group to drive action on climate change risks and its initiative was launched in 2007. Its purpose is for insurers to work together to respond to the myriad risks and opportunities of climate change and reduce the overall risks faced by economies and societies. There are now over 40 insurance companies and organisations who have signed up to this initiative and its membership extends as far as Asia, Europe, North America, and Southern Africa.[72]

The United Nations Environment Program Financial Initiative (UNEP FI) is a global voluntary public-private partnership between UNEP and the global financial sector established in 1992. The partnership includes around 200 banks, insurance companies, fund managers and other categories of financial institutions, all working together to understand the links between sustainable development considerations and financial services, in order to maximise mutual positive impacts. The purpose of the initiative is to identify, promote, and realise the adoption of best environmental and sustainability practice at all levels of financial institutions operations.[73]

The United Nations-backed Principles for Responsible Investment (PRI) Initiative is an international network of investors including asset managers and investment managers, who work together to put the six Principles for Responsible Investment into practice. Its goal is to understand the implications of sustainability for investors and support signatories to incorporate these issues into their investment decision making and ownership practices. The PRI count as signatories around 1,200 institutions (asset owners, investment managers, and professional service partners) managing more than USD 34 trillion in assets.[74]

In addition, there has been a growing movement in the U.S. calling on universities, colleges, and city governments to divest stocks of companies contributing to climate change. Some endowments including Hampshire College as well as the City of Seattle's pension fund have announced plans to change their investment approach by divesting their endowments to help to serve environmental goals.[75]

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[70] http://globalinvestorcoalition.org/wp-content/uploads/2012/11/2012-Global-Policy-Letter-Press-Release-FINAL.pdf

[71] http://www.climateinstitute.org.au/verve/_resources/AODP_Global_Climate_Index_2012_Report.pdf

[72] http://www.climatewise.org.uk/about/

[73] http://www.unepfi.org/about/index.html

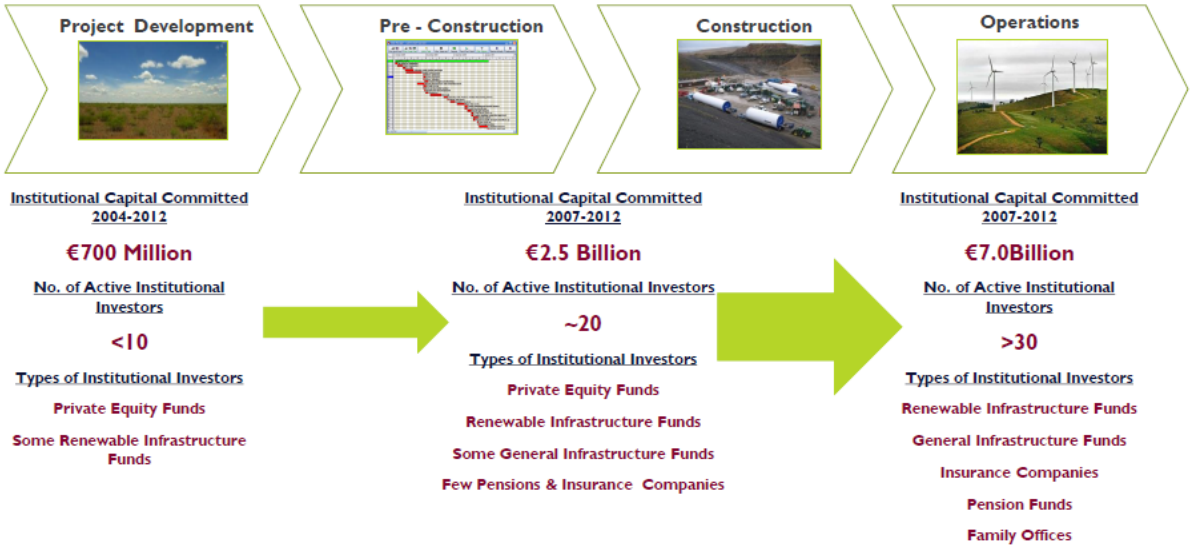
[74] http://www.unpri.org/news/pri-fact-sheet/

[75] http://www.theguardian.com/environment/2013/apr/25/us-cities-climate-divestment-fossil-fuels, http://www.bloomberg.com/news/2013-06-05/fossil-fuel-divestment-difficult-for-schools-yet-alternatives-exist.html

66. The principal objective of institutional investors is to provide services such as pensions and life insurance at reasonable costs, with a very high degree of certainty. Thus these investors must maintain appropriate levels of liquidity, transparency, diversification, and risk to maintain this certainty. Financial regulation codifies these requirements, and in so doing may limit direct investment or in other ways impact direct renewable energy investment (CPI, 2013a).

67. Risks, returns, and policy impacts vary across the lifecycle of renewable energy projects. Therefore, it is important not only to describe the investment channels, but also the stages along a project cycle where institutional investors can participate (Figure 8). A project typically has the highest risk at the beginning, during the development phase. As a project passes certain key milestones, it gains more certainty and the risk diminishes. PCCP (2012) points out that capital flows follow an inverse path. The beginning of a project requires a relatively low level of investment, with the majority of capital deployed during the construction phase. Once the project enters operation, cash flows stabilise and risks are significantly reduced. Depending on the technology and country the timescales for development and construction vary significantly ranging from as little as a few months to over 7 years (PCCP, 2012).

Figure 8. Stages of a renewable energy project and investor appetite



Source: Hg Capital: "Institutional investor trends and regulatory risk" B20 investments and infrastructure Taskforce Presentation, March 2013.

68. During project development, capital is generally in the form of equity and typical investors at this stage include private equity funds, utilities and developers' own capital. Very few institutional investors have directly participated in this stage other than through specialist funds. Construction finance is typically a mix of equity and debt, usually in the form of bank loans. Institutional investors are generally not very well suited to bear construction or technology risk at this stage although some with well-developed direct investment teams have.[76] Before a project enters the construction phase, it is not unusual for the developer to sell it to other entities such as utilities and private equity funds that provide the construction equity.

[76] The construction phase is characterised by the absence of revenues for the project – this could be overcome by issuing bonds with deferred coupon payments – in essence these would be forms of deferred term annuities if amortising.

69. Infrastructure projects have traditionally been financed with significant leverage. However, there is an increasing trend to unleveraged investments, particularly in view of banking market developments. The theory here is that investors need both equity investments to provide return-enhancement and debt for liability-matching with longer-term, stable cash flows.

70. Unlevered equity is, essentially, a recombination offering both characteristics of equity and debt to investors who are only interested in steady cash-flows, taking advantage of the cheaper alternative financing which avoid higher costs associated with issuing debt and preferred equity. Thus, since the investor has already assessed the investment, by buying unlevered equity, they get both types of assets, but with lower overall transaction costs, as well as a lack of both structuring costs and risks that their investment in the equity or debt will be adversely affected by the demands of the other investor group. Equity providers at this stage are infrastructure funds, utilities and institutional investors (PCCP, 2012). At this stage, project bonds may be issued for several reasons including to secure lower-cost financing with a fixed interest rate, to refinance higher-cost debts at lower rates for the long term, and to reduce the refinancing risk associated with rolling over short-term commercial loans (BNEF, 2013b).

71. Traditionally the project bond markets have been dominated by privately placed issues, meaning that project bonds are not sold directly to retail investors, but rather to qualified institutional investors (BNEF, 2013b). This offered potential investors and borrowers little visibility or opportunity to learn and replicate investment structures and financial arrangements, for example through the availability of prospectuses.

Institutional investors, bonds and green growth

72. Traditionally, bonds have been the dominant asset class favoured by pension fund managers in the OECD, making up on average around 33% of portfolios.[77] As an indication of the potential of this asset class to institutional investors, in 2012 the total amount of capital held in global bond markets owned by all types of entities (banks, retail investors, etc.) was around USD 78 trillion.[78] Consequently, much attention has been focused on the potential to develop the use of fixed-income vehicles to support greater institutional investor participation in green growth investments.

73. A challenge has been the perceived risk associated with renewable energy and other climate-change-related investments. While some climate-change-related investments, such as mass transit or rail, are well-established investment classes with solid ratings levels, most, like renewable energy, suffer from a relative lack of track record. Combined with uncertainty about public subsidy regimes — exacerbated by retroactive changes to Feed-in Tariffs in countries like Spain — this has led to sub-investment grade ratings and low interest from general investors. While this has begun to change in OECD countries, with a number of renewable energy bond issues reaching low investment grade levels, rating levels remain an issue in emerging markets. Moreover, the lack of familiarity of the investors implies that they will need to hire specific resources that are capable of evaluating the technical risks associated with renewable energy projects.

74. 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

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

[78] Bank of International Settlements Quarterly Review, 2012. http://www.bis.org/publ/qtrpdf/r_qt1212h.pdf

while obtaining risk-adjusted returns. Green or climate bonds are broadly defined (OECD 2012d) as fixed-income securities issued (by governments, multi-national banks or corporations) in order to raise the necessary capital for a project which contributes to a low carbon, climate resilient economy.

75. Green bonds involve the issuing entity guaranteeing to repay the bond over a certain period of time, plus either a fixed or variable rate of return. They can be asset backed securities[79] tied to specific green infrastructure projects or plain vanilla "treasury-style" bonds issued to raise capital that will be allocated across a portfolio of green projects (such as the World Bank's issuances). One principal advantage of these products as opposed to loans is that an issue with a longer tenor than in the loan option can be structured. Additionally, investors may have greater recourse to the underlying assets in some cases.

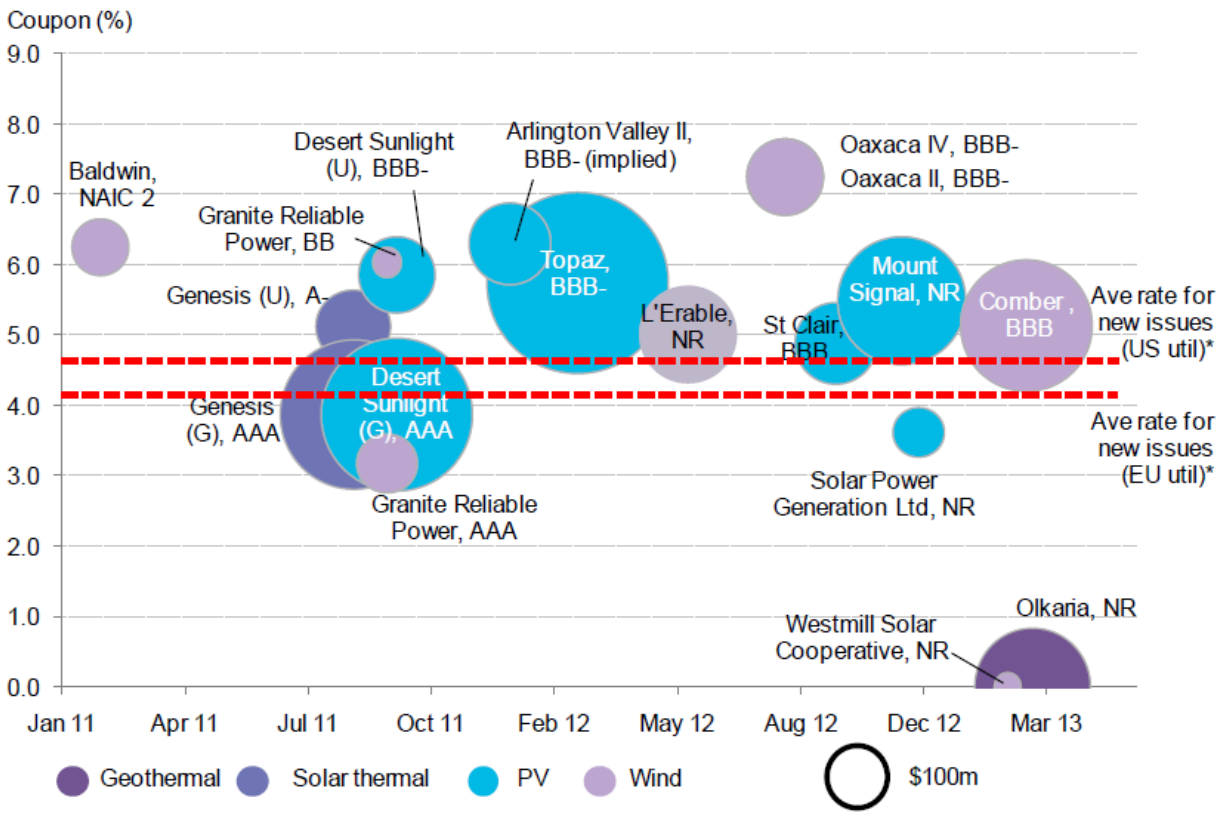
76. An HSBC and Climate Bonds Initiative analysis estimates that there were USD 174 billion of outstanding bonds in 2012 that should be post-facto included in a climate change universe; the 2013 estimate marks a significant expansion to USD 346 billion, of which USD 163 billion are of the investment-grade benchmark-type with issuance sizes of greater than USD 100 million. BNEF (2013b), using a different equity-based methodology, estimates USD 230 billion in 2012. Such bonds have been issued by a variety of institutions including private corporations, governments and financial institutions. The multilateral development banks including the World Bank, European Investment Bank, Asian Development Bank have been particularly active in this area, as have the United States government and South African state-owned financial institutions through its offering of a tax-effective 'green bond' vehicle for investors.

77. With US, German, Japanese and UK 10-year government bond yields all at or below 2%, and weak economic growth in many OECD countries, alternative asset classes are increasingly being looked to as vehicles to meet risk-return investment requirements and green growth aspirations (UNEP, 2012a; OECD, 2012d, 2012e).[80] The still nascent green project bond market has developed along an entire yield spectrum offering institutional investors varying levels of risk-adjusted returns and terms to choose from.

[79] Asset backed or securitised bonds are similar to ordinary bonds but have specific assets whose revenues pay the interest and principal. An ordinary bond's payments are generally guaranteed by the company that issues them. In asset backed or securitised bonds a set of revenue generating assets are put into a special purpose company and these assets pay the bond holder their interest and principal.

[80] For example, see Copenhagen Infrastructure Partners, an €800 million fund established by PensionDanmark to invest in energy-related assets http://infrastructurepartners.dk/ is part of PensionDanmark's push to have 10% of all its assets allocated to renewable power projects. Pension funds have also invested in equity through listed funds. For example, over half the money raised in the EUR330 million Impax New Energy Investors II fund Impax by Asset Management, was bought into by UK pension funds.

Figure 9. Coupons and offering size for clean energy project bond issuances, 2011-present

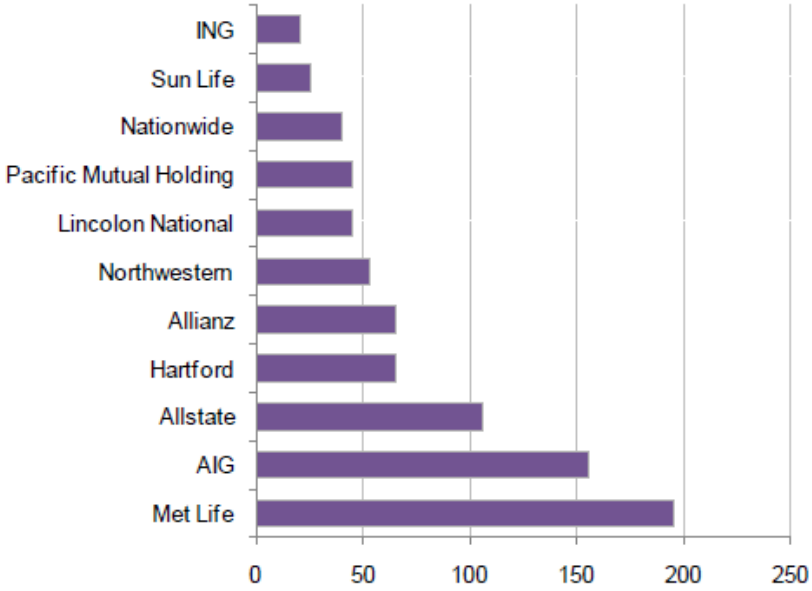


Source: BNEF (2013d).

78. BNEF (2013b) identifies a USD 7 billion market for green project bonds[81] which have been predominantly invested in by insurers and some pension funds. Figure 9 shows that the top 10 disclosed investors of clean energy project bonds have been North American insurance companies. While insurance companies appear to be the dominant purchasers of the debt, the recent bond issuance for the Oaxaca Wind projects, the first renewable issues from Mexico, attracted a mixed group: 61% pension funds, 27% life insurance companies, 12% private banks and hedge funds. Since 2011, clean energy project have issued USD 4.1 billion through privately placed bonds, including USD 1.9 billion in 2012. Asset financing for clean energy accounted for 13% of asset financing across all infrastructure sectors.

[81] The private placement bond market represents only a part of the private placement debt market which includes loans, promissory notes, debentures, etc. Note that these numbers here include only a portion of the private placement debt and the actual figure for renewable energy debt investment by these investors could be very much higher.

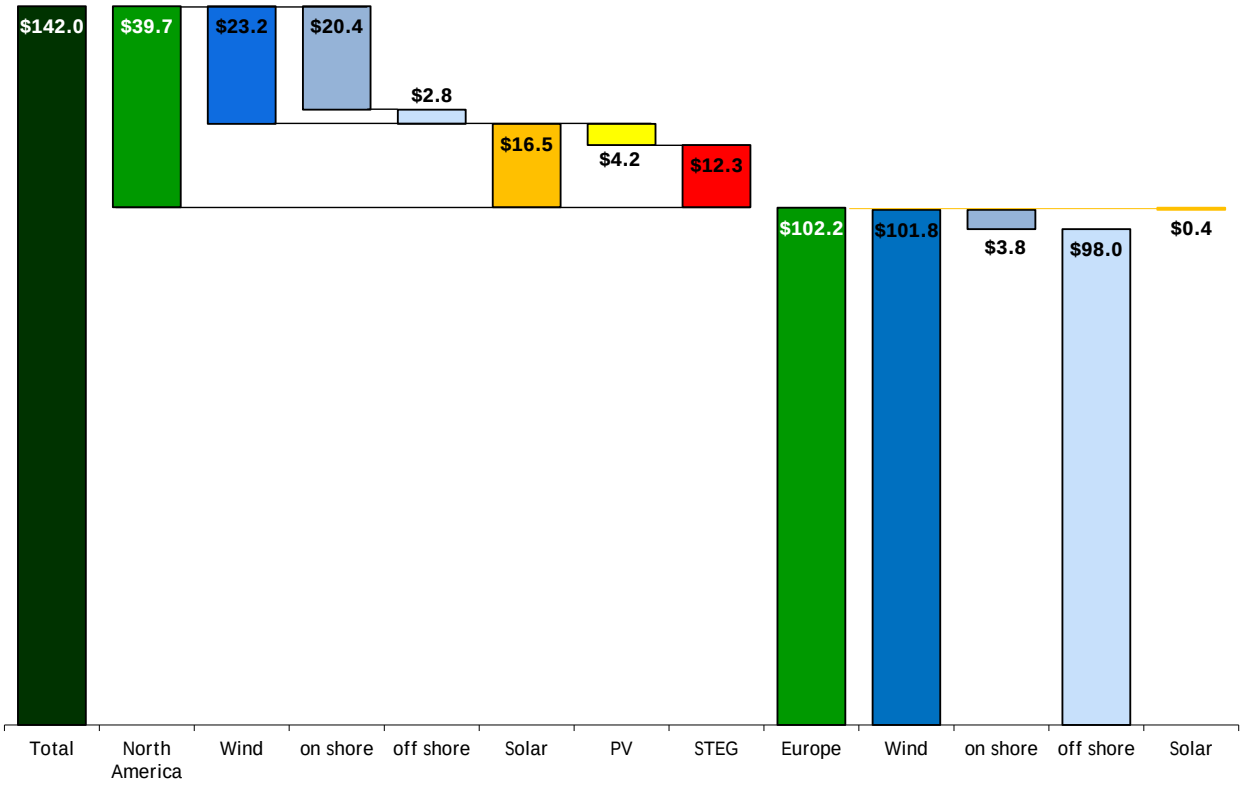
Figure 10. Top disclosed holders of clean energy project bonds since 2011 (USD Millions)



Source: Bloomberg New Energy Finance (2013).

79. As part of its green bond market analysis, BNEF identifies a pipeline of 225 projects in Europe and North America that may be suitable for bond offerings in the near future, amounting to USD 142 billion for potential institutional investments across North America and the EU. This means that at a current market size of USD 7 billion, project bonds have only begun to scratch the surface in terms of their potential for engaging institutional investors. On the other hand, this USD 142 billion figure is significantly lower than the USD 1 trillion of additional finance needed each year to address infrastructure development and climate change goals.

Figure 11. Clean energy project bond pipeline



Source: OECD chart and analysis based on BNEF data file.

Landscape of institutional investors

80. 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 in the world, which can make a difference in terms of the channel they would choose for investment in green infrastructure. In the US and Canada, the pension fund landscape is characterised by some large institutions, and many small diverse funds. Over half of large pension funds (with over USD 50 billion in AuM) are in the US and Canada and their assets represent around a quarter to one fifth of global pension holdings. It is estimated that the pension funds in North America have greater potential in terms of the assets available for project equity than the European pension funds (CPI, 2013a). On the other hand, the insurance industry in North America is dominated by a small number of large insurance companies, but the total assets of insurance companies is less than that of European insurance companies (OECD 2013a).

81. In Europe there are fewer large pension funds and smaller total assets in pension funds than in North America. The exception is the Netherlands where the 3 largest pension funds represent over a half of the total assets managed by pension funds larger than USD 50 billion in assets in Europe. However, UK funds have more of an appetite for direct investing than equivalent-sized US funds. In contrast, insurance companies in Europe are based in a wider range of countries. It is estimated that insurance companies have greater potential than pension funds in terms of assets available for project equity and debt (CPI, 2013a).

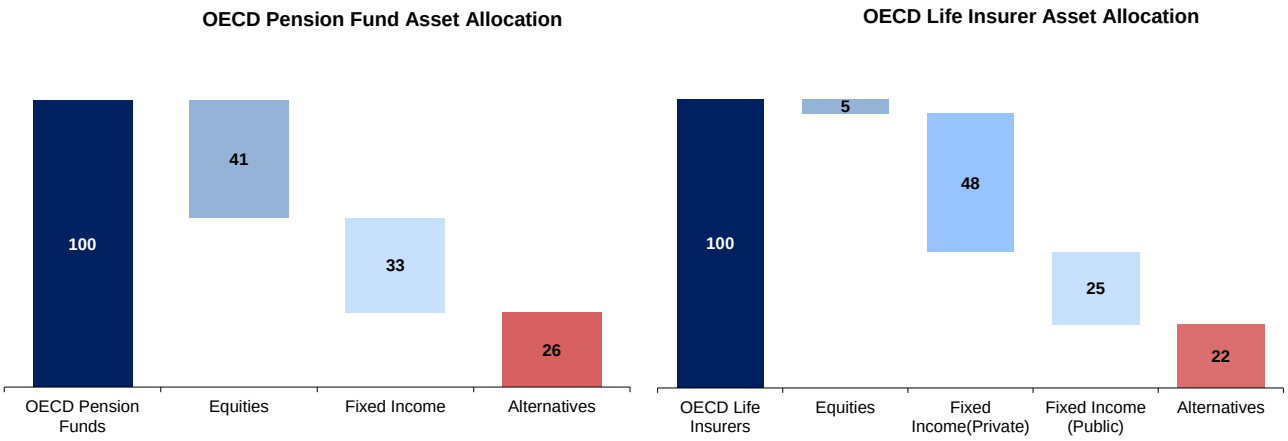
82. In the Asia-Pacific region, Australian superannuation funds have actively allocated to infrastructure investment through infrastructure funds rather than direct investment. In Japan, most of

pension assets are in a handful of public and corporate pension funds. The insurance market in Japan is also dominated by relatively small number of insurance companies.

83. The investment strategies of institutional investors differ significantly across countries. Asset allocation is influenced by a variety of factors, such as market trends, investment beliefs, regulation, risk appetite, liability considerations, cultural factors, governance structures, tax issues and ultimately domestically available assets.

84. Traditionally, institutional investors have been seen as sources of long-term capital with investment portfolios built around the two main asset classes (bonds and equities) and an investment horizon tied to the often long-term nature of their liabilities. However, over the last decade there have been major shifts in investment strategies. In particular, there has been a marked decline in allocation to listed equities, while investment in bonds and so-called alternative assets classes has increased substantially. [82]

Figure 12. Percent (%) asset allocation of institutional investors in OECD (2011)



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

85. Investors' exposure to alternative assets continues to grow, extending a long-established trend and reflecting the growing appetite among pension funds for diversification, their search for yield and the attraction of valuation methods for unlisted assets. Institutional investors have been increasing allocation to alternative assets such as hedge funds, real estate, and private equity and, most recently, infrastructure, including 'green infrastructure'.

86. In the UK, the Government is aware of the opportunity and is engaged with institutional investor representatives to try to create the right conditions to bring institutional funding to project financings. For example, in July 2012, the Treasury announced a GBP 50 billion guarantee scheme to back infrastructure projects in the UK. Some of the UK's largest pension funds, including BAE Systems Pension Funds, BT Pension Scheme, and the Railways Pension Scheme, joined forces in 2012 to invest directly in infrastructure, becoming founding members of the Pensions Infrastructure Platform to help gain better access to the asset class. The platform aims to raise GBP 2 billion to invest in projects free of construction risk and will launch in Q3 2013.

[82] OECD (2013a), '*The Role of Banks, Equity Markets and Institutional Investors in Long-term Financing for Growth and Development*'

87. In some cases greater allocations to green infrastructure can enable institutional investors to achieve risk adjusted returns (See Box 4). Despite the turbulence in the financial markets in 2012 PensionDanmark, for instance, was able to achieve a record-high yield of DKK 12 billion (EUR 1.7 billion). Their investment profile focused strongly on investments in real estate and stable alternatives including wind farms, and bank loans and export credits to those farms in order to make the portfolio more robust at a time when listed markets were extremely volatile. The fund has a strategic asset allocation of 16% to stable alternatives for 2013, including 8% in property and 8% in investments in infrastructure and sustainable energy.

Box 4. UK Environment Agency Active Fund[83]

The UK Environment Agency Active Fund has nearly 22,000 members and assets of almost GBP 1.9 billion. It was the first fund in the Local Government Pension Scheme (LGPS) to join the United Nations Principles of Responsible Investment in 2006. It was also the first UK pension fund to produce a Responsible Investment Review in 2009.

The Active Fund's 2012 Annual Report and Financial Statement show its investment performance was +5.1 % almost double the average (+2.6%) of the other 89 LPGS funds, and over the last 3 years its annualized performance was +16.1% or 1.6% more than the 14.5% average of the other funds.

The Active Fund sets its future investment objective of aiming to continue to de-risk where possible, and maintain and develop the Fund's reputation as financially and environmentally responsible investor. It is based upon the belief that it has a fiduciary duty to take account of financially material environmental risks and opportunities that could affect its current and future investment returns, such as climate change.

On the basis of the view that climate change puts the portfolio of the funds at risk, the Active Fund's investment strategy is designed to improve its risk-adjusted returns, enhance diversification, make as effective use as possible of its assets, provide flexibility to meet the challenges of difficult economic conditions, and strengthen the fund's commitment as a long-term responsible investor. In order to improve the fund's funding positions and reduce the fund's vulnerability to climate change, the Active Fund has decided to: adopt a more flexible approach to the Active Fund's asset allocation; to target a broader and better spread of investments, including an increased allocation to real assets; and to seek to improve risk-adjusted returns within equities.

The new asset allocation includes reducing the fund's passively managed public equities and gilts, increasing actively managed corporate bonds, and increasing alternative investments, particularly real assets via sustainable property, infrastructure, and farmland/forestry. This asset allocation change is expected to assist the Active Fund to move towards its target that by 2015 some 25% of the fund will be invested in the green economy. They estimated that as of 31 March 2012, the fund has nearly GBP 250 million invested in clean technology or around 13% of the fund.

In terms of their internal operations, they have set out the Environment Overlay Strategy (EOS), which provides guidance to the team and service providers in every asset class from property to private equity. The guidance show how they should evaluate financially material environmental risks and opportunities. The strategy ensures that they consider both the financial and environmental implications of decisions made.

The EOS requires their fund managers to: research financially materially environmental risks and opportunities; collaborate with other bodies where appropriate; and take steps to minimize the fund's exposures to financially material environmental risks.

When considering a new investment, their fund managers are required to analyse and rate how the company manages environmental, social and corporate governance (ESG) risks as well as evaluate actual environmental performance. Each fund manager is required to report quarterly on their implementation of their EOS.

[83] "*Environment Agency Active Pension Fund: briefing note*", July 2012 and "*Environment Agency Active Pension Fund Responsible Investment Review 2012*".

88. In addition to diversifying their portfolios into a wider range of asset classes, institutional investors have also gradually increased their international exposure over the years. Following the financial crisis, an accelerated trend of investing in emerging markets has been documented, with investors expecting investment performance to track the positive economic prospects of these countries (OECD/G20 2012).

89. Another potential source of financing for clean energy projects is Sovereign Wealth Funds (SWF). These investors not only have a long-term horizon but also often have specific Socially Responsible Investment (SRI) objectives through mandates that address significant public policy issues. As with other institutional investors, SWF funds are coming under increasing scrutiny against Environmental, Social and Governance (ESG) criteria and as vehicles for the projection of state power. This has recently culminated in the Santiago Principles, which emphasise transparency, clarity, and equivalent treatment with private funds similarly operated. [84] A report by CityUK projects that assets under management of SWF increased by 8% in 2012 to a record USD 5.2 trillion and is expected to increase further to USD 5.6 trillion by the end of 2013, as inflows from trade surpluses and commodity exports continue for some nations. [85]

90. According to the SWF Institute[86] green growth investments are increasingly becoming a focus for SWF funds with the OECD (2012d) providing an overview of some of the activity in this space. A related source of investment dollars for renewable energy projects which is growing in significance is Chinese state-backed corporations and banks. (UNEP, 2012a)[87]. SWFs already have holdings of utility assets such as China Investment Corporation and Abu Dhabi Investment Authority's investments in Kemble Water which owns Thames Water. Since May 2012, UK registered Gingko Tree Investment Ltd., a wholly owned unit of China's State Administration of Foreign Exchange, has invested more than USD 1.6 billion in at least four deals, including a water utility, student housing, and office buildings in London and Manchester. [88]

91. Water is a key sector of green infrastructure being reportedly targeted by institutional investors. The Asia Water Fund is an example of a recent fund innovation that is permitting emerging market pension funds to invest in this asset class (See Box 5).

[84] www.iwg-swf.org/pubs/gapplist.htm.

[85] The CityUK, *"Financial Market Series Sovereign Wealth Funds"* (March 2013).

[86] www.swfinstitute.org/

[87] E.g. China Three Gorges Corporation paid EUR 2.7 billion for a 21% stake of EDP Portugal and Irish company Mainstream Renewable Power signed a deal with a Chinese turbine maker for 1GW of wind power in Ireland with loans from the China Development Bank.

[88] The CityUK, *"Financial Market Series Sovereign Wealth Funds"* (March 2013).

Box 5. Asia Water Fund

Water infrastructure is one of the key green infrastructures in Asia in view of its rapidly growing population and economic growth. Asia, with 60% of the world's population, only has access to 40% of the world's readily available surface water and less than 1% of the world's water volume[89].

With unceasing and growing global demand for clean water, in large part driven by population and economic growth, urbanisation, and climate change in Asia, the need for water infrastructure investments is critical. Under the circumstances, the Asia Water Fund is the Asia's first water-focused private equity fund invested by a number of private investors including Kumpulan Wang Persaraan, a Malaysian pension fund, as well as public sources such as the Asian Development Bank and International Finance Corporation with commitments of up to USD 20 million respectively. The Asia Water Fund's investment strategy will be to create a diversified portfolio of assets with opportunities for strong capital gains in the following water subsections: (a) municipal water and wastewater treatment plants, (b) industrial water and wastewater treatment plants, (c) rural water and wastewater treatment plants, (d) agricultural wastewater treatment plants, and (e) water rehabilitation projects in China and south-east Asia.

The Fund aims to provide investors with stable, long-term capital growth and cash distributions by investment in water and water-related assets. No more than 10% of the commitments will be invested in a single transaction. It is reported that the fund has raised USD 69 million and is targeting returns of 14-18 % at the project level.

Barriers to institutional investment in green infrastructure

92. There are a number of significant barriers to scaling up institutional investors' allocation to green infrastructure and they can be summarised in the three categories of 1) issues with infrastructure investments generally, 2) issues particular to green investments, and 3) a lack of suitable investment vehicles.[90]

93. The prerequisite to increasing institutional investor allocation to green infrastructure is to make sure that green investments are competitive on a risk-adjusted return basis. Investors with fiduciary responsibilities will not make an investment just because it is green — their primary concern is that it simply has to deliver financially. This principle is codified in the Employee Retirement Income Security Act of 1974 (ERISA), whereby it is in investors' legal duty to invest solely in assets with competitive risk-adjusted returns. The challenge therefore is for governments to design efficient and prudent policy frameworks and corporations to structure deals that allow this and encourage evolution of the industry towards a sustainable state, allowing investors to capture the increasing price competitiveness of renewable energy while providing the regulatory certainty that long-term investors need.

[89] ADB (2010), *'Proposed Equity Investment: Asia Water Fund'*, Report and Recommendation of the President to the Board of Directors, and http://www.globalwaterintel.com/archive/13/12/general/asian-water-projects-fund-gets-first-airing.html

[90] OECD (2012d), *The Role of Institutional Investors in Financing Clean Energy*

Figure 13. Summarising challenges to scaling up institutional investor participation in green infrastructure[91]

Barriers to institutional investment in green infrastructure

1 Issues with infrastructure investments

- **Direct investing challenges**
  - Short term investment horizon and need for liquidity (illiquidity risk)
  - Difficulties with bidding process and timing; lack of investor best practice and expertise
  - Asset and liability matching (ALM) application issues; diversification and exposure limits
  - Need scale >$50Bn AuM and dealflow to maintain costly team
  - Min $100M deal size; expensive and time consuming due diligence; higher transaction costs;
- **Regulatory and policy issues**
  - Political uncertainty
  - Illiquidity and direct investment restrictions e.g. capital adequacy rules (Solvency II, IORP II)
  - Uncertain new policy application e.g. Solvency II for pension funds?
  - Accounting rules e.g. mark to market for illiquid assets
- **Lack of project pipeline and quality historical data**
  - Compounded by exit of banks (Basel III/deleveraging)
  - Little historical pricing data or indices for investments such as private placement debt

2 Issues particular to green investments

- **Risk/return imbalance**
  - Market failures: insufficent carbon pricing and incentives; presence of fossil fuel subsidies
- **Unpredictable, fragmented, complex and short duration policy support**
  - Retroactive support cuts, switching incentives (FiT to FiP) or start and stop (PTC)
  - Use of tax credits popular with insurers can discourage tax exempt pension funds
  - Unrelated policy objective discouragement e.g. EU unbundling preventing majority ownership of both transmission and generation/production
  - Fiduciary duty debate
- **Special species of risk,** e.g. technology and volumetric require expertise and resources
- **Competition for capital** with other traditional infrastructure assets

3 Lack of suitable investment vehicles

- **Issues with fund and vehicle design**
  - High fees to support fund structure
  - Liquidity trade-off with connection to underlying asset and associated benefits: difficult to offer liquidity without asset disconnect, churn and leverage in fund
- **Nascent green bond markets, no indices/funds, restricted access to liquid vehicles** (MLPs & REITs)
  - Small pipeline of projects, high transaction costs, minimum deal size and definition uncertainty
- **Challenges with securitisation**
- **Credit and ratings issues**
  - Historical lack of ratings data, expensive process
  - Absence of monoline insurers since financial crisis

Source: OECD authors' analysis based on OECD (2012a/b) CPI (2013), BNEF (2013).

94. Facilitating an 'investment grade' policy environment remains a key challenge in aligning institutional investor needs with policy makers' visions for involving private capital in green infrastructure (see OECD, 2012d; CPI, 2013a).

95. For example, as examined in previous and on-going OECD work (2012, 2013 forthcoming), in terms of regulatory barriers, international accounting and funding rules can inadvertently discourage institutional investors from investing in longer-term, illiquid or riskier assets such as infrastructure projects. Such regulations as the fair value principle, Solvency II[92], and Basel III can apply a different

[91] Note here that the potential review of the IORP Directive should be taken into account.

[92] The implementation of Solvency II rules, which are designed to make insurance companies allocate the same capital reserves against the risks they take, have been delayed as a number of EU member countries' insurance companies have been opposed over their impact on long-term savings products. The Solvency II requirements are scheduled to replace the Solvency I requirements on 1 January 2014, and to apply to all insurance firms in Europe with gross premium income exceeding EUR 5 million or gross technical provisions in excess of EUR 25 million. However, there has been a call from member countries for the

capital charge to different investments depending on their perceived riskiness and there is a concern that this could discourage investment in green infrastructure. These noteworthy issues include[93]:

- Basel III rules and EU Capital Requirements and Directives and Regulations (CRD IV) for banks. The liquidity coverage ratio (LCR) is forecast to significantly limit the ability of banks to provide long-term, non-recourse project finance. Green infrastructure projects are expected to be particularly vulnerable due to their high upfront capital costs and dependence on this type of financing. In addition, Basel III rules on the Net Stable Funding Requirement (NSFR) are forecast to increase the cost of shorter-term construction (and trade) finance. This is resulting in the exit of many banks from extending the type of financing needed to build a pipeline of green infrastructure assets for institutional investors to then off-take. Under the Basel III and CRD IV, complex securities perceived as highly risky, such as Asset Backed Securities (ABS), are treated unfavourably by the regulations, while securities where risk is retained on balance sheet, such as covered bonds, are given a favourable treatment.

- Solvency II regulations on the amount of capital held by insurance companies in Europe are expected to encourage insurance companies to shift to shorter-dated and higher-rated assets and reduce their appetite for long-term investments. In particular, there is some concern that the capital requirements for investments in infrastructure (49 %) and real estate (25 %) are too high and do not reflect the real risks associated with such investments. Some countries also apply risk-based Solvency rules to pension funds.

- The rules on the matching of assets and liabilities (ALM) tend to encourage pension funds to increase their holding of corporate and government bonds to reduce volatility. In general, the output of ALM depends on: (1) the level of risk that is acceptable, (2) limits to the acceptable cost of pension or insurance, (3) who takes the risk of fund shortfall (members, shareholders, government, clients), (4) time horizon for analysis and liability matching, and (5) reporting requirements and regulation. But as a result of particular challenges to green infrastructure investment, many institutions may find it difficult to evaluate the value of renewable energy project investing through the ALM exercise.

- At the European level, insurers are faced with additional regulatory requirements in the form of stress tests from the European Insurance and Occupational Pensions Authority (EIOPA). Though chosen risk scenarios should be adequate and realistic, these stress tests encourage insurers to have a short-term bias within their investment strategies, in order to be sure to comply with even the most improbable of risk scenarios utilised. Moreover, Institutional insurers are discouraged from investing in long-term energy projects along the whole value chain due to the restrictive application of the current unbundling regime in directives 2009/72/EC and 2009/73/EC.

- Laws governing fiduciary duties of pension fund trustees do not explicitly require trustees to take account of long-term risks such as climate change or the potential impact of environmental,

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revision of the rule or a "carve out" in light of promoting institutional investors' investment in energy infrastructure.

[93] Severinson, C and Yermo, J (2012e) "The effect of solvency regulations and accounting standards on long-term investing: implications for insurers and pension funds", OECD Working Papers on Finance, Insurance and Private Pensions, No. 30, OECD Publishing, Paris. Bloomberg New Energy Finance (2013a), 'Clean Energy –White Paper', World Economic Forum (2013), 'Financial Regulation – Biased against Clean Energy and Green Infrastructure?'

social and governance issues on financial returns, and as a result, investors tend to fail to reflect these considerations in their investment practices.

Box 6. The impact of financial sector reform on green infrastructure finance

The Basel III Accords are the latest set of international banking standards which have been brought in by governments to help encourage a more resilient banking system. Targeted to strengthen a banking system which is highly leveraged and has a history of dealing in complex instruments of dubious value, they encompass a suite of capital adequacy, leverage and liquidity requirements. They will also have a significant effect on broader commercial lending, including to renewable energy projects.

For example, project finance loans are usually characterised by long tenors of 10 to 40 years, and are often serviced by income generating assets which do not have a ready secondary market. Provisions that cover banks liquidity ratios include the Liquidity Coverage Ratio and the Net Stable Funding Requirement, will likely foreshorten loan tenors and raise interest rates in the project finance market.

As a response to these changes, some analysts are expecting a large bank pull-out of the renewable energy sector. However, new vehicles such as bond issuances may gain greater prominence which will ameliorate this effect. Green bonds could be regarded as short-term liquidity, if they are of high enough quality, and thus could help banks meet liquidity requirements under Basel III.

Source: Chan, E. and Worth, M. 2012.

96. In this context, it is noteworthy that a Green Paper released by the European Commission in March 2013 stated that the Commission has asked the European Insurance and Occupational Pensions Authority (EIOPA) to examine whether the detailed calibration of capital requirements for investments in certain assets under the Solvency II regime (including infrastructure financing and project bonds; SME financing; debt securitisation etc.) should be adjusted to ensure there are no obstacles to long-term financing, albeit without creating additional prudential risks. The Commission also pointed out the importance of ensuring that new prudential rules for occupational pension schemes do not discourage sustainable long-term financing (EC, 2013).

97. Also it is important to note that infrastructure does not always live up to its promise as an asset class; investors could be forced to bear losses caused by the volatility of certain projects. For instance, toll roads and ports are generally pro-cyclical as volumes and revenues drop with declines in economic activity.[94]

98. The recent OECD paper on the role of institutional investors in financing clean energy identified some key constraints and barriers to institutional investors' investment towards clean energy. They include: (1) lack of a project pipeline and lack of investor capabilities and understanding, (2) lack of data to assess the associated risks (3) lack of suitable investment vehicles, (4) unsupportive environmental policy backdrop and lack of carbon price and/or presence of harmful subsidies, and (5) policy risk derived from regulatory uncertainty and technology risks (OECD, 2011d).

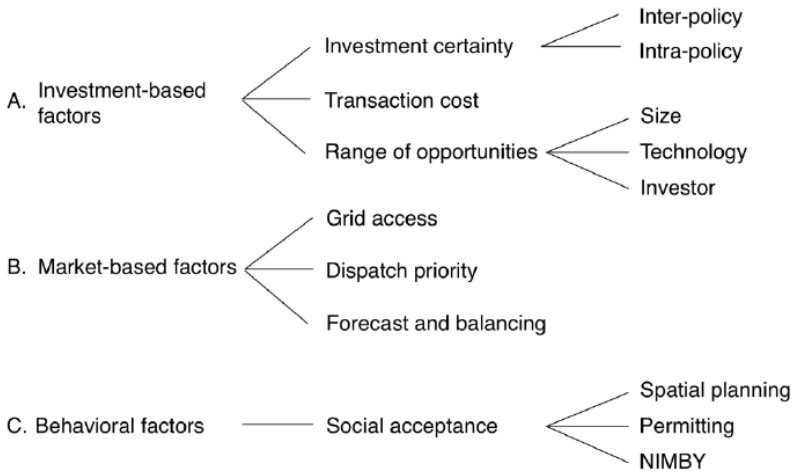
99. In addition, other more structural constraints have been holding back institutional investment in green growth activities (CPI, 2013a). These include: the tendency of asset allocation methodologies to not

[94] A key point demonstrated by the Walney case study #3 is that strategic investors can aim to avoid this type of volatility by investing in assets backed by long-term contracts and fixed-price off-take, which Walney exemplifies.

capture the benefits of project investing; the illiquidity of project investments; the lack of access to project investments; funds in which poorly packaged projects are not aligned to institutional investor needs; and other considerations such as the effects of tax equity, solvency and unbundling (competition) laws.

Importantly, the face value of a renewable energy deployment policy's[95] remuneration level is an essential, but by no means the only, factor that determines whether an institutional investor will invest in renewable energy. Mormann (2012) explores how investment-based, market-based, and behavioural "soft-cost" factors determine a policy's ability to spur investment in renewable energy looking at renewable energy deployment policies from an investor's point of view (see Figure 14).

Figure 14. "Soft-Cost" Factor Framework for Deployment Analysis



Source: Mormann, F. (2012), Enhancing the Investor Appeal of Renewable Energy, Environmental Law, Vol. 42, 681 (2012)

100. One finding suggests that the public funds with an explicit focus on low-income countries that work with private firms by co-investing and guaranteeing renewable energy can play a role in reducing asymmetries of information and country risk perception and removing structuring barriers by aggregating the projects and reducing the transaction costs. Bilateral and multilateral donors could also play a role in identifying bankable projects and developing them to become investable projects and overcoming informational and structural barriers. Their participation through co-investing, for example, could serve to mitigate regulatory risk, which is considered as a particularly great risk to investors in developing countries. [96]

Navigating the risks of transition: from black to green growth

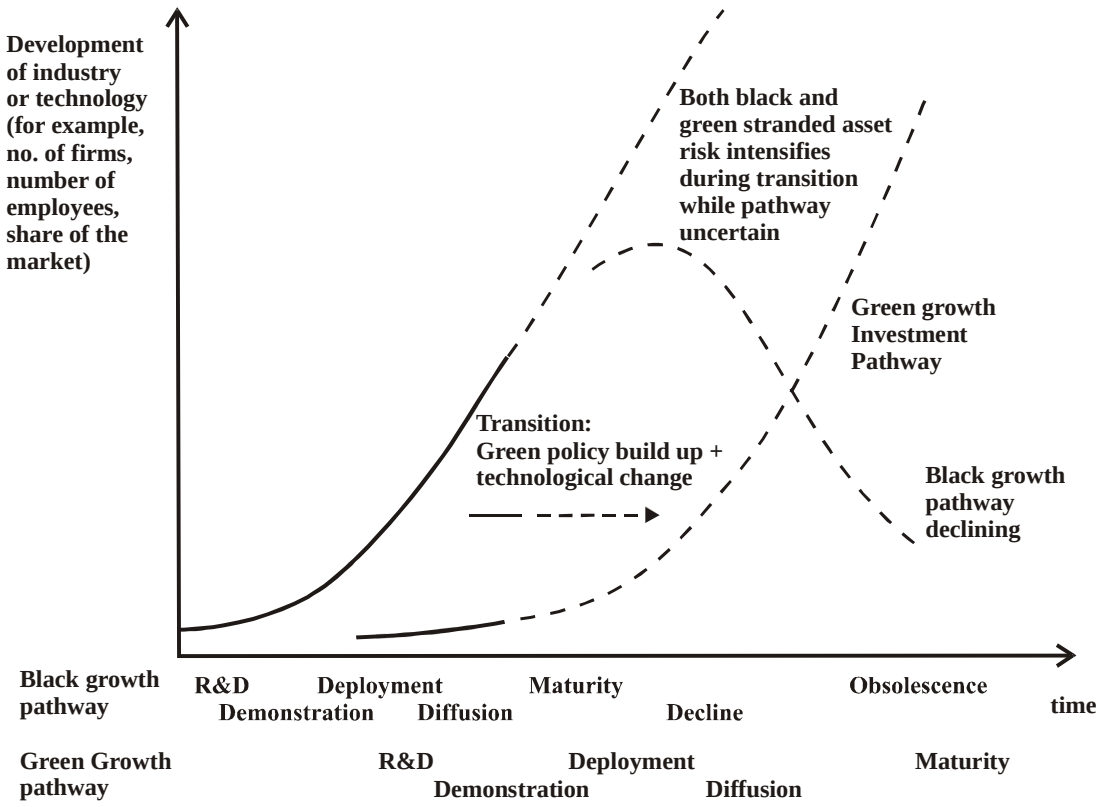
96. The transition from a 'black' to a 'green' economy will encompass a massive reallocation of existing capital and deployment into new investments, particularly in the resource, energy, transport, water and building sectors. It will also require a commensurate shift in the enabling policy framework (OECD, 2012c).

[95] For example: Renewable Portfolio Standards, Tender/Auction Regimes, Feed-In Tariffs, Production Tax Credits

[96] Federal Ministry for Economic cooperation and Development of Germany and GIZ (2013), *'Mobilising Investments for Inclusive Green Growth in Low-Income Countries'*,

97. According to the recently published '*OECD Environmental Outlook to 2050*' the world economy, driven by growth in emerging economies, is likely to almost quadruple in size by 2050 and will demand around 80% more energy (OECD, 2012b). In addition, without new policy action, global water demand is expected to increase by 55% and terrestrial biodiversity expected to decline by 10% over this period. At the same time, investors have to navigate the risks and opportunities of transitioning from a high-carbon to a low-carbon *green growth* pathway (OECD, 2011c, 2012a; World Bank, 2012).

Figure 15. Transition from black to green growth and stranded asset risk



Source: authors based on IEA (2010), Kalamova, Kaminker and Johnstone, (OECD, 2011).

98. It is estimated by the IEA (2012a) that the immediate investment requirement of transitioning from a 'black' to 'green' development pathway for the power sector alone will require capital in the order of USD 24 trillion by 2020. This transition is occurring in the context of a build-up in environmental and climate policies which are shaping innovation in the energy and other sectors (Figure 15).

99. The IEA (2012a) suggests that about 80% of the projected global CO_2 energy emissions to 2020 are already locked-in through the world's current infrastructure base (the estimated operational lifetime of a coal-fired power station is between 40 and 60 years). Furthermore, around 60% of power plants in service or under construction today are projected to still be in operation in 2035. This means the majority of power sector emissions mostly already built in developed countries are already "locked in". Successful climate policy will either strand these assets, or require their retrofitting with carbon capture and storage (CCS).

100. Investment patterns over the last seven years in the power sector suggest that many economies are shifting onto 'green growth' pathways. In 2011, renewable energy (excluding large hydro) accounted

for 44% of new generation capacity added worldwide or USD 237 billion, up from 34% in 2010 and just 10.3% back in 2004 (UNEP, 2012a). Gross investment in fossil fuel generating capacity was about USD 302 billion in 2011 compared with USD 262.5 billion for renewables, including large hydro.

101. However, if the investments made to replace old coal and oil fired capacity with newer plant of the same type are netted out then the amount invested in fossil fuel generation falls to USD 223 billion. Even so, the proportion of energy generated by renewable sources (excluding large hydro) in 2011 is still small relative to total generation capacity at 6%, up from 5.1% the previous year. Although these data suggest the beginning of a transition to a green growth pathway in energy generation, they are still some way below the USD 600 billion in clean energy investment per annum that UNEP estimates to be needed to bring emissions to a peak by 2020 (UNEP, 2012a).

102. The risk of stranded assets due to the intersection of environmental change, regulation and technological shifts has been highlighted as a potential constraint on the transition towards cleaner energy systems which will need to be carefully managed (OECD, 2011c).[97] Increased liquidity requirements and other regulations brought into effect in the wake of the financial crisis may exacerbate these risks by encouraging shorter-term performance and investment horizons (OECD, 2012c).

103. These risks are not just confined to assets exposed to carbon such as coal generation and fossil fuel reserves, but also to assets in the water, urban planning and agricultural sectors. For example the typical lifespan of water infrastructure (e.g. dams, reservoirs, sanitation facilities) and transportation infrastructure (e.g. ports, bridges) is between 30 and 200 years; building and housing (e.g. insulation and windows) between 30 and 150 years; land use and urban planning (e.g. in flood plain, coastal areas and urban design) greater than 100 years; and dykes and sea walls greater than 50 years (Hallegatte, 2009). Scenario analysis (Mercer, 2011) suggests exposure of these infrastructures to climate-related risks, if not managed could cost investment funds USD 8 trillion by 2030.[98]

104. However, the transition from black growth to green growth is crucially dependent on pricing carbon, removing support systems to fossil fuel energy systems and replacing them with support mechanisms for new green energy systems (Grubler, 2012; Simmie, 2012). Without such continuous, but evolving, policy support — consistent with the stage of technological maturity — there is also the risk that investments in the green growth pathway will become stranded.

[97] Letter to the Bank of England on stranded assets risk, co-ordinated by Climate Change Capital www.climatechangecapital.com/media/256968/letter%20to%20bank%20of%20england%20financial%20policy%20committee%20-%2019th%20january%202012%20-%20final.pdf

[98] Mercer Responsible Investment, Climate Change Scenarios – Implications for Strategic Asset Allocation, http://uk.mercer.com/articles/1406410

SECTION 2: CASE STUDIES

Case study 1: Investment in solar PV power generation in the United States by the global insurer MetLife

Highlights:

- Institutional investor: Life Insurer (USA)
- Green investment: Solar photovoltaic (PV) power generation
- Location: Domestic (USA)
- Return: Not disclosed
- Type of investment: Direct equity

Summary

105. The case study explores what enabled an insurance company to make direct investment in solar PV power generation. This is a leading example of direct investment via equity by an institutional investor and shows that the clear and stable long-term investment plans and the long-term power-purchase contracts served to reduce the political regulatory risks associated with solar PV generation and meet the demands of predictable cash flows. In the Webberville Solar case, the city council passed the resolution that set a renewable electricity capacity goal by 2020, and an energy company made a commitment to purchase all the generated power for 25 years.

General context

106. Despite international trade tensions around solar panels between the United States and Europe on the one hand, and China on the other, the year 2012 saw remarkable growth in solar PV instillations which grew to over 100 GW globally. This was led by the addition in 2012 of around 7.6 GW of newly connected systems in Germany, 5 GW in China, 3.4 GW in Italy, 3.3 GW in the United States and 2 GW in Japan.

107. This boom in solar installations occurred despite significant corporate distress in the solar manufacturing sector driven by declining prices for solar modules. Recent years have seen the booming rooftop photovoltaic (PV) installations in Germany and Italy, the spread of small scale PV from China to other countries, and a spurt in the financing of several large-scale solar thermal projects in Spain and the United States, as well as PV in the latter (UNEP, 2012). For the second year in a row, solar PV was the number-one new source of electricity generation installed in Europe. According to the European Photovoltaic Industry Association, PV now covers 5.2% of peak electricity demand in Europe.

108. The year 2012 also saw a challenge to Europe as the primary growth market for new instillations, with countries such as China, the United States and India lifting their rates of deployment. For example, in 2011 Europe accounted for 74% of the world's new PV installations, while in 2012 the number was closer to 55% (SEIA, 2013).

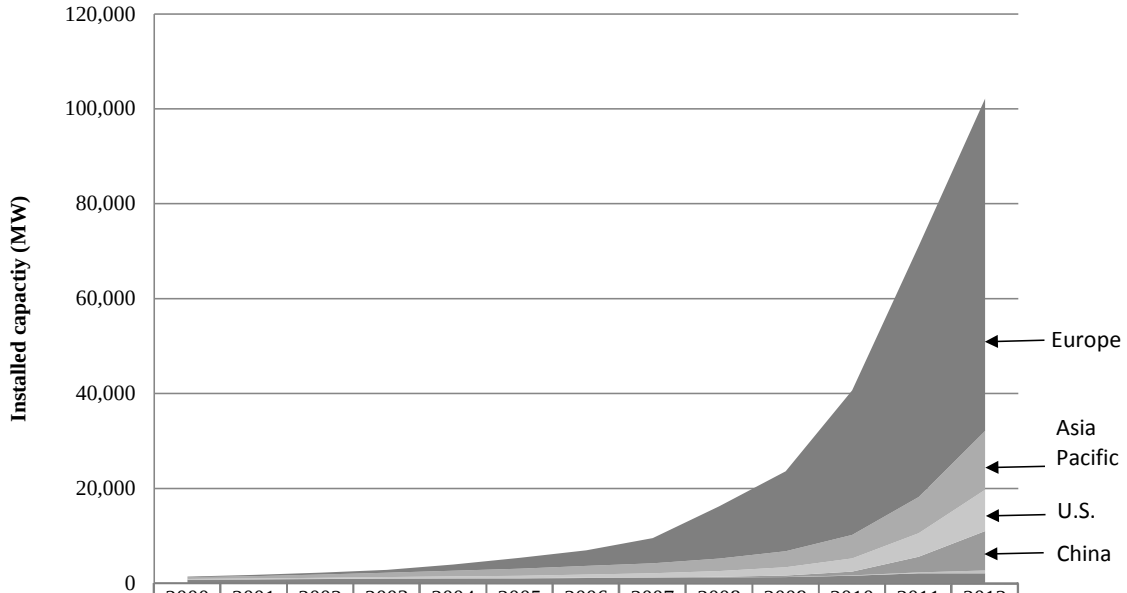
109. This boom in installations took place against the backdrop of significant corporate distress due to sharply falling prices for PV modules, which fell by close to 50% in 2011 alone (UNEP, 2012) driven by intense international competition, particularly from low-cost Chinese producers, dramatic declines in the spot price and polysilicon, and an oversupply of panels following the scaling back of solar subsidies in Germany, Italy and Spain. For instance, according to the Solar Energy Industry Association (SEIA,

2013), the average price of a solar panel in the United States has fallen by around 60% since the beginning of 2011, to around USD 3.37/W at the start of 2013.

110. As a result of these changes, corporate bankruptcies, acquisitions and restructurings of solar manufacturers have become common,[99] most notoriously the Solyndra bankruptcy in August 2011 (which was also attributable to other non-market factors).

111. One encouraging aspect of the declining PV module prices was that it stimulated demand for PV installations, particularly on roof tops. By the end of 2011, PV modules were selling in world markets for between USD 1 and USD 1.20 per watt, some 76% below their prices in 2008 (UNEP, 2012).

Figure 16. Cumulative global PV instillations



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Europe	129	262	396	598	1305	2289	3281	5310	11020	16850	30472	52884	70043
Asia Pacific	355	495	686	916	1198	1500	1825	2096	2631	3373	4956	7628	12397
America	146	178	225	290	394	501	650	863	1209	1752	2780	4959	8717
China	19	24	42	55	62	70	80	100	140	300	800	3300	8300
Middle east and africa					1	1	1	2	3	25	71	192	601
Rest of world	751	807	887	964	993	1003	1108	1150	1226	1306	1590	2098	2098
Total	**1400**	**1765**	**2235**	**2820**	**3952**	**5364**	**6964**	**9521**	**16229**	**23605**	**40640**	**71061**	**102156**

Source: EPIA, 2013.

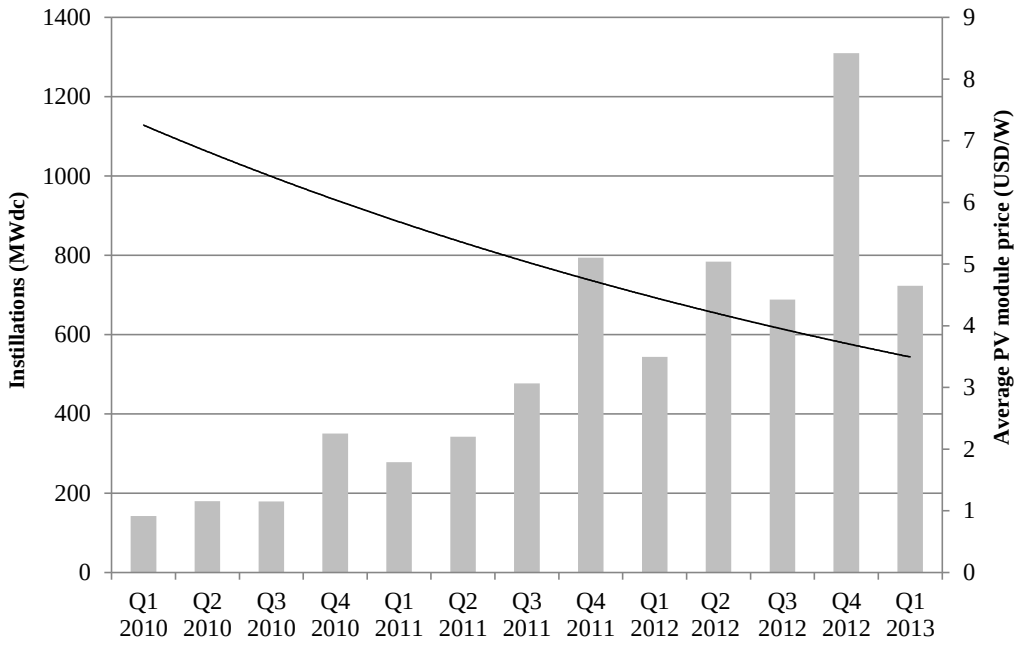
112. The impact of the drop off in demand from within the European Union, has been mitigated somewhat by dramatic growth in Chinese solar deployment, which was expected to exceed 5GW in 2012 (SEIA, 2012b).

[99] For a comprehensive list see: http://www.greentechmedia.com/articles/read/Rest-in-Peace-The-List-of-Deceased-Solar-Companies

113. The intense competition amid declining module prices made it difficult for some manufacturers to remain profitable and this has in turn intensified trade pressures. On the one hand European and North American manufacturers have argued that their Chinese competitors benefit from a low capital cost environment and supportive industrial policies which they lack. On the other hand European and North American suppliers of components to Chinese manufacturers, small and medium enterprises engaged in the instillation of solar panels in European and North American markets and consumers have benefited from low cost Chinese exports.

114. As a result of these pressures, the European Union and Chinese trade negotiators reached an agreement in July, 2013 to curb E.U. imports of solar panels from China in exchange for exempting the shipments from punitive tariffs. These are intended to be dynamic arrangements to enable Europe to take advantage of cost reductions while preventing supply constraints developing. The accord aims to set a minimum price for imports from China and targets more than 100 Chinese companies including Yingli Green Energy Holding Co., Wuxi Suntech Power Co. and Changzhou Trina Solar Energy Co. This agreement follows the prospect of provisional antidumping duties as high as 67.9% which had been announced by the European Commission in June.[100]

Figure 17. Quarterly PV installations in the United States



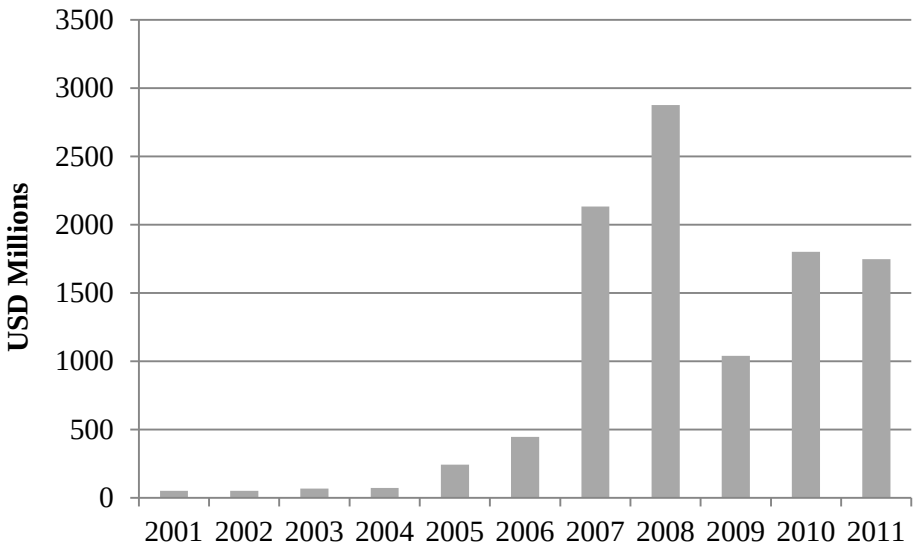
Source: SEIA, 2013.

115. The United States now has over 8,500 MW of cumulative installed solar electric capacity, approximately enough to power 1.3 million average American homes. The top states for new installations

[100] www.bloomberg.com/news/2013-07-27/european-union-china-agree-on-solar-panel-shipment-deal.html

were California, followed by Arizona, New Jersey, Nevada and Texas. Overall, residential and commercial installations showed relatively consistent growth, with the recent significant upswing in installations being driven by large new investments by major utilities.

Figure 18. U.S. venture capital and private equity investment in solar energy technology companies



Source: Figures represent deals disclosed derived from BNEF's desktop database

116. The figure above shows that, while venture capital and private equity investment in solar energy companies peaked in 2008, it has remained relatively robust despite recent industry turmoil on the manufacturing side. This investment represents higher-risk capital investment in technology companies themselves (important drivers of technological improvement), which is distinct from institutional investor's investment in the physical assets of a solar project, which is the focus of this case study.

117. Institutional investors are seeking predicable cash flows guaranteed by long-term power-purchase contracts which extend for two decades or more. For example, while details around the terms of specific deals are subject to commercial confidentiality clauses, regulators approved contracts in 2010 for utilities to pay USD 161 to USD 232 per MWh for solar energy. This was about four times the USD 40 per MWh average wholesale price at the time according to Arno Harris, CEO of Sharp Corporation's renewable power development unit Recurrent Energy.

118. Dan Reicher, the Executive Director of Stanford University's Taylor Centre for Energy Policy and Finance, points out that part of the attraction of such investments is the "free fuel and very low operating costs" once the initial investment is made.

119. Stefan Heck, a director at McKinsey and Co. in New York goes on to point out that the long-term nature of solar-purchase deals make them similar to some types of bond, and because a solar farm is a tangible asset these investments function like other infrastructure projects. He observes that institutional investors with long-term horizons are showing a lot of interest in these investments, which exhibit returns higher than for government bonds.

120. Clean Power Finance is a firm in San Francisco which bundles solar projects to create investment products. Nat Kreamer, their CEO, observes that while demand for their products has been highest among private equity firms, there is increasing appetite from institutional investors to own solar assets directly.

The diffusion of solar energy in Texas and the Webberville Solar Project

121. The global insurer MetLife and Longsol Holdings US Inc announced in February 2012 that they had purchased a 30 MW solar power plant in Texas from SunEdison to sell electricity under a 25-year contract to the publicly-owned Austin Energy utility for an undisclosed amount.

122. Planned to be the largest solar facility in Texas, the plant is expected to produce approximately 63 000 MWh annually, enough to power 5 000 homes. Austin Energy also stated that the facility will contribute to achieving the company's 35% renewable energy target for the utility by 2020.[101] The city of Austin has achieved high levels of solar energy by setting goals and adopting policies to facilitate the growth of solar power. In 2007, Austin City council passed a resolution that set a renewable generation capacity goal of 30% by 2020, with 100 MW of that power capacity coming from solar energy. Since 2011, Austin Energy has increased these targets beyond the goals of the Austin City Council's resolution — to 35% renewable energy by 2020 and 200 MW of solar development by 2015. More recently, the Austin Local Solar Advisory Committee recommended that Austin Energy increase its solar energy requirement to 400 MW by 2020, including 200 MW of solar power capacity within Austin's city limits.

123. The Webberville project, which is 15 miles east of the city on land owned by Austin Energy, was developed and financed by FotowatioRenewable Ventures, a division of Spanish renewable energy company Fotowatio SL. It was originally owned by SunEdison, which sold it to MetLife and Longsol Holdings in late 2011. Longsol Holdings is a private owner and operator of solar projects in the U.S. and Europe.

124. RES Americas was responsible for the building of the Webberville solar facility, as well as maintenance services for the first five years of the project, under contract from Austin Energy. Upon RES America's five-year O&M commitment ending, SunEdison will take over the O&M for the 30 MW solar farm for 20 years. The project began construction in spring 2011 and was completed in February 2012.

125. The solar field covers approximately 220 acres, and the project has 127 728 Trina Solar modules. Eighteen large module sections are connected together in a series and are wired to 448 combiner boxes that are distributed throughout the site. A total of 26 400 driven piles were installed to support the 2 400 rows of single axis trackers. There are 112 tracker motors that move the modules to follow the sun from east to west. Nineteen centralized inverter houses and step-up transformers convert the 35 MW of DC power to 30 MW of AC power and the solar park is positioned around a mile away from Austin Energy's Austrop substation, which helps minimize the additional transmission infrastructure required to deliver power generated to the electricity grid.

126. Linking the project to the grid required significant upfront coordination with the Electric Reliability Council of Texas (ERCOT) and Austin Energy. This added an extra dimension of complexity as the facility was the first project of its size in Texas.

127. Speaking about the deal, Steven J. Goulart, executive vice president and chief investment officer for MetLife, Inc explained that it built upon MetLife's more than USD 2.2 billion invested in renewable

[101] www.austinenergy.com/About%20Us/Newsroom/Press%20Releases/2012/activateSolarFarm.html

energy projects;[102] this represents roughly 0.5% of their total investment portfolio. While the details of this deal have not been disclosed, it joins other large solar investments, including a 13.78 MW facility at China Lake, California; a 24 MW solar park in Puerto Rico; a 32 MW power plant on Long Island, New York; and a 19MW solar farm in Colorado.

128. A number of Texas communities and utilities have adopted innovative financing mechanisms aimed at encouraging residential and commercial solar installations. For example, several electric utilities offer incentives to help consumers deal with the high upfront cost and long payback period associated with installing solar PV systems. Oncor Energy, Texas New Mexico Power Company, AEP Texas, Southwestern Electric Power Company, El Paso Electric, Austin Energy, and CPS Energy are among the Texas utilities that offer residential and non-residential incentives, between USD 1.50 and 2.50 per watt installed. These installation incentives can be combined with a 30% federal tax credit to greatly reduce the cost of installing rooftop solar panels. In September 2009, Texas House Bill 1937 took effect, enabling cities to establish solar panel financing programmes. Through this legislation, cities can fund the installation of solar panels on residential properties, which the homeowners then repay over several decades via a small line item on their property tax bills. Austin became the first city to act on this legislation.[103]

129. When it comes to state government initiatives, residential, commercial, and industrial renewable energy devices are exempt from property tax under Texas law. This exemption is applicable to most renewable-energy technologies, including those powered by solar, wind and biomass. Also, companies solely engaged in manufacturing, selling, or installing solar or wind devices are exempt from the Texas franchise tax. Other businesses that install solar or wind energy systems are eligible for a franchise tax deduction of 10% of the systems' cost.

130. Austin Energy has adopted additional policies to provide a payment to the owners of solar PV systems for the excess solar energy they generate. Such compensation is a critical incentive for the widespread installation of small-scale solar energy projects.

131. In the Webberville Solar project, the USD 100 million project was made possible in part by Austin Energy's commitment to buy all of the facility's power for 25 years.[104]

Lessons learned

132. The Webberville case is a leading example of direct investment in solar PV power generation by an insurance company. Institutional investors seek long-term policy stability and predictable cash flows guaranteed by long-term power-purchase contracts which extend for two decades or more. The first lesson to be drawn is that public authorities should provide clear and stable long-term investment plans which promote green infrastructure investment. In the Webberville Solar case, the Austin City Council passed a resolution that set a renewable electricity capacity goal of 30% by 2020, with 100 MW of that capacity coming from solar energy. Since 2011, Austin Energy has set even higher target of 35% renewable energy capacity by 2020 and 200 MW of solar development by 2015.

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[102] www.prnewswire.com/news-releases/metlife -and-longsol-holdings-announce-purchase-of-a-30mw-solar-farm-140904673.html

[103] *Texas Renewable Energy Industry Report July 2012*, Texas, Office of the Governor, Economic Development & Tourism

133. This long-term policy framework helped reduce the political and regulatory risks associated with a higher-cost form of electricity generation than fossil-fuel alternatives, such as solar PV. MetLife also bought into the project at a later stage of the project's development in partnership with a specialised investor and operator of solar parks, Longsol Holdings. This helped avoid risks associated with the earlier, riskier, phases of the project such as construction. Moreover, MetLife also acted as a "tax-equity investor" in that their tax liabilities were such that they could make use of the federal tax credit and accelerated depreciation.

134. The second lesson to be drawn is that it is important to provide the mechanisms which enable institutional investors to take predictable cash flows. In the Webberville Solar case, the project was made possible due to Austin Energy's commitment to purchase all of the facility's power for 25 years. Institutional investors were able to expect a long-term cash flows extending as long as 25 years which similarly function as long-term fixed-income.

Case Study 2: Green Growth and Agriculture: TIAA-CREF's farmland investment in Brazil

Highlights:

- Institutional investor: Financial services company incorporating retirement, asset management, mutual funds, and life insurance (AuM of over USD 500 billion).
- Green investment: climate smart agriculture.
- Location: International (Brazil).
- Type of investment: Direct equity.

Summary

135. The focus of this case study is different from the other three in that it explores the linkages between the OECD's green growth framework and the sustainable farmland investments of TIAA-CREF. First, the general context of agricultural investment, as well as a brief overview of what makes agricultural investments green is reviewed in light of recent OECD work on these issues. Secondly, the specific context of agricultural investment in Brazil is summarised, before the details of TIAA-CREF's business model in the sector are outlined. This draws on interviews with TIAA-CREF representatives and publicly available information including reporting under the United Nations Principles of Responsible Investment in Farmland. These have been developed by the investors which are UNPRI signatories, including TIAA-CREF, and closely align with elements of the OECD's framework for green growth in agriculture. Finally, drawing on the material in the study, the authors reflect on the lessons learned for investors and policy makers.

General context

136. With the world's population set to expand from 7 billion to over 9 billion over the next 40 years, the long-term demand for agricultural produce is set to structurally increase. This long-term trend will take place against a transition towards higher calorie and meat-based diets in many poorer countries. These two factors inform expectations that agricultural production will need to increase by 60% over the next 40 years to meet demand (OECD/FAO, 2012).

137. However, this picture of long-term growth in the sector will be subject to the major challenge of limited land and declining freshwater availability. Water demand is expected to be around 55% higher in 2050 compared with 2000, and climate change is likely to exacerbate weather variability (OECD, 2012b:63-64).

138. While the area devoted to agriculture in OECD countries has fallen slightly since the 1970s, it has increased substantially in Brazil (35%), China (40%) and Indonesia (26%). While set to continue in the medium term, this growth in demand for new agricultural land will be dampened somewhat by improvements in yield enhancing technologies which allow greater production with the same area under cultivation (OECD, 2012b).

139. Agricultural investment is essential to promoting agricultural growth, reducing poverty and hunger and promoting environmental sustainability. The overwhelming majority of investment in agriculture is by farmers with only very minor involvement by institutional investors.[105] Broadly speaking, investment involves giving up something today in order to accumulate assets that generate increased income or other benefits in the future. For agriculture this can be in natural assets such as farmland (e.g.

[105] FAO, (2012) *The state of food and agriculture: investing in agriculture for a better future*, FAO Publishing Rome.

land improvements) and water (treatment of effluents); physical assets such as animals, plantation crops, farm buildings, irrigation systems, machines and equipment; community infrastructure such as dams and processing facilities; intellectual capital such as research and development (e.g. GMOs, biofuels) and management practices; human capital acquired through education, training and extension services; and social capital such as cooperatives and other institutions that build trust and reduce risk.

140. Recently, the increasing international flow of funds directed to large scale land acquisitions by private companies, investment funds and sovereign wealth funds has been receiving significant attention. While currently limited in scale, the negative social and environmental impacts at the local level along with prospects for growth has led to concerns, especially in low income countries, which often have less capacity to establish and implement a regulatory framework to address such issues.

141. When determining the value of an agricultural investment, regional and micro-climate factors play a key role, as do soil quality and water availability, local infrastructure, access to markets, skilled labour and inputs (seeds, fertilizers, pesticides) as well as the potential for future growth and capital appreciation (Andra AP-fonden, 2012). Thus, the attractiveness of an agricultural investment will depend on a broad range of macro and regional specific risks which require significant local resources to understand and manage. Because institutional investors generally do not have the knowledge or experience to manage the farms or market the crops, they must work with local farmers or other organizations to manage their farmland investments.

142. With these opportunities and risks in mind, the case for 'greening' agriculture has become a priority for farmers, policy makers and investors alike. Applying the green growth framework in agriculture has also been a focus for OECD and others through a series of sectoral analyses which describe a broad strategy[106] and the role of private finance for the sector.[107] Broadly, green growth in agriculture requires that in the coming decades enough food is provided for an increasing, and increasingly affluent, global population while reducing environmental pressure (OECD, 2011e:11).

[106] OECD, (2011e) *OECD Green Growth Studies: Food and Agriculture*, OECD Publishing, Paris and FAO Publishing, Rome.

[107] WEF, 2012. *Financing Green Growth in a Resource-constrained World: Partnerships for Triggering Private Finance at Scale*, World Economic Forum.

Figure 19. What makes agricultural investments 'green'?

Source: based on OECD, 2011e:8-9.

143. At the centre of what makes an agricultural investment 'green' is the challenge to increase productivity and output in a sustainable manner. Sustainability places a strong emphasis on the complementarities between the economic (e.g. land productivity, farm incomes, employment); social (e.g. food security, equity, poverty reduction, rural development) and environmental (e.g. natural resource use, pollution, biodiversity) dimensions of development. Nevertheless, despite the potential for complementarities, trade-offs still exist, which, in practice, are resolved in each country according to national priorities (OECD, 2011e:14-18).

144. Just as no "one-size fits all" prescription for implementing a green growth strategy exists for governments, and in every case policy requires looking across a very wide range of areas beyond explicitly "green policies" (OECD, 2011c:18), investors must be cognizant of the differing norms that govern sustainability in different economic and political contexts. Even so, there are broad principles which can be applied across countries, and there are valuable lessons which can be learned regarding best practice investment and government regulation.

Farmland Investment in Brazil

145. Brazil is the fifth largest country in the world with an area of 851.5 million hectares (ha). Seven per cent of land (60 million ha) is used for forestry and agriculture, while 23% (198 million ha) is used for grazing (FIP, 2012). Administratively, the country has a democratic presidential system and is divided into 26 states and the Federal District, with 5,565 municipalities.

146. Having prioritized policies to support an open and stable economy, Brazil has also emerged recently as agricultural powerhouse, ranked first in the world as an exporter of various commodities including: sugarcane, beef, poultry, coffee, tobacco and ethanol. Brazil is the second largest exporter of soybeans and corn and the world's fourth largest exporter of pork (FIP, 2012:9).

147. The country exports around 1,500 different agricultural products to over 200 markets in Europe, Asia and Africa, the Americas and the Middle East. Between 2003 and 2009, the value of Brazil's

agribusiness exports tripled from USD 20.6 billion to USD 64.7 billion. This was driven mainly by soybean production based in the Cerrado Biome (FIP, 2012:9).

148. Managing deforestation and other environmental risks is a key issue for sustainably developing Brazilian farmland (FAO, 2006; Morton et al. 2006, Santilli et al., 2005). After peaking at over 27,000 km^2 per year in 2004, the deforestation rate in the Brazilian Legal Amazon decreased substantially in the second half of the 2000s to about 5,000 km^2 in 2011 (INPE, 2012). There is substantial literature on the long-run socio-economic drivers of deforestation activity in the Amazon, including due to factors such as population change, road development, rural credit and agro climatic characteristics (Chomitz and Thomas, 2003; Reis and Guzmán, 1994, Reis and Margulis, 1991 and CPI, 2013a). Theoretically, increasing investment in agriculture can either promote sustainability through funding the capital expenditures required to improve agricultural technology and productivity, or it may exacerbate deforestation if it leads to the incorporation of new lands for production.[108]

149. In the last year, there has also been a certain amount of debate about investment in farmland by institutional investors being characterised by some NGOs as 'land grabbing'.[109] Quite often this term has been used regardless of how, where, or why such investments are made. Examples of transactions that could be considered 'land grabbing' include situations where an investor acquires/leases land in another country, with a view to securing food supplies to cater for its domestic needs, or when 'weak' governments 'selloff' or lease land without those who currently earn their living from the land in question having any opportunity of affecting the decision (Andra AP-fonden, 2012:11).

150. To pro-actively address such concerns and manage risks, in 2011 a group of institutional investors who were signatories to the United Nations' *Principles for Responsible Investment* developed the *Principles for Responsible Investment in Farmland*.[110] The *Principles* cover the environment, labour rights, human rights, land and business ethics, and all investors who have signed onto the *Principles* are pledged to report annually on progress with their implementation.[111] Such issues intersect closely with the elements of the OECD's framework on green growth in agriculture. We have thus looked to TIAA-CREF's reporting under *The Principles* as the basis for our case study on green growth in farmland supported by interviews with several members of their investment team (TIAA-CREF, 2012; UNEP-FI, 2012b).

TIAA-CREF farmland investment in Brazil

151. With over USD 500 billion of assets under management, TIAA-CREF is one of the largest managers of retirement and investment funds in the United States. As of December 31, 2012 it had over USD 3 billion of farmland assets under management and a global portfolio of nearly one million acres which represents around 0.5% of its total assets under management. In May, 2012 TIAA-CREF established a USD 2 billion global agricultural company, TIAA-CREF Global Agriculture LLC (TCGA), which looks to invest in the major growing regions of the world including Australia, the United States and Brazil.

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[108] This is one reason why, for example, TIAA-CREF only invests in existing farmland.

[109] See for example: http://farmlandgrab.org/

[110] www.unpri.org/commodities/Farmland%20Principles_Sept2011_final.pdf

[111] Nineteen funds have so far become signatories to *The Principles* including: the Second AP Fund (Sweden); ABP (Netherlands), ATP (Denmark), BT Pension Scheme/Hermes EOS (Great Britain), PGGM (Netherlands) and TIAA-CREF (USA).

152. TCGA is made up of institutional investors who have made capital contributions to the investment entity and in return receive periodic capital distributions as the portfolio matures. These distributions have several revenue sources including rent paid by farmers, crop sales and proceeds from the sale of properties.

153. According to Jose Minaya, the Managing Director of TIAA-CREF's Global Natural Resources and Infrastructure Investments, farmland is an attractive asset class due to the structural drivers of increasing demand for food and biofuel, the opportunity to diversify outside of public markets and the low correlation with other investments:[112]

> "*We see increased protein consumption in developing economies and alternative energy mandates driving increased demand for food, fibre and fuel from a limited resource — land. Direct investment in farmland provides access to the key driver of food production. We believe farmland offers excellent portfolio diversification given its low correlation to traditional asset classes like stocks and bonds. Farmland also acts as a hedge against inflation within a portfolio*."

154. However, despite these advantages, institutional investors are not large holders of farmland assets due to historically high barriers to entry such as limited access, low liquidity, limited market information and research, and a large number of off-market transactions.[113] To overcome these barriers, TIAA-CREF works with local asset managers to acquire and monitor properties. Brazil is attractive because it offers diversification by crop and climate. TIAA-CREF has invested in over 500 farms globally, some in the sugarcane growing areas of the Sao Paolo Region. Assets in the TIAA-CREF farmland portfolio are typically made with a 20 to 30 year hold view.

TIAA-CREF's business model

155. Up until relatively recently, the role of institutional investors in investment in agricultural production has been limited. Farmland has been owned and managed primarily by individual farmers and agribusinesses, with institutional investors owning less than 1% of the approximately USD 2 trillion global farmland market (TIAA-CREF, 2012). However, attracted by strong sectoral fundamentals, combined with good returns with low correlation to other asset classes, long-term investors are increasingly looking for vehicles to gain exposure to this sector (Hallam, 2009).

156. For example, between 1970 and 2009 in the United States, agricultural land values, as measured by the USDA's ERS database, have outperformed both domestic stocks and bonds on an annualized basis, returning an annual average of 10.25% vs. 6.24% for the S&P 500 and 7.3% for 10-year Treasuries. Spreading farmland investment across regions with different climates, crops and economic influences, further reduces risk, according to TIAA-CREF chief economist Tim Hopper.[114]

157. Direct ownership of farmland or long-term leases offers such an opportunity for investors while avoiding much of the risk associated with the high variability of agricultural commodities themselves.

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[112] See online interview at www.tiaa-cref.org/public/about/asset-management/innovation-stories/brazil-farmland and the farmland return as measured by the NCREIF Farmland Index, stocks measured by the S&P500, bonds as measured by the 3 month Treasury Bill, and inflation as measured by the Consumer and Producer Price Indexes.

[113] TIAA-CREF press release: www.tiaa-cref.org/public/about/press/about_us/releases/articles/pressrelease422.html

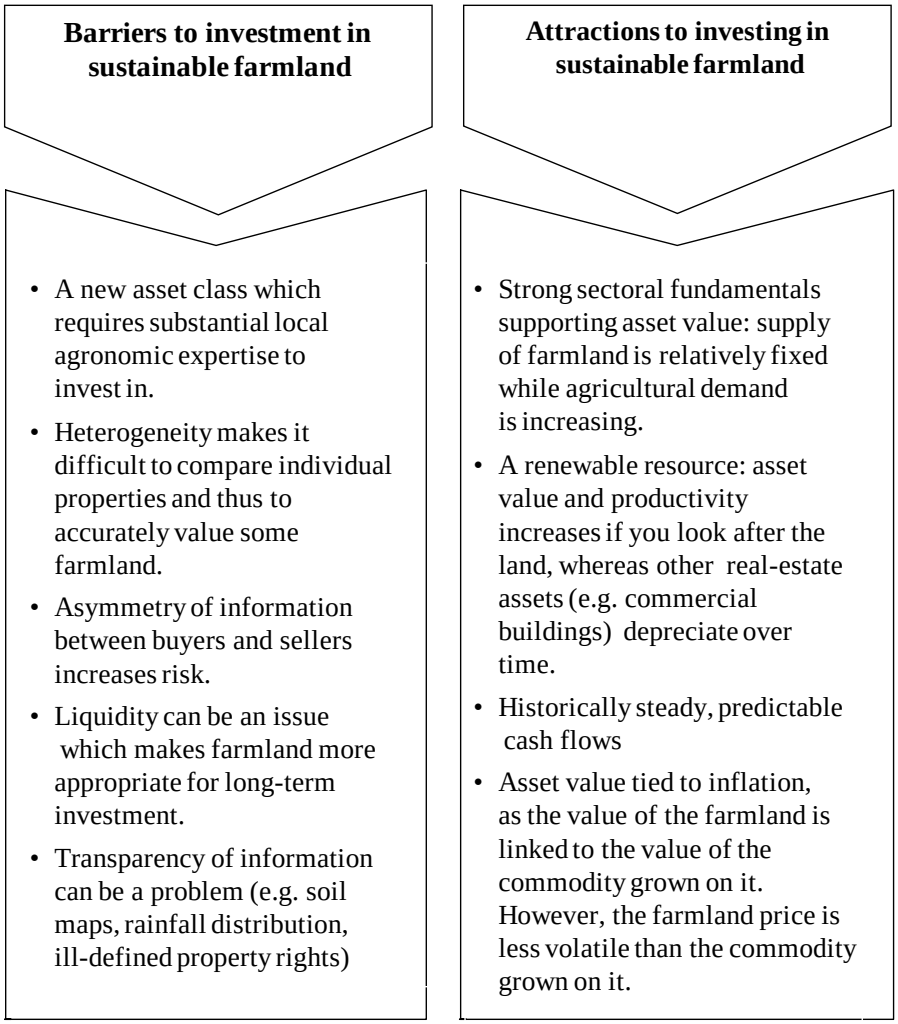
[114] https://www.tiaa-cref.org/public/advice-planning/market-commentary/market-commentary/investment_insight_articles/comm_063.html

158. TIAA-CREF's business model typically works with farm operators who manage the farms and earn a return from growing and marketing crops. The relationship between the investor and operator will generally depend on whether the crop is an annual crop (e.g. corn, cotton, soy), or a permanent crop (e.g. crops grown on vines or trees such as nuts or wine grapes). With annual crops the farmer leases the land from the investment entity and pays rent to the entity with terms generally established or renewed on annual or multi-year basis. The farmer is responsible for growing and selling the crop and reaps the proceeds from this activity. In the case of permanent crop land, the asset manager helps manage the sales and marketing of the crop, and the proceeds of the sale go directly to the investment entity. The farm operator, who is paid by the investment entity, is responsible for the cultivation over several years while the trees or vines are still in the non-bearing stage and for management of the crop once they are producing. In contrast to annual crops, a significant part of the asset value is in the tree or vine. A crop management contract is the process by which the relationship between grower and investor is managed.

159. An important part of TIAA-CREF's farmland investment strategy is first the selection of appropriate regions and types of investment to target. The sustainability of the investment programme is built in such a way to focus on situations where the risk of cultural, legal or environmental problems is minimized. Investments that do not meet the requirements of the UNPRI *Farmland Principles* are avoided at the outset. Prior to acquisition, any farmland investment must pass TIAA-CREF's formal due diligence process. This covers a checklist including previous ownership and the identification of any boundary disputes, the uses and conditions attached to the property, any significant environmental values attached to the land such as the presence of wetlands or endangered species and other issues covering any water rights attached to the property, intellectual property, property improvements, and patented crops. Once an investment is made, TIAA-CREF applies its corporate governance standards to address issues relating to financial controls, voting rights, anti-corruption measures and compliance.

160. A key lesson TIAA-CREF cites as instrumental in their success in investing in this area in Brazil was partnership with local companies. In 2008 TIAA-CREF developed Radar through a joint venture with Cosan, the world's largest grower and processor of sugarcane and ethanol. Radar's mission is to identify and acquire agricultural properties with strong investment potential across Brazil and employs 17 professionals in its São Paulo office. Radar uses a proprietary agricultural pricing model and land analysis technology to assist in the selection of the most productive agricultural land. Since then the partnership has invested over USD 500 million in seven Brazilian states and has prioritised transparency and fair process in environmental, labour, legal, and land use issues.

Figure 20. Barriers and attractions to investment in sustainable farmland for institutional investors



Source: Interview with Ricardo Mussa, January 2013.

161. Sustainability is also a core element of TIAA-CREF's investment approach, with every acquisition undergoing a rigorous assessment against a range of environmental, social and agronomic criteria. According to Ricardo Mussa, Director of Radar, their environmental assessment has been used as a benchmark by the regulatory authorities and often results in a premium being placed on the value of farmland they buy highlighting the link between good stewardship and asset value. As part of the environmental due diligence, Radar also investigates the potential impact of climate change and an increase in temperatures on farmland values.

162. To ensure that their farmland investment does not lead to increased deforestation, Radar focuses on improving the productivity of existing farmland, rather than the development of new areas. Furthermore, all investments are subject to an environmental site assessment which provides a baseline risk assessment. This way threats to sensitive environmental areas, endangered species and other risks can be avoided or controlled (TIAA-CREF, 2012:12).

163. TIAA-CREF's farmland investments target export commodities, particularly sugarcane and soybeans. Sugarcane is used as a feed stock for ethanol production which accounts for around 15 percent

of energy consumption in Brazil, with almost all motor vehicles in the country using it as a bio-fuel. Mr Minaya notes that sugar-based ethanol is more efficient to produce than the corn-based fuel made in the United States and is designated by the EPA as an advanced biofuel due to its over 60 percent reduction of total life cycle greenhouse gas emissions. In addition, the waste stream from the sugarcane harvest is recycled as a bio-mass generation feedstock, substituting for fossil fuel generation.

Box 7. Development of the ethanol market in Brazil

In the late 1970s, the Brazilian Federal Government mandated the mixture of anhydrous ethanol in gasoline (blends up to 25%) and encouraged car makers to produce engines running on pure hydrated ethanol (100%). Brazilian adoption of mandatory regulations determining the amount of ethanol to be mixed with gasoline (basically a renewable portfolio standard for fuel) was essential to the success of the programme. The motivation was to reduce oil imports that were consuming one-half of the total amount of hard currency from exports, but it was soon realised that the programme had significant environmental and social benefits. Conversion to ethanol enabled the phasing out of lead additives and MTBE and reduced sulphur, particulate matter and carbon monoxide emissions. It helped mitigate GHG emissions efficiently by having a net positive energy balance. Subsidies for ethanol production are now a thing of the past because new plants benefit from the economies of scale and the modern technology available today, such as high pressure boilers that allow the co-generation of electricity. Combined with a favourable natural environment, this has helped make Brazil's sugarcane producers some of the most efficient and profitable in the world (Hira *et al*., 2009).

Source: Goldemburg, 2007 'Ethanol for a sustainable energy future'.

164. One particular problem faced by Brazil is the challenge of poorly defined property rights. Ownership of land is characterised by a multitude of market participants ranging from small family farms and indigenous communities through to sophisticated global corporations. As a result, there is often the problem that land disputes prevent planned development of the land available for use.

165. To deal with these issues, TIAA-CREF invested resources to understand the local legal and regulatory environment. They also implemented a strategy for dealing with gaps in information required under the law to establish ownership.

166. For example, Radar uses photographs dating back to the 1950s to assist in establishing the historical use of the land, cultivation patterns, and its transformation or development, to establish the presence of indigenous populations and other issues related to the environment. This process has been highlighted in the UNPRI farmland case studies for its ability to bring interested parties to the table and for providing ancillary benefits to neighbouring communities who have learnt from it in resolving their own land disputes.

167. For example, in 2009 Radar made an offer on a property with disputes that involved more than 500 regional farms. Due to these disputes, the farmers had been unable to secure credit and unable to develop their business. Radar convened negotiations that after 12 months settled the disputes with reasonable terms for the parties and cleaned the deed. Other farms in the same region have since followed this model, unlocking under-utilised land for development, increasing farm investment, productivity and output. As a result, a respected multinational firm announced a new production facility in the region. Furthermore, with ownership rights able to be more securely identified, Radar has developed a title insurance model that, if adopted by the national government, may reduce risk and improve liquidity for the entire market (UNEP-FI, 2012).

Lessons for investors and governments

168. The main lesson from this case study for institutional investors wishing to gain exposure to green growth agricultural investments is the importance of local knowledge and governance. This case study also highlights the range of available investments utilising different capital structures and investment channels as well as their associated risks and risk-adjusted returns. Fundamental to this type of investment is the need to build the necessary capabilities to manage such investments.

169. TIAA-CREF have used Radar to identify, acquire and monitor properties in Brazil and to negotiate lease and crop management contracts. Having people positioned in the country of the farmland working directly with the farmers and crop managers was a key part of their business model. This also required investing significant resources in the due diligence of land ownership and dispute resolution.

170. For TIAA-CREF's farmland investments in Brazil sustainability and 'green' investment is not at odds with profitability. By focusing on existing high quality farmland and investing in its sustainable management, they have increased the value and productivity of their assets.

171. Regarding the role of government in creating an enabling framework for green growth investment in Brazil, much progress has been made towards creating a stable, investment-grade business environment where investors can be confident that the rules of doing business will not rapidly change. This has had a significant impact on the attractiveness of Brazil as a destination for investment, which has increased substantially in the last decade since the reform.

172. One of the potential barriers for institutional investors wishing to invest in farmland is where land rights are not clearly defined and allocated. This is a particular issue in parts of the world where farmland yields are very low, which could benefit from high-quality institutional investment. Attention clearly must be given to any transition arrangements to ensure existing landholders are not disadvantaged by new arrangements, and smarter regulations could help exert influence on how land is managed without restricting ownership. This may help encourage capital to flow into productivity enhancing investments, supporting the broader "Freedom of Investment for Green Growth" agenda.[115]

[115] http://www.oecd.org/investment/internationalinvestmentagreements/47721398.pdf

Case study 3: Investment in offshore windfarms: Walney Offshore Windfarms in the UK[116]

Highlights:

- Institutional investor: PGGM (Pension Fund: AuM of EUR 140 billion) and Ampère Equity Fund (Private Equity Fund: AuM of over EUR 1 billion)
- Green investment: offshore wind energy (367.2MW)
- Location: International (UK)
- Return: 8-10%[117]
- Type of investment: Direct equity and investment in pooled vehicle

Summary

173. The Walney Offshore Windfarm project highlights the interaction between government policy regulations and incentives, and the deployment of innovative financial structuring by the project developer, to secure sufficient financing to achieve the commissioning of the world's largest offshore windfarm.

174. The challenges facing the project include:

- Offshore windfarms are relatively expensive investments compared with carbon-based technologies or other more widely deployed renewables, including onshore wind. Despite improvements over the last decade the technology remains subject to medium risks. For example, construction is subject to both weather conditions and some supply chain considerations and it is difficult to have access to turbines for repair or maintenance during adverse weather conditions.

- The scale of the Walney project added cost and price risks, creating further obstacles for potential developers and investors. With its 367.2 MW capacity, Walney significantly scaled up previous examples of offshore power generation, and was further away from shore and deeper in the seabed.

175. Under these circumstances, the UK government's policy framework, and particularly its green tradable certificate systems, specifically rewarded the generation of cost-effective renewable electricity. The policy incentives targeting the deployment of offshore windfarms rewarded generators with two Renewable Obligation Certificates (ROCs)[118] per MWh generated by offshore windfarms that began generating on or after 1 April 2010.

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[116] Climate Policy Initiative (2012), *San Giorgio Group Case Study: Walney Offshore Windfarms* CPI Report, and Walney Offshore Windfarms, '*Walney Offshore Windfarms'* (brochure) , available at: http://www.dongenergy.com/SiteCollectionDocuments/wind/walney/Walney_Offshore_Windfarm.pdf

[117] This is the project-level internal rate of return. Returns are adjusted at the individual shareholder level based on the outcome of several arrangements surrounding the special purpose vehicle (profit or losses on the power purchase agreements, margins on sale of equity stakes, etc.).

[118] ROCs are a key component of the Renewables Obligation, the main support scheme for renewable electricity projects in the UK. ROCs can be traded and are designed to encourage generation of electricity from eligible renewable sources in the UK. They place an obligation on licensed electricity suppliers to source an increasing proportion of their electricity from renewable sources. Electricity supply companies are required to purchase ROCs from the producers up to the specified quota of their electricity sales or pay an equivalent amount into a buy-out fund. The quota is set by the government.

176. OPW, a consortium of the Dutch pension fund service provider PGGM and Ampere Equity Fund, took a 24.8% stake in the project in December 2010. The partnership with PGGM and Ampere Equity Fund, which is managed by Triodos Bank's subsidiary Triodos Investment Management, clearly demonstrates that institutional investors are willing to invest in well-structured offshore wind projects alongside market leading industry participants. DONG Energy has around 30% of the offshore wind market throughout Europe.[119]

177. In response to a request from the Dutch financial investors to be protected from price risks, the power-purchase agreement established between DONG Energy and OPW was used to address financial investors' concerns and give them the stable price they expected from the investment. DONG Energy played multiple roles in this project and held a large share of the risks as the developer, majority shareholder, construction manager, operation and maintenance service provider, and bridge financing lender.

178. This case study is intended to summarise how the various stakeholders involved in the Walney Offshore Windfarm project addressed specific financing challenges and potential investors' concerns. Finally, on the basis of the material in the study, lessons to be learned are reflected on for policy makers and investors.

General context

179. During the years 2010 and 2011, the Walney Offshore Windfarm Ltd. constructed the Walney 1 and Walney 2 offshore windfarms, located approximately 15km off Walney Island, Cumbria, in the Irish Sea in the UK.

180. Walney 1 and Walney 2 both comprise 51 turbines with a total capacity of 367.2MW. The development includes foundations, turbines, export and array cables, offshore substations and onshore connection to grid. They are expected to help the UK achieve its target of reducing CO2 emissions and increasing renewable sources by providing clean electricity for approximately 320,000 UK households. Walney 1 and Walney 2 were constructed sequentially, leading to periods of intense construction activity, particularly during Walney 2 when parallel installation activities shortened the construction timeframe.

181. Building wind farms offshore is a relatively recent application of wind energy technology. Thus, despite offshore wind having several distinct advantages and attractions, project developers are very much faced with challenges in attracting private investment, which is typical of immature technologies with limited diffusion.

182. When the Walney Offshore Windfarm project opened in February 2012, the project was the largest installed offshore windfarm in the world. At the time of its approval in 2007, its developer, DONG Energy[120], was faced with serious financing challenges. Despite strong market penetration of wind technology, the offshore location added numerous risks to the project profile. These included significant revenue, construction, operation, and maintenance costs. These challenges were exacerbated by the reluctance of banks to provide project finance in the aftermath of the escalating European debt crisis.

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[119] http://www.dongenergy.com/EN/Media/Newsroom/News/Pages/World-slargestoffshorewindfarmoffthecoastofCumbriabreaksindustryrecords.aspx

[120] DONG Energy is one of the leading energy groups in Northern Europe headquartered in Denmark. The business is based on procuring, producing, distributing and trading in energy, and related products in Northern Europe.

183. Under these circumstances, the Walney Offshore Windfarm project used a combination of policy and financial tools and incentives to successfully address critical barriers to renewable energy investment:

- First, the long-term and forward-looking government policy framework including clearly articulated targets of emissions reduction and increased renewable sources provided a stable and credible policy backdrop and lessened policy risks derived from regulatory and policy uncertainty.

- Second, with the support of a long-term policy framework and associated future revenue stream, DONG Energy employed extensive financial structuring to carefully reallocate project risks and share benefits in a way that attracted non-traditional investors, such as institutional investors.

184. The project-level internal rate of return was estimated to be between 8-10% (CPI 2012). Returns are adjusted at the individual shareholder level based on the outcome of several arrangements surrounding the special purpose vehicle including the profits or losses on the power purchase agreements.

UK Government Policy Framework

185. The UK government has singled out offshore wind as a cornerstone of its low carbon future, implementing policies specifically designed to give incentives to large-scale offshore projects. The Crown Estate auctioned seabed leases to offshore wind developers through several bidding rounds. The UK Department of Energy and Climate Change and the Office of Gas and Electricity Markets have the responsibility for: (1) granting permits for the construction of windfarms, (2) managing the bidding process, and (3) issuing ROCs to eligible renewable energy producers. The UK Department of Energy and Climate Change and the Office of Gas and Electricity Markets awarded the Walney windfarms two ROCs per MWh generated by offshore windfarms that began generating on or after 1 April 2010.[121].

186. While the UK government did not contribute directly to the special purpose vehicle or its shareholders, the UK Government indirectly contributed to financing through the policy arrangements with ROCs, which created a stream of steady revenues for the Walney Offshore windfarms by imposing a variable charge on the UK electricity supplier.[122] In addition, the UK government passed the 2008 Climate Change Act and established the world's first legally binding climate change target, which aims to reduce the UK's greenhouse gas emissions by at least 80% (from the 1990 baseline) by 2050. Also by presenting the renewable energy roadmap, the UK government has made clear its commitment to increasing the deployment of renewable energy across the UK in the sectors of electricity, heat and transport, setting renewables as a key part of the decarbonisation of the energy sector necessary by 2030.[123]

187. The UK Government's long-term policy framework with a clear roadmap and commitments played an essential role in attracting project developers and creating sufficiently attractive revenue streams to allow developers to bring on board institutional investors as minority shareholders. In the Walney transaction, the most critical role public finance was the provision of green tradable certificates over a 20-year horizon, which is estimated to provide around 60% of the expected project revenues.

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[121] Although buy-out ROCs price is changeable, it stood at GBP 36.99 per MWh between 1 April 2010 and 31 March 2011. (GBP 42.02 per MWh between 1 2012 and 31 March 2013)

[122] CPI report estimates total annual revenues between GBP 178-203 million including the annual revenues from ROCs sales between GBP 104 and 127 million in this case.

[123] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/80246/11-02-13_UK_Renewable_Energy_Roadmap_Update_FINAL_DRAFT.pdf

Extensive Financial Structuring

188. In the Walney project, DONG Energy (50.1%), SSE (Scottish and Southern Energy) (25.1%), and the consortium of PGGM and Dutch Ampère Equity Fund (24.8%) are the companies behind Walney Offshore Windfarms Limited. DONG Energy is the leading partner in the construction and operational phases of the Walney Offshore Windfarms. Through extensive financial structuring including the deployment of PPAs and the transfer of various types of risks, DONG Energy was able to share future benefit streams and offset project risks through structured products in ways that helped provide satisfactory returns for non-traditional equity investors.

189. PGGM is a leading pension fund administrator with origins in the care and welfare sector. PGGM provides pension management, integrated asset management, management support and policy advice for pension funds.

190. Ampère Equity Fund managed by Triodos Investment Management, is an institutional fund which invests in utility-scale renewable energy projects in Western Europe. The fund focuses on investment in energy producing assets applying proven technology that provide stable and predictable long term returns for its investors. Ampère Equity Fund functions as a vehicle which aggregates the contributions and/or commitments of institutional investors. The fund states that their buy and hold strategy ensures stable operating cash flow and dividends during the economic lifetime of the projects.

191. In the Walney project, DONG Energy de-risked their investment by deploying power purchase agreements, construction management agreements, and operations & maintenance agreements and shouldering a large part of the associated risks. It significantly reduced uncertainties relative to cash flow components. The risks affecting all major cash flows that non-traditional investors such as pension funds could not manage were transferred to more able parties such as project developers. Such financial structuring protected pension funds from price, early-stage financing, construction, and operating performance risks.

192. In addition, investors were allowed to pay for equity stakes in several deferred instalments, and were also provided with a loan by DONG Energy to help them acquire shares, addressing risks faced by financial investors through the share purchase agreements. For example, the share purchase agreements reduced OPW's financing requirement at the date of the closing.

193. As a result of protecting investors from potential cash flow downside risks such as cost overrun and delay-related costs by shifting them to DONG Energy, the project developers essentially 'de-risked' the equity stake and created an investment opportunity with features of a quasi-fixed income security. Taking direct stakes in the renewable energy project provided non-traditional investors with some benefits including diversification from traditional asset classes and lower fees than typical infrastructure funds.

194. In December 2012, PGGM and Ampere Equity Fund announced that they have closed the refinancing of the purchase (completed in December 2010) of their 24.8% stake in the Walney offshore wind farm. A group of 4 commercial lenders: Lloyds Bank, the Royal Bank of Scotland plc, Santander, and Siemens Bank GmbH, together with the newly established UK Green Investment Bank ("GIB"), have provided between them facilities totalling GBP 224 million. This financing is expected to enable PGGM and Ampere Equity Fund to refinance on a non-recourse basis approximately 70% of the purchase price agreed with DONG Energy. [124]

[124] The UK Green Investment Bank was formed as a public company in May 2012. With GBP 3.8 billion of funding from the UK Government. It is the first bank of its kind in the world. It is a "for profit" bank, whose

Lessons learned

195. In this case, the combination of the favourable UK government policy incentives and the project-specific financial structuring, allowed institutional investors to achieve a quasi-fixed income position after the construction phase and make a decision to undertake a long-term investment in offshore windfarms, a technology which is still a distance from commercialisation and grid parity.

196. The first lesson to be drawn is that providing a clear and stable policy framework in support of long-term green investment is an essential element in enabling institutional investors to evaluate and manage such long-term risks. To this end, an incentive-based clear long-term policy framework combined with a well-established set of instruments (here ROCs with ambitious deployment targets), together with extensive financial structuring such as power-purchase agreements, plays a key role in creating sufficiently attractive revenue streams, a central part of risk-return profiles that match the investors' expectations. The Government effectively created the conditions under which a project pipeline can develop.

197. The second lessons is that providing risk transfer opportunities and financing vehicles which can help to mitigate risks and increase the appeal for institutional investors is a key element in allowing institutional investors to build long-term investment portfolios. In this case, various financial structuring approaches such as power-purchase agreements and deferred instalments of payments for equity stakes enabled DONG Energy to structure projects in a way that de-risked the investments and offered the same income positions as fixed income securities to the institutional investors especially during the operating phase. The transfer of risks which are difficult for institutional investors to manage such as construction, operations and maintenance risks, together with power-purchase agreements, served to mitigate risks during construction, operation and maintenance and attract institutional investors to long-term investment for green infrastructure.

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mission is to accelerate the UK's transition to a more green economy, and to create an enduring institution, operating independently of Government. The bank became fully operational in October 2012 when it was granted State Aid approval by the European Commission to make investments on commercial terms. This approval covers a number of green sectors, certain of which have been chosen by the UK Government as "priority sectors", to which at least 80% of the bank's capital must be directed: offshore wind, waste (treatment and recycling and energy from waste), non-domestic energy efficiency, and the Green Deal. Other permitted sectors are biofuels for transport, biomass power, carbon capture and storage, marine energy and renewable heat. http://www.pggm.nl/About_PGGM/Press/Press_releases_and_news_items/Press_releases_and_news_items/121220_PGGM_en_Ampere_Equity_Fund.asp

Case study 4: Green securitisation as a tool for green growth: lessons from the CRC Breeze Finance Bonds[125]

Highlights:

- Project sponsor: Christofferson, Robb & Company (CRC) and CRC Breeze Finance (SPV)
- Green investment: Onshore wind farm (430MW)
- Location: International (Germany and France)
- Return: 5.3-6.1%
- Type of investment: Asset Backed Securities

Summary

198. This case study looks at the role of securitisation in green growth and illustrates how private capital markets can finance renewable energy when the support is right but how unforeseen issues can complicate the financing. Securitisation, where illiquid financial assets are transformed into tradable investment products (Asset Backed Securities), is currently being advocated as a tool for green growth, but CRC Breeze Finance, the first securitisation of wind farms, has been a disappointment for investors.

General context

199. According to the U.S. National Renewable Energy Laboratory (NREL, 2012), securitisation provides a potentially useful mechanism by which to attract investment from as-yet untapped sources of capital such as institutional (e.g. pension and insurance), retail, and sovereign wealth funds. The EC (2013a) states in its Green Paper that reshaping securitisation markets could also help unlock additional sources of long-term finance. Subject to appropriate oversight and data transparency, they can help financial institutions free capital, which can then be mobilised for additional lending, and manage risk.

200. In March 2013, the U.S. Department of Energy formed the Solar Access to Public Capital (SAPC) working group through NREL to facilitate securitisation of solar by standardizing the power purchase agreements (PPAs), leases, and other instruments on which they are based and to improve clarity on risk. NREL (2012) states that Asset Backed Securities operate efficiently in many asset classes and could potentially tap vast sums of capital for renewable energy projects, while avoiding the challenges associated with the mortgage-backed securities which are widely seen as a major cause of the financial crisis of 2008–2009.

201. According to Dealogic, global project debt in 2012 amounted to USD 345 billion; of that, bank lending remains the primary (95%) source of business and project lending. In the past, banks have used securitisation — pooling assets and using cash-flows to back securities — to pass on mature loan portfolios to long-term debt holders and so recycle their lending limited lending allocations. This had been particularly useful to regional banks with smaller balance sheets. Securitisation grew as a funding source in the 1950s and in particular in the 1970s and 1980s because Governments actively encouraged it for

[125] Sources: OECD Analysis, Interview with Richard Robb, S&P Presale Report (2006), Fitch Ratings Action (2011) – Box in 2011 paper

housing seeking the economic multiplier effect of housing investment. Tax breaks, guarantees and regulatory support were used to encourage this and banks responded by increasing lending to housing. Securitisation worked well for 40 years to unlock the value of illiquid assets, drive down the cost and increase access to finance.

Addressing stalled bank project lending

202. Unfortunately, bank recapitalization currently being experienced in Europe and the USA has led to a squeeze in business lending, both in those countries and in emerging markets they have a strong presence, and this is expected to continue as new Basel III rules are introduced. According to the Bank of International Settlements, in 2012 alone lending rates fell 31%.[126] This problem has been compounded by the confidence in commercial securitisation having been affected by the financial crisis and the collapse of the residential mortgage-backed securities (RMBS) market.

203. As the International Monetary Fund argues in its Global Financial Stability Report, "Current reservations about securitisation do not invalidate its economic rationale, arguing instead for repairing flaws exposed by the crisis .... failure to restart securitisation would come at the cost of prolonging funding pressures on banks and diminution of credit." [127] Blommestein, Keskinler and Lucas argue in the 2011 OECD Journal on Financial Markets "a recovery in securitisation markets could be a prerequisite to unlocking credit markets in general and supporting a wider global economic recovery" [128]. Similar conclusions were drawn at the OECD's financial roundtable held in April 2012.[129]

Getting the policy settings right

204. The challenge for policy-makers is to maintain a regulatory regime that maintains the economic benefits of securitisation while avoiding the problems experienced in the run-up to the economic and financial crisis. It is crucial; therefore, that securitisation of bank loans needs to be done in a transparent, well-regulated and prudent way, to avoid the problems that contributed to the crisis.

205. There are some concerns that current policy proposals aimed at addressing policy-maker concerns — notably the requirement for originators to maintain a significant equity stake in securitisations —may inhibit the regrowth of the market. The focus should be on improving transparency and reducing complexity where it works against transparency, such as with securitisations of securitisations (the European Banking Authority has, for example, set new rules on this). An improved dialogue with the securitisation industry is required to develop optimal policy solutions while also addressing valid governance concerns.

206. The EC (2013a) suggests that market-based initiatives may be used to stimulate securitisation markets including through labels for high quality, transparent and standardised securitisations, such as the Prime Collateralised Securities (PCS) label, conceptualised in 2012 by the Association for Financial Markets in Europe (AFME) and the European Financial Services Roundtable (EFR). The EC argues for simple securitisation products based on simple and unleveraged structures, using low-risk and diversified

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[126] As cited in Investment & Pensions Europe, April 2013, p53.

[127] 'Outlook for the Securitisation Market', Blommestein, H. J., Keskinler, A., Lucas, C., 2011. OECD Journal: Financial Market Trends. P.12. http://www.oecd.org/finance/icdebtmanagement/48620405.pdf

[128] Ibid.

[129] Wehinger, G (2012), Bank deleveraging, the move from bank to market-based financing, and SME financing. *OECD Journal: Financial Market Trends, 1,* p.9f. http://www.oecd.org/daf/fin/financial-markets/Bank_deleveraging-Wehinger.pdf

underlying assets. The EC also highlights the importance of adequate prudential rules and supervision systems, as well as securitisation markets specifically dedicated to SMEs and specific sectors.

A role for public sector banks

207. The energy efficiency and renewable energy sectors are characterised by a predominance of smaller projects, with bank lending spread over a wide variety of banks. To successfully tap debt capital markets using securitisation, banks need a pipeline of loans big enough to ensure bulk and liquidity in a market. There are very few, if any, banks with adequate renewable energy or energy efficiency loan books in their own right.

208. In the U.S. market "Conduit Entities" have typically been used to meet the need of lenders with smaller loan books. A Conduit Entity is a governmental or private entity that pools mortgages and other loans from multiple institutions and securitises them, as a private conduit to investors. Conduit Entities are usually backed by mortgages, credit card receivables and other loans. They enable banks and other lenders to more easily sell their loans to investors in the secondary market, avoiding the restrictions of size of the pool or limitations on eligibility.

209. In the current absence of investor confidence, kick-starting the securitisation market will likely require public sector intervention — in much the same way that the development of the economic multiplier housing securitisation market in the mid-20th century required public sector support.

CRC Breeze Bonds

210. The project's sponsor was the hedge fund Christofferson, Robb & Company (CRC). The bonds were all issued through a Special Purpose Vehicle (SPV) called "CRC Breeze Finance" and are secured on a number of wind farms in Germany and France.

211. Richard Robb, CRC's CEO, describes how in 2005 they started looking at the securitisation of loans to wind farms. They were motivated by the fit with CRC's traditional business of investing in asset-backed securities and private structured credit transactions. These are aimed at helping European banks transfer risk and improve their balance sheets and return on regulatory capital. CRC decided that the money to be made at the time, at least in onshore wind, was through owning the farms, rather than lending to them. Accordingly, they looked for an opportunity to buy a scale portfolio as part of a strategy to look to benefit from efficiencies in operating, maintenance and financing arrangements.

212. Once the wind farms are constructed, returns largely depend on how hard the wind blows. This creates a revenue stream that would be marketed to CRC's investors. CRC bought its first onshore German wind farm within their Credit Fund in July 2005 so that they could learn about how they worked. In the worst case, they were confident in being able to sell it in a year if they changed their minds about the economics of wind.

Project Details

213. By the spring of 2006, CRC's Energy Fund acquired 430 MW of onshore wind farm capacity in Germany and France. CRC contributed the equity, and a bank lent the money needed to finance construction. Once the portfolio was assembled, the fund sold the projects to a special-purpose vehicle called CRC Breeze Finance, which issued EUR 470 million of asset-backed securities in a whole-business securitisation. According to Windpower Monthly (May 2006), this was the "first international financing where renewable energy infrastructure has been funded directly from the capital markets".

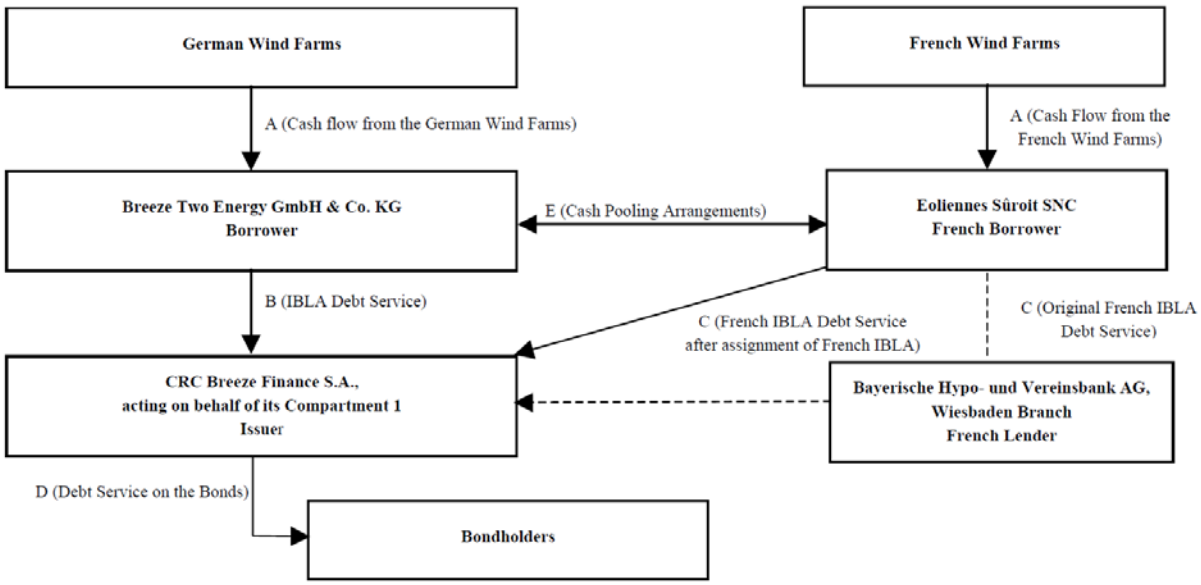
214. The bonds are structured so that the revenues from the wind farms pay interest and capital back on the bonds specifically associated with this project. Even if the wind does not blow as hard as usual or operating and maintenance expenses turn out to be higher than originally assumed, there is enough of a cushion that bondholders will be paid out on schedule. These revenues are reasonably consistent, so they fit neatly with the demands of the fixed income bond investor. The CRC Breeze portfolio generates expected annual returns of about 8%, which were boosted to 15% with the help of leverage.

215. However, none of this would have been possible without government subsidies. In Germany, the Renewable Energy Act guarantees a feed-in tariff for 20 years and mandates the grid operator to purchase all the electricity a wind farm can produce at the guaranteed price. The feed-in tariff obtained for this project was about €83.6 per megawatt hour (MW/h), compared with free market prices for electricity that generally range from €30 – €70 per MW/h.

Bond Structure

216. The bond comprises a total of three tranches, two of which have been placed in the capital market. Two tranches of structured Eurobonds called "Breeze Two"; and a privately placed tranche C of EUR 120m have also been placed. Interest and principal payments on Breeze Two will come from the sale of electricity to grid operators. The 20-year senior bonds maturing in May 2026 (EUR 300m, with 5.3% coupon) and EUR 120m, respectively) are rated BBB by both Standard & Poor (S&P) and Fitch, while the 10-year subordinate bonds, maturing in May 2016 (EUR 50m, with 6.1% coupon), are rated BB+ by both agencies. HypoVereinsbank (HVB) acted as structurer and consultant for the purchase of the investment project for Christofferson. The German bank also underwrote and distributed the bonds to a wide range of investors, including insurance companies, banks, pension funds and asset managers. The bonds are to be repaid in semi-annual instalments through the end of the term.

Figure 21. Transaction cash flows



Risk identification

217. According to S&P, the investors (such as pension funds) were exposed to the following risks:

- The cash flow from each project depends directly on energy production that, in turn, depends on the wind resources. The lack of long-term on-site wind-resource data at most of the sites introduces the risk that projected energy production levels, and therefore cash flows, might not be realized.

- The revenues of the individual projects rely on support provided by the regulatory systems in France and Germany for renewable energy. Any change in these regulations could affect the support for the underlying wind projects which could result in lower revenues than predicted.

- Construction risk was a factor as about 50% of the wind-power projects were still under construction at the time of the transaction.

- There is some concentration risk from the employment of a new technology with little performance track record (the Vestas V90-2.0 MW wind turbine), which accounts for more than 20% of the portfolio.

- There is an off-take price risk for the French wind farms in the years 16 to 20 of their operation. French renewable energy law sets prices only for the first 15 years of operations. Thereafter the wind farms will be exposed to the market price.

Risk management

218. The project developer's response to these risks includes the following points:

- The regulatory regimes in Germany and France are considered supportive, both for existing wind-power projects and the development of new projects. In particular, the regulation provides both price and off-take certainty for the wind energy produced over the life of the debt except for the French price risk post year 15.

- Although the wind risk is prevalent, the projections benefit from two separate wind assessments by independent wind consultants. In addition, the base case assumes a wind probability of 90% of occurrence, based on one-year calculations.

- The overall portfolio benefits from cross-collateralization and satisfactory diversification because the projects are located at more than 30 different sites and in two different countries.

- The developers that will operate the wind parks have a good track record in constructing and operating wind farms with more than 800 turbines (approximately 1,200 MW as at March 31, 2006) already up and running.

- Off-taker counterparty risk is low.

- The price risk for the French wind farms in years 16 to 20 is mitigated by a conservative price assumption in the financial model and by the portfolio benefit via full cross-collateralization.

Downgrade

219. On 21 July 2010, Fitch Ratings downgraded CRC Breeze Finance S.A.'s (Breeze II) EUR 258.4m class A notes to `BB' and their EUR 36m of class B notes to `B'. These downgrades were an extension of the negative rating action that Fitch took on both classes of notes on 5 June 2009 and result from a

combination of an achievable energy yield significantly below original expectations, higher than expected operating costs, and technical difficulties with some turbines.

220. On November 30, 2011, Standard & Poor's lowered the rating on the EUR 287 million class A notes to "B+" from "BB-," according to research by the New York-based company. The main reason for the downgrade has been the wind underperformance. Principal payments on the Class B notes have been deferred since the April 2009 payment date.

221. The ratings company revised its outlook on the A and B notes to stable from negative on December 5 2012 saying wind-park performance improved and the risk of insolvency decreased.

222. On 28 January, 2013, Theolia SA, the French wind-power, announced that a BGE Investment SARL, a subsidiary wholly owned by Theolia SA, will purchase 70% of the class C notes. Due to underperformance, the principal payments of class B and C were deferred in November 2012. Theolia SA was reported to have stated that the purchase will increase sales in a bid to reassure bondholders.

223. Main risks identified in the downgrade:

- The volatility of wind supply. This is reflected in the low wind levels over the past five years, which has been significantly below historical averages.
- A deterioration in the project's liquidity because the operating and financial performance of the project was below expectations.

Lessons learned

224. This case illustrates how private capital markets can finance renewable energy. Central to this is the availability of data to investors and credit rating agencies to provide an indication of the performance of what is an illiquid investment. Also important is the availability of the right risk transfer mechanisms for long-term projects to mitigate political and regulatory risks, and sophisticated tools to help predict and hedge against wind volatility.

225. The first lesson to be drawn is that the appropriate provision of objective and high quality data on infrastructure and a clear and agreed benchmark is a key element in enabling private investors to assess the risks in green infrastructure investments and to understand correlations with other assets. Most institutional investors require that debt instruments such as bonds carry at least investment grade ratings to invest in them. Rating agencies are naturally conservative particularly when trying to assess very long-term projects or contracts particularly if there is a limited long-term performance history on which to draw. Eventually, without objective and high quality information which enable private investors to assess and monitor risks and performance of green investments, private investors are reluctant to make such allocations.

226. The second lesson to be drawn is that risk transfer instruments have an important role to play in facilitating institutional investors' investment in green infrastructure. Institutional investors are looking for investments which provide steady, long-term and preferably inflation adjusted income streams. In this case, such mechanisms as the cash-pooling mechanism of cross-collateralisation played an important role.

227. As NREL (2012) points out, institutional and other long-term investors are reluctant to invest, in a significant manner, without better quantification and mitigation of two primary risk factors: long-term power production capability and customer, or off-taker, default. These risks, if better understood through improved and more accessible datasets, could be mitigated via credit enhancement strategies or accurately priced into the securitised investment. Investment securitisation requires standardisation of contractual documents and project evaluation procedures. Standardisation may offer the opportunity to minimize due

diligence requirements of institutional and other investors, which is necessary for wide-scale and rapid investment. Other securitised assets such as auto loans and credit cards are highly liquid due to the standardisation of procurement documents and comprehension of underlying asset values. NREL also describes that it is important to integrate financial or securitisation solutions in the renewable energy sector with complementary efforts in the energy efficiency space.

228. Since the issuance of these bonds, an important development has occurred in the market for tailor-made insurance and derivative solutions aimed at protecting weather-related earnings volatility. This has been driven by the joint efforts of the European Wind Turbine Committee (EWTC), initiated by the insurer Swiss Re. It gives European insurers and reinsurers a forum to discuss trends and technologies with representatives from the wind energy sector, including wind turbine manufacturers, project developers, plant owners and operators, lenders and engineers. The EWTC dialogue aims to support the development of tailored insurance products that better meet the needs of the industry.

229. One of the key outcomes of the EWTC has been the development of a number of innovative risk transfer products which comprise insurance products to manage weather volume risks and risks associated with the construction and operation of renewable power infrastructure, including third party liability, contractor plant and equipment and assets.

SECTION 3: POLICY IMPLICATIONS

What is the role of policy makers in facilitating institutional investor participation in green infrastructure?

230. In its work on policies that tackle climate change and shift economies onto a more sustainable, green growth path, the OECD has highlighted that investment on such scale will require a mixture of public and private capital, including from newer sources. Green infrastructure and related projects may well provide the steady, inflation adjusted cash flows which such investors require.

231. Institutional investors have a potentially important role in this regard, given that they manage an estimated USD 83 trillion in assets, and yet their allocations to green investments remain limited. This is due to a range of factors as discussed in Section I, including regulation and policy uncertainty, lack of a project pipeline and suitable financing vehicles, and a lack of quality historical data. In addition, pension fund trustees, who are not environmental specialists, remain cautious when it comes to increasing their exposure to this sector, partly as they have witnessed some high-profile negative set-backs in the sector and are not convinced that the necessary risk-adjusted returns can be generated.

232. The case studies outlined in this paper show that, while the returns in some green investment sectors have been disappointing (notably around equity investments in solar power manufacturing, corporate and asset-backed bond investments in wind farms and early-stage venture capital investments), there appear to be some important opportunities for pension funds and insurance companies to derive the returns they need from green investments — ***if these deals are properly targeted and structured***. This condition is an important one, particularly for policy makers. In order to deliver the required risk-adjusted returns, the right policy framework will need to be put in place. Policy support mechanisms and the overall market framework can also be structured so as to create cash-flow characteristics that institutional investors might find attractive. Deal and financing structuring is not an area governments need to get involved in, the exception being targeted interventions by green banks or liquidity provision, concessional finance via state development banks, provision of risk guarantees, etc., where it is needed to cover specific risks that the private sector is unwilling to bear at a reasonable cost.

233. For example, the solar energy case study analysed in this paper shows how policy support for solar has driven a boom in solar module production, which then led to a massive fall in the market price of solar modules. For several reasons, governments in Europe and elsewhere have scaled back the value of their support programmes for solar installation. This lack of policy stability and adequate sequencing has led to several bankruptcies on the manufacturing side, which has brought down the performance of clean energy market indices such as the NEX index and returns on investments in related stocks as capital values have been eroded. But the value of and returns from renewable energy projects can be insulated from volatility in module prices through the use of long-term electricity purchase contracts, such as in the case of the MetLife Webberville Solar Park deal. This case also demonstrates the importance of separating risks between the construction and electricity generation elements of project finance.

234. By way of contrast, policy stability was an important element of making the investments in Walney off-shore wind farms a success as highlighted in case study 3. The innovative financial structure of this project, successfully allocating risk between the parties which can manage it best, was also an important element in making this project attractive to institutional investors — in contrast to the Breeze Finance bonds, whose investors were left highly vulnerable when the operating assumptions proved overly optimistic. Finally, the example of case study 2 on farmland investment in Brazil shows how, with the necessary due diligence and working with local partners, institutional investors can generate diversified

returns from sometimes interesting and unexpected sources which are also delivering environmental benefits.

235. Lessons learned from these cases provide confirmation for a number of the OECD's 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* (OECD 2012e) offers recommendations to policy makers which can be adapted based on this new analysis and lessons from the case studies:

1. **Ensure a stable and integrated policy environment,** developed in co-ordination with asset allocators, which provides investors with clear and long-term visibility and incentives. This helps provide the risk-return profile and confidence in future regulatory stability needed for investors to invest in long-term assets. Though prudential regulation is important for protecting pension fund members, it sometimes may have unintended consequences, creating barriers to long-term investments by pension funds which may need to be addressed.

2. **Address market failures** which create risk-return investment profiles that favour polluting or environmentally damaging infrastructure projects over green infrastructure investments. In the energy sphere, Power Purchase Agreements or similar measures that achieve cash flow characteristics desired by institutional investors are particularly important. 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) is also an important element of shaping the risk-return profile of green investments.

3. **Provide a national infrastructure road map**. This would give investors confidence in government commitments to the sector and demonstrate that a pipeline of investable projects will be forthcoming. This will reassure investors that it is worth building up their investment capability.

4. **Facilitate the development of appropriate green financing vehicles**. Governments can issue financing vehicles (e.g., green bonds) or support the development of markets for instruments or funds with appropriate risk-return profiles for institutional investors. They can also provide first loss cover, cornerstone stakes, risk mitigation and credit enhancement tools where appropriate.

5. **Reduce the transaction costs of green investment.** Governments can foster collaborative investment vehicles between investors and help to build scale and in-house expertise among institutional investors. This will also allow for capacity sharing and provide the scale necessary for smaller funds to participate in these projects.

6. **Promote public-private dialogue on green investments**. 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 green infrastructure 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. International organisations such as the OECD can also play a role through creating a platform for dialogue to assist this.

7. **Promote market transparency and improve data on infrastructure investment.** Governments could, where appropriate and needed, strengthen formal requirements to provide information on

investments by institutional investors in infrastructure and green projects, 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.

236. The barriers to institutional investors' investment identified in recent OECD reports on behalf of the G20[130] include a lack of appropriate financing vehicles, a lack of debt instruments, regulatory barriers, inappropriate risks transfer, lack of objective, high quality data and limited experience in evaluating potential investments. The reports further elucidate challenges particular to green infrastructure, which range from energy and environment regulatory and policy uncertainty to risks specific to new technology related projects, which prevent rating agencies from assigning investment grade rating to green infrastructure projects. The reports point out that these issues are compounded by a lack of suitable investment vehicles (such as green bonds or funds) providing the liquidity and risk-return profile that institutional investors need, and that pension fund trustees, who are not environmental experts and indeed often non-financial specialists, remain cautious when it comes to increasing their exposure to newer clean technologies.

What is the role of policy makers in facilitating investment in green growth initiatives?

237. Policy makers play a vital role in building the institutional framework to enable green growth. Through setting clear, long-term policies they can also help reduce the policy risk presented by the transition to green growth. At the structural level, the OECD has launched a project on "Achieving a level playing field for international investment in green energy" which aims to assess country-specific policy impediments that are likely to hamper international investment in green energy infrastructure (such as local content requirements or subsidies likely to distort international competition), and identify good practices in removing those obstacles, looking at a broad range of country experiences across developed countries and emerging economies.

238. The *OECD Policy Guidance for Investment in Clean Energy Infrastructure* looks at country-specific impediments to private investment in clean energy infrastructure. It is a non-prescriptive tool to help host governments – including in developing and emerging economies – identify ways to mobilise private investment in clean energy infrastructure. The OECD has been asked by the G20 Study Group on Financing for Investment to move the work on this Policy Guidance forward.

239. In addition, the OECD project on "Assessing experience with Green Investment Policies and Instruments for Infrastructure" is conducting a series of country-specific case studies in OECD and non-OECD countries to advise governments on policies to mobilise private finance and investment in green infrastructure. The project builds on the five-point policy framework developed in the report *Towards a Green Investment Policy Framework: The Case of Low-Carbon, Climate-Resilient Infrastructure*, to tailor elements of good practices to unique country contexts (see Figure 22). In particular, this framework highlights the importance of aligning environmental and investment policies, as demonstrated in the 4 case studies in this report.

[130] OECD/G20 Note on Pension Fund Financing for Green Infrastructure and Initiatives (OECD 2012e) was further developed in the OECD report on the role of Banks, Equity Markets and Institutional Investors in Long-term Financing for Growth and Development.

Figure 22. Integrating climate and investment policies: the elements of a green investment policy framework

Investment Policies	**Elements of a green investment policy framework** **1. Strategic goal setting and policy alignment** Clear, long-term vision and targets for infrastructure and climate change; policy alignment and multilevel governance, including stakeholder engagement **2. Enabling policies and incentives for LCR investment** Sound investment policies to create open and competitive markets; market based and regulatory policies to "put a price on carbon", remove harmful subsidies and correct for environmental externalities **3. Financial policies and instruments** Financial reforms to support long-term investment and insurance markets; innovative financial mechanisms for risk-sharing such as green bonds; transitional direct support for LCR investment **4. Harness resources and build capacity for a LCR economy** R&D, human and institutional capacity building to support LCR innovation, monitoring and enforcement, climate risk and vulnerability assessment capacity **5. Promote green business and consumer behaviour** Corporate and consumer awareness programmes, corporate reporting on climate change, information policies, outreach	**Climate Policies**

Source: Corfee-Morlot, J., et al. (2012), "Towards a Green Investment Policy Framework: The Case of Low-Carbon, Climate-Resilient Infrastructure", OECD Environment Working Papers, No. 48, OECD Publishing. doi: 10.1787/5k8zth7s6s6d-en.

240. As a first step, policy mechanisms must be chosen according to the level of maturity of the associated technologies that are being encouraged; and hence the type of financing that the private capital markets should be expected to commit (WEF, 2010, 2011).

241. Secondly, policies should be considered in the broader national policy context, not in isolation, and from the perspective of establishing an enabling environment of investment and development at its centre (OECD, 2012b).

242. Five key categories for policy have been highlighted at the World Economic Forum (2010, 2011). These include: energy market regulation (such as competition policy); support for equity investment; support for debt investment; tax policies; and creating markets to trade emission credits. First-best policies are likely to be the withdrawal of historical support for black investment. This can free fiscal resources for supporting a green growth pathway.

243. Such support can come in a variety of forms including: capital grants, loan guarantees, and low interest rate loans, tax policies such as accelerated depreciation, tax exemptions and rebates, and price-based policy at the output stage, such as feed-in tariffs, cap-and-trade regulation and carbon taxes. There is also a role for public financing mechanisms to provide risk mitigation cover for country, policy and currency risk, and for co-ordinating standards for 'green' project ratings. For example, refinancing has been identified as a particular risk. A so-called green refinancing guarantee facility could reduce refinancing risks for project and hence mitigate the impacts of constrained long-term credit. The KfW has provided such as instrument for trade finance in response to the financial crisis. Green infrastructure is generally still more dependent on income generated through subsidies, regulations, obligations and incentives that are created by public policy, compared with conventional infrastructure. Measures to reduce

policy risk and improve the revenue certainty of low-carbon assets will improve the credit rating of a bond and lower the average cost of capital.[131]

244. In addition to the work of the multilateral investment banks, a number of special purpose 'green investment banks' have been established to assist governments in this task. The U.K.'s Green Investment Bank commenced operations in 2013. Most recently, a number of U.S. states have begun to explore green banks that find a variety of ways to use scarce public resources to leverage private investment, for example Connecticut's Clean Energy Finance and Investment Authority. New York State recently announced its intention to create a USD 1 billion green bank to overcome a number of obstacles and uncertainties in the clean energy sector. The proposed new finance entities will build on models in the US such as the Overseas Private Investment Corporation and the Export-Import Bank, and they can also draw on relevant experiences in other countries.

245. If pension and other institutional investor involvement in financing green growth is indeed a priority for policy makers, then addressing the potential lack of attractive pooled investment vehicles is another area where government may help to build the market for green investment.

246. The EU's "Europe 2020 Project Bond Initiative" pilot phase commenced in 2013 and will see the EIB providing first loss subordinated debt financing to projects, thereby enabling the credit rating of senior project bonds of key infrastructure assets to be enhanced to a level that will enable institutional investors to participate (i.e. a single-A rating range). It is designed specifically to provide an alternative to financing projects through bank loans or public sector grants in order to close the infrastructure financing gap. If successful, the EIB pilot of EUR 230 million could conceivably be rolled out further and expanded. In terms of credit enhancement, supranationals and state-backed entity guarantors (such as export credit agencies) appear to be slowly moving into the space left following the demise of the monolines. Another consequence of this is that the rating agencies are being relied on more than ever.

247. Policy makers have an important role to play in harnessing the opportunities and overcoming the challenges of institutional investor involvement in green growth infrastructure. The OECD continues to work in these areas and it is hoped that this report will provide a platform to spark further ideas and debate on the topic.

[131] Caldecott, B (2010)., 'Green Infrastructure Bonds: Accessing the scale of low coast capital required to tackle climate change', Climate Change Capital

BIBLIOGRAPHY

Andra AP-fonden (2012) '*Corporate governance report*, July 1, 2011 to June 30, 2012', www.ap2.se/Documents/agarrapporter/Agarrapport%202012%20_GB_web.pdf

Bachher, J.S., and Monk, A.H.B.(2013), 'Platforms and Vehicles for Institutional Co-Investing', *Rotman International Journal of Pension Management*, Vol. 6, Issues 1, Spring 2013

Benatia, D., N. Johnstone and I. Haščič (2013), "Effectiveness of Policies and Strategies to Increase the Capacity Utilisation of Intermittent Renewable Power Plants", *OECD Environment Working Papers*, No. 57, OECD Publishing, Paris, http://dx.doi.org/10.1787/5k46j0trlrnn-en.

Benoit, P (2012) 'State-owned enterprises and their domestic financial base: two keys to financing our low-carbon future', *Electricity in a Climate Constrained World 2012*, IEA

BNEF (Bloomberg New Energy Finance) (2013a), *'Clean Energy – White Paper, Financial regulation-biased against clean energy and green infrastructure'*

BNEF (2013b) '*Green Bonds Market Outlook 2013: Ripe pickings at the green bond market'*

BNEF (2013c) 'New Investment in clean energy fell in 2012' (14 January, 2013)

Caldecott, B (2010)., *Green Infrastructure Bonds: Accessing the Scale of Low Coast Capital Required to Tackle Climate Change*, Climate Change Capital

Chan, E. and Worth, M. (2012) 'Basel III and Project Finance' Linklaters, Republished from *Project Finance International*, issue 460

Chomitz, K. and Thomas, T. (2003). Determinants of Land Use in Amazônia: A Fine-Scale Spatial Analysis. American Journal of Agricultural Economics, 85(4):1016–1028. Climate Policy Initiative (2012), *San Giorgio Group Case Study: Walney Offshore Windfarms* CPI Report

Clark, G.L. and Monk, A.H.B (2012)., Principles and Policies for In-House Asset Management (December 14, 2012). Available at SSRN: http://ssrn.com/abstract=2189650 or http://dx.doi.org/10.2139/ssrn.2189650'

Climate Policy Initiative [CPI] (2012), San Giorgio Group Case Study: Walney Offshore Windfarms CPI Report.

Climate Policy Initiative [CPI] (2013a), The Challenge of Institutional Investment in Renewable Energy

Climate Policy Initiative [CPI] (2013b) 'Does credit affect deforestation? Evidence from a rural credit policy in the Brazilian Amazon' Technical Report, Climate Policy Initiative, Rio.

CohnReznick (2013), 'Green Energy 2013', CohnReznick report produced by Clean Energy Pipeline

Deutsche Bank (2012a) 'Investing in Climate Change 2012' Deutsche Bank Climate Change Advisors

Deutsche Bank (2012b) 'Cleaner Technologies: Evolving Towards a Sustainable End-State' Deutsche Bank Climate Change Advisors

Deutsche Bank (2012c) 'Sustainable Investing: Establishing Long-Term Value and Performance' Deutsche Bank Climate Change Advisors

Deutsche Bank (2013a) 'Solar Market Analyst Outlook 2013'

Dixon, A. and A.H.B. Monk, (2013) 'Frontier Finance', Available at SSRN: http://ssrn.com/abstract=2203656

DONG Energy (2012) 'Walney Offshore Windfarms' (brochure), available at: http://www.dongenergy.com/SiteCollectionDocuments/wind/walney/Walney_Offshore_Windfarm.pdf

EDHEC (2010) 'Adoption of green investing by institutional investors: a European survey' EDHEC-Risk institute, http://docs.edhec-risk.com/mrk/000000/Press/EDHEC_Publication_Adoption_of_green_investing.pdf

EPIA (2013) *Global Market Outlook for Photovoltaics 2013-2017*, European Photovoltaic Industry Association.

Environment Texas Research & Policy Center, (2013), *Reaching for the Suns, How San Antonio and Austin Are Showing that Solar is a Powerful Energy Options for Texas*

European Commission (2013) '*Green Paper: Long-Term Financing of the European Economy'*

European Commission (2013b), Staff Working Document, '*Long-Term Financing of the European Economy'*

FAO (2006). '*Global Forest Resources Assessment 2005: Progress Towards Sustainable Forest Management'*

FAO (2009) '*Capital Requirements for Agriculture in Developing Countries to 2050'*

FIP (2012) 'Investment Plan for Brazil', Forest Investment Programme, Climate Investment Funds, www.climateinvestmentfunds.org/cif/

Goldemburg, J. (2007), "Ethanol for a Sustainable Energy Future", *Science* (315), American Association for the Advancement of Science (AAAS), New York, pp. 808-810.

Grantham, J. (2013), '*The Race of Our Lives'*, GMO Quarterly Letter to Investors

Grubb, M. (2004) 'Technology innovation and climate change policies: an overview of issues and options', *Keio Economic Studies*, 41(2):103-132.

Grubler, A. (2012) 'Energy transitions research: insights and cautionary tales', *Energy Policy*, No. 50 pp. 8-16.

Hall, D (2009), 'Infrastructure, the crisis, and pension funds', Public Services International Research Unit, December

Hallam, D (2009), "International Investments in Agriculture", paper presented at the FAO Expert Meeting, 24-26 June, Rome on "How to Feed the World in 2050". Available at: *www.fao.org/wsfs/forum2050/wsfs-background-documents/wsfs-expert-papers/en/*

Hallegate, S. (2009) 'Strategies to adapt to an uncertain climate change' *Global Environmental Change*, Vol. 19, No. 2, May 2009, pp.240-247.

Hamilton, K. (2009) Unlocking Finance for Clean Energy: the need for 'investment grade' policy, Chatham House, Renewable Energy Finance Project, April 2010.

Hira, A and L .G. de Oliveira (2009) 'No substitute for oil? How Brazil developed it's ethanol industry', *Energy Policy*, (37): 2450-2456.

IEA (2010), *Energy Technology Perspectives 2010: Scenarios and Strategies to 2050*, OECD Publishing, Paris, http://dx.doi.org/10.1787/energy_tech-2010-en.

IEA (2011), *Harnessing Variable Renewables: A Guide to the Balancing Challenge*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264111394-en.

IEA (2012), *Energy Technology Perspectives 2012: Pathways to a Clean Energy System*, OECD Publishing, Paris, http://dx.doi.org/10.1787/energy_tech-2012-en.

IEA (2012b), *Medium-Term Renewable Energy Market Report 2012: Market Trends and Projections to 2017*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264178007-en.

IEA (2013), *Tracking Clean Energy Progress 2013*, IEA Paris

IFC (2013), A Dialogue Platform for Inclusive Green Growth Investment: An Expanded Stocktaking for the G20 Development Working Group, IFC/World Bank Group, Washington D.C.

Inderst, G. (2009), "Pension Fund Investment in Infrastructure", *OECD Working Papers on Insurance and Private Pensions*, No. 32, OECD Publishing, Paris, http://dx.doi.org/10.1787/227416754242.

INPE (2012). Projeto prodes: monitoramento da floresta amazônica brasileira por satélite. Technicalreport, INPE. http://www.obt.inpe.br/prodes/index.php

IPCC (2007) Fourth Assessment Report, Chapter 9, Forestry available at http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-chapter9.pdf

Kalamova, M., C. Kaminker and N. Johnstone (2011), "Sources of Finance, Investment Policies and Plant Entry in the Renewable Energy Sector", *OECD Environment Working Papers*, No. 37, OECD Publishing, Paris, http://dx.doi.org/10.1787/5kg7068011hb-en.

Lord, R., Goldberg, S., Rajamani, L. and Brunnée, J. (2012) *Climate Change Liability*, Cambridge University Press.

McKinsey Global Institute (2012) *'Solar power's next shining'*

McKinsey Global Institute (2013) *'Infrastructure productivity: How to save USD 1 trillion a year'*

Mercer (2011) *Climate Change Scenarios – Implications for Strategic Asset Allocation*, Mercer Responsible Investment http://uk.mercer.com/articles/1406410

Mormann, F. (2012), Enhancing the Investor Appeal of Renewable Energy, Environmental Law, Vol. 42, 681 (2012)Morton, D. C., DeFries, R. S., Shimabukuros, Y. E., Anderson, L. O., Arai, E., Espirito-Santo, F., Freitas, R., and Morisette, J. (2006). Cropland Expansion Changes Deforestation

Dynamics in the Southern Brazilian Amazon. Proceedings of the National Academy of Sciences, 103(39): 14637Ű–14641.

National Renewable Energy Laboratory (NREL) (2012), '*Mobilizing Public Markets to Finance renewable Energy Projects: Insights from Expert Stakeholders'*

OECD (2006), *Infrastructure to 2030: Telecom, Land Transport, Water and Electricity*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264023994-en.

OECD (2010), *Interim Report of the Green Growth Strategy: Implementing our commitment for a sustainable future*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264087736-en.

OECD (2011a) 'The Role of Pension Funds in Financing Green Growth Initiatives', No. 10, OECD Publishing, Paris, http://dx.doi.org/10.1787/5kg58j1lwdjd-en.

OECD (2011b), *Towards Green Growth*, OECD Green Growth Studies, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264111318-en.

OECD (2011c), *Pension markets in focus, July 2011'*, OECD Publishing, Paris.

OECD (2011d), "Measuring progress towards green growth in food and agriculture", in OECD, *Food and Agriculture*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264107250-7-en.

OECD (2011e) '*Pension Funds Investment in Infrastructure: A Survey'*

OECD (2012a), *Energy*, OECD Green Growth Studies, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264115118-en.

OECD (2012b), *OECD Environmental Outlook to 2050: The Consequences of Inaction*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264122246-en.

OECD (2012c) '*Towards a green investment policy framework: the case of low-carbon, climate resilient infrastructure';* No. 48, OECD Publishing, Paris, http://dx.doi.org/10.1787/5k8zth7s6s6d-en.

OECD (2012d) *'The role of institutional investors in financing clean energy';* No. 23, OECD Publishing, Paris, http://dx.doi.org/10.1787/5k9312v21l6f-en.

OECD (2012e) '*The effect of solvency regulations and accounting standards on long-term investing'*, No. 30, OECD Publishing, Paris, http://dx.doi.org/10.1787/5k8xd1nm3d9n-en.

OECD (2012f), *Strategic Transport Infrastructure Needs to 2030*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264114425-en.

OECD (2012g) '*Defining and Measuring Green Investments: Implications for Institutional Investors' Asset Allocation'*, No. 24, OECD Publishing, Paris, http://dx.doi.org/10.1787/5k9312twnn44-en.

OECD/Food and Agriculture Organization of the United Nations (2012), *OECD-FAO Agricultural Outlook 2012*, OECD Publishing, Paris, http://dx.doi.org/10.1787/agr_outlook-2012-en.

OECD (2013a) '*The Role of Banks, Equity markets and Institutional Investors in Long-term Financing for Growth and Development (Report for G20 Leaders)'*

OECD (2013b) '*Cross-Border Trade in Electricity and the Development of Renewables-Based Electricity Power: Lessons from Europe'*, No. 2013/02, OECD Publishing, Paris, http://dx.doi.org/10.1787/5k4869cdwnzr-en.

OECD (2013, forthcoming) '*Leveraging Private Finance for Clean Energy through Public Policy Design: Microdata Analysis for Environmental Finance and Investment*'. OECD Publishing, Paris.

OECD/G20 (2012) ' *Policy Note on Pension Fund Financing for Green Infrastructure and Initiatives'*

O'Neill, P.M. (2009), Infrastructure investment and the management of risk. In G.L. Clark, A.D. Dixon, A.H.B. Monk (eds.), '*Managing Financial Risks: From Global To Local*', Oxford University Press, 166-188

Oxford Analytica (2012) *Solar energy to boom amid global market tension*, Daily Brief, 27 July, 2012.

PCCP (Paradigm Change Capital Partners) (2012) 'Going Green Institutional investment in European Green Infrastructure'

Poterba, eds. Global Warming: Economic Policy Responses. Cambridge, MA: MIT Press, pages 335–375.

Preqin (2011), Alternatives Investment Consultants. *Private Equity Spotlight* (9)1.

RARE (2009), Infrastructure Special Fund Update, August 2009

Reis, E. and Guzmán, R. (1994). An Econometric Model of Amazon Deforestation. In K. Brown and D. Pearce, eds. The Causes of Tropical Deforestation. London: UCL Press, pages 172–191

Reis, E. and Margulis, S. (1991). Options for Slowing Amazon Jungle Clearing. In R. Dornbusch and J.M. REN21 (Renewable Energy Policy Network for the 21st century), *'Renewable 2012 Global Status Report'*

REN21 (2013) Renewable Energy Policy Network for the 21st Century '*Renewables 2012: Global Status Report'*

RiskMetrics (2008), 'Infrastructure Funds: Managing, Financing and Accounting. In Whose Interests?'', RiskMetrics Group, Melbourne.

Santilli, M., Moutinho, P., Schwartzman, S., Nepstad, D., Curran, L., and Nobre, C. (2005). Tropical Deforestation and the Kyoto Protocol. Climatic Change, 71:267–276.

SEIA (2013) '*Solar energy facts: Q1 2013*' Solar Energy Industries Association/GTM Research.

Sharma, R.(2013), 'The Potential of Private Institutional Investors for Financing Transport Infrastructure', Discussion Paper 2013-14, International Transport Forum at the OECD, May 2013

Sierra, K. (2011) *The green climate fund: options for mobilising the private sector*, CMCI/Climate and Development Knowledge Network (CDKN) Consultation Paper, August 2011.

Simmie, J. (2012) 'Path dependence and new path creation in renewable energy technologies', *European Planning Studies*, Special Issue: New Path Creation, Vol, 20 (5): 729-721.

Soares-Filho, B.S., D. Nepstad, L. Curran, E. Voll, G. Cerqueira, R.A. Garcia, C.A. Ramos, A. Mcdonald, P. Lefebvre, and P. Schlesinger, 2006: Modelling conservation in the Amazon basin. *Nature*, **440**, pp. 520-523

Stadelmann, M., Castro, P. and Michaelowa, A. (2011) '*Mobilising Private Finance for Low-Carbon Development'*, Climate Strategies.

Texas, office of Governor, economic Development & Tourism, (2012) '*Texas Renewable Energy Industry Report July 2012'*

TheCityUK (2013) '*Sovereign Wealth Funds March 2013'*

TIAA-CREF (2012) '*Responsible investment in farmland report'*, TIAA-CREF Financial Services, http://tcasset.org/sites/default/files/c7057_farmland_sustainability_report.pdf

TUAC and ITUS CSI IGB (2012) '*What role for pension funds in financing climate change policies?'*

UBS (2013), Investment Research European Utilities *'The unsubsidised solar revolution'*

UNEP (2011) *'Forests in a Green Economy: A Synthesis'*

UNEP (2012) *Global trends in renewable energy investment 2012*, Bloomberg New Energy Finance/Frankfurt School, UNEP Collaborating Centre for Climate and Sustainable Energy Finance

UNEP-FI (2009) *The materiality of climate change, how finance copes with the ticking clock*, A report by the Asset Management Working Group of the United Nations Environment Programme Finance Initiative, Geneva.

UNEP-FI (2012a) *Financing renewable energy in developing countries*, United Nations Environment Programme Finance Initiative, Geneva.

UNEP-FI (2012b) *Responsible investment in farmland: a compendium of case studies*, UNEP, available at: www.unpri.org/files/2012.10%20RI%20in%20farmland.pdf

US Department of Energy (2013), Letter from Secretary Steven Chu to Energy Department Employees, 1 February, 2013, http://energy.gov/articles/letter-secretary-steven-chu-energy-department-employees

Ward, M., Frankhauser, S., Hepburn, C. Jackson, H. and Rajan, R. (2009) *Catalyzing low-carbon growth in developing countries: public finance mechanisms to scale up private sector investment in climate solutions*, Vivid Economics for UNEP and Partners.

WEF (World Economic Forum) (2010) 'Green investing 2010: policy mechanisms to bridge the financing gap' World Economic Forum http://www.weforum.org/reports/green-investing-2010-policy-mechanisms-bridge-financing-gap

WEF (2011), *'The Future of Long-term Investing'*

WEF (2012) '*Green Investment Report 2012'*

World Bank (2012) *Inclusive Green Growth*: *the pathway to sustainable development*, The World Bank, Washington DC.

Glossary[132]

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

Asset backed security
A financial security backed by a loan, lease or receivables against assets other than real estate and mortgage-backed securities.

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.

Basel III
The third version of the Basel Accords agreed upon by 27 countries on September 12, 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 standardized 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.

Belleweather 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
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 move, 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.

Churning the portfolio

[132] Disclaimer: Explanations on the terms are very condensed and may not be complete. They are not considered to necessarily reflect official position of the OECD.

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

Corporate bond
Debt obligations issued by corporations.

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.

Deleveraging
The reduction of the ratio of debt in the balance sheet of an economic entity.

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.

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 premiums (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.

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

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.

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.

MLP (Master Limited Partnership)

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

Monoline insurer

Specialised insurance companies which provide guarantees and thereby credit enhancement to bond issuers. Monoline insurance is a type of insurance used by capital market participants. Insurance is purchased assuring bond principal and interest payments if an issuer defaults.

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).

Private equity fund

A fund which use their own capital or capital raised from investors 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.

REITs (Real Estate Investment Trusts)

A corporation or trust that uses the pooled capital of many investors to purchase and manage income property and/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.

Risk adjusted return

A measure of valuing the risks involved in an investment's return. It enables the investors to make comparison between performance of a high-risk high return investment with less risky and lower return investment. There are various methods of calculating risk adjusted return such as Alpha, Beta, Sharpe

ratio and 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
Creating a more or less standard investment instrument such as the mortgage pass-through security, by pooling assets to back the instrument. Also refers to the replacement of nonmarketable loans and/or cash flows provided by financial intermediaries with negotiable securities issued in the public capital markets.

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.

Tax credit
Allowance of deduction from or a direct offset against the amount of tax due as opposed to offset against income. Energy production tax credit (PTC) provides an income tax credit per kilowatt-hour for the production of electricity from utility-scale turbines.

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. Type of financing sought by early-stage companies seeking to grow rapidly.

Volumetric risk
Loss incurred from volume imbalances.

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

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