Going Green: Institutional Investment in European Green Infrastructure

Institutional investment trends and benefits in European Green Infrastructure

November 2012

PARADIGM CHANGE
CAPITAL PARTNERS

This document is for professional parties only and not for retail clients. It may not be distributed to third parties

Executive Summary

An unprecedented amount of investment is expected to take place over the next two decades in what we define as European green infrastructure. The very nature of these assets, particularly in view of its developed and mature profile in Europe is ideal for institutional investor involvement. This research paper by Paradigm Change Capital Partners ('PCCP') identifies how large-scale financial investors have participated in European green infrastructure to date and the developments in future investment trends, with some significant conclusions:

- Green infrastructure has desirable characteristics enabling it to attract interest from a range of long term institutional investors due to its ability to provide stable, inflation-linked returns, while having a lower volatility than traditional asset classes
- The attributes of the asset class, combined with the on-going market uncertainty, indicates that portfolio allocations will increase in the medium to long term
- The method of accessing green infrastructure is evolving, with investors looking to build direct market access and perform individual investments so as to gain further discretion over their illiquid portfolio allocations, while also reducing costs

Through various conversations with investors while performing research for this paper, we were struck by the fast growing sophistication and interest in these assets, which we expect to be a harbinger for solid investment growth in green infrastructure assets going forward.

About PCCP

Paradigm Change Capital Partners LLP ('PCCP') is a leading investment advisor, with expertise in advising institutional investors on low carbon assets and designing specialised collective funding vehicles to access such investments. Our expertise encompasses:

- In-depth knowledge of low carbon value chain participants, from utilities, supply chain manufacturers to developers and independent power producers
- Understanding the individual needs and constraints of large investors such as pension funds, insurance companies, sovereign wealth funds, family offices, foundations and endowments
- Creating innovative risk-sharing partnerships and investment vehicles to access and unlock capital from traditional and unconventional sources

We work with clients through all stages of the investment lifecycle, providing:

Advisory

- Conducting educational workshops
- Strategic portfolio review
- In-depth market analysis
- Most appropriate methodologies for accessing the market

Execution

- Access to high calibre investment opportunities, teams and projects, across technologies and geographies
- Structuring investment vehicles
- Monitoring financial and physical asset performance

Contents

1 Introduction 6

2 Defining Institutional Investors 7

2.1 Identifying Institutional Investors 7

2.2 Investor Considerations 7

2.3 Features of Infrastructure Assets 8

2.4 Institutional Investor Interest to Date 8

2.5 Green Infrastructure Investments 9

2.6 Institutional Investors in Green Infrastructure 11

3 Characterising European Green Infrastructure 12

3.1 Renewable Energy 12

3.1.1 Revenue Model 12

3.1.2 Size of Current Market 13

3.1.3 Project Lifecycle 14

3.2 Electricity Transmission 16

3.2.1 Revenue Model 16

3.2.2 Size of Market 16

3.2.3 Project Lifecycle 17

3.3 Energy Efficiency 18

3.3.1 Revenue Model 18

3.3.2 Size of Market 19

3.3.3 Project Lifecycle 19

4 Gaining Exposure in European Green Infrastructure Across Asset Classes 21

4.1 Pure Exposure 21

4.1.1 Equity 21

4.1.2 Fixed Income 23

4.2 Non-Pure Exposure 24

4.2.1 Equity 24

4.2.2 Fixed Income 25

5 Evolution of The Market: Trends & Opportunities 26

5.1 General Market Trends 26

5.1.1 Renewable Energy 26

5.1.2 Transmission 26
5.1.3 Energy Efficiency 27
5.1.4 Shrinking Bank Lending 27
5.1.5 Low Carbon Bonds 27
5.1.6 Operating Asset Divestments 28
5.2 Changes in Institutional Investor Asset Allocation Practices 28
5.2.1 Increasing Alternatives Allocation 28
5.2.2 Increasing Infrastructure Allocation 28
5.2.3 Changing Attitudes Towards Infrastructure Investment 28
5.3 Green Infrastructure Asset Allocation Trends 29
5.3.1 Renewable Energy 29
5.3.2 Transmission 30
5.3.3 Energy Efficiency 30
6 Conclusions 32
7 References 33

1 Introduction

There have been numerous reports and analyses arguing that an unprecedented amount of investment is required in renewable energy, electricity transmission and energy efficiency in order to meet the European decarbonisation targets. These reports also usually warn of an imminent financing gap in these activities. It has been suggested that the efforts to fill this gap should focus on unlocking and channelling institutional investor money towards green infrastructure.

We believe that to some extent this shift has already begun and anticipate its acceleration in the future as a large number of investors take notice of the attractiveness of these sectors. Simultaneously, and as a general trend, we expect that investors will look to a range of vehicles to access European green infrastructure, with a rising tendency towards direct investment.

This research piece looks to clarify a range of institutional investors, their key investment considerations and interest in the infrastructure asset class, with emphasis on green infrastructure in particular.

We then expand on the definition of European green infrastructure, various asset types, their revenue model and market size.

Next we examine how investors have participated in these assets via a number of asset classes to date.

Finally, we present our outlook for institutional investor involvement in European green infrastructure going forward.

We acknowledge the valuable feedback our clients provided regarding their investments in green infrastructure. We would also like to extend a special thanks to PensionDanmark CEO, Torben Möger Pedersen for his expert insights and assistance with the report.

2 Defining Institutional Investors

We define institutional investors as the primary layer of capital in the investment value chain, the most commonly known term for which is 'asset owner'. Below we set out the parameters which uniquely define Institutional Investors which are asset owners and invest a large portion of their assets through internal or external investment teams.

2.1 Identifying Institutional Investors

Institutional investors are organisations which aggregate smaller contributions from beneficiaries (pension funds), premium payers (insurance companies), state savings (sovereign wealth funds), etc. into large pools of investable capital. The key responsibility of such organisations is to disburse funds according to their pre-agreed obligations. Due to their size and responsibilities, such entities are highly regulated and have to conform to onerous requirements at local, national and international levels. As a result, their decision makers are inundated with wide-ranging obligations to several key stakeholders, meaning that while investment strategy is important, it is by far not the only issue occupying their time and focus.

On a separate note, strategic investors, whose investments serve their core business needs, such as corporates and utilities, do occasionally act as pure financial investors. However, we are not including them in our analysis due to the fact that such action is not prevalent and very few trends can be extrapolated from the diverse examples of such investments to date.

Based on the above, the following investors qualify as institutional:

- Pension funds
- Insurance Companies
- Sovereign wealth funds
- Endowments
- Foundations
- Family offices

2.2 Investor Considerations

Investors' beneficiaries, size and regulatory environment tend to delineate the differences amongst them; direct their investment strategy and ultimately their allocations. The main drivers are:

- **Investment beliefs** - including among others:
  - Macro filters such as ESG considerations and the macroeconomic environment
  - Benefits of active versus passive investment across traditional asset classes
  - Short-term versus long-term investment goals
- **Risk appetite** - the amount and type of risk that an institution is able and willing to accept in pursuit of its goals, for example interest rate, inflation, currency, credit and liquidity risks, among others

- **Liability profile** - the timing and size of payout obligations to beneficiaries
- **Return Profile** - the minimum acceptable return on investments, driven by the type, size and mix of liabilities for each institution
- **Decision-making process** - after an institution has established its investment beliefs, return goals and risk appetite, it needs to translate this strategy into specific investment decisions. How those decisions are carried out, utilising external or internal investment teams, as well as the internal process that predicates this, is affected by internal governance, size of assets under management and cost considerations

In conclusion, these institutions invest through a variety of channels and investment decisions take place on multiple levels. To this one can add that the drivers for such decisions can vary significantly across investor types.

2.3 Features of Infrastructure Assets

Investments into infrastructure are, by definition, of a long term nature and as such might not be appropriate for all types of investors. Given the current low interest rate environment and weak economic growth prospects in many countries however, infrastructure can be viewed as an asset class which delivers steady, typically inflation linked income streams, with low correlations to traditional public market returns. This can serve to reduce the volatility of portfolio returns. Advantages to such investments are:

- **Yield based return profile** - infrastructure investments generate income rather than seeking capital appreciation
- **Long-term inflation hedging potential** - the returns for many of these investments are wholly or partially linked to inflation
- **Diversification** - some infrastructure, notably energy and social infrastructure assets, have a low return correlation with traditional asset classes. This coupled with different risk exposures, provide significant portfolio diversification benefits
- **Low asset volatility** - the lack of liquidity in these investments, in addition to the nature of their return stream, creates a more stable, inelastic price profile versus the more fungible financial assets which are vulnerable to daily value fluctuations through supply/demand spikes
- **Access to unique, regulated monopoly assets** - typically, infrastructure assets have high barriers to entry, and in some instances, a monopolistic arrangement due to its concessional nature. For example, the investment in a major transmission line is not likely to have to compete for income with another major transmission line nearby. The lack of competition limits the risk that the asset will become supplanted by another asset

2.4 Institutional Investor Interest to Date

To date, allocation by institutional investors to infrastructure remains relatively small. Table 1 below shows estimates of average allocation

Table 1: Institutional investors' allocation to infrastructure, as a percentage of alternatives

Institutional Investor	Allocation within alternatives
Pension Funds	9%
Insurance Companies	5%
Sovereign Wealth Funds	5%
Foundations	1%
Endowments	1%

Source: Global Alternatives Survey 2012, Towers Watson

by various investor types to this asset class from within their 'alternatives' bucket.

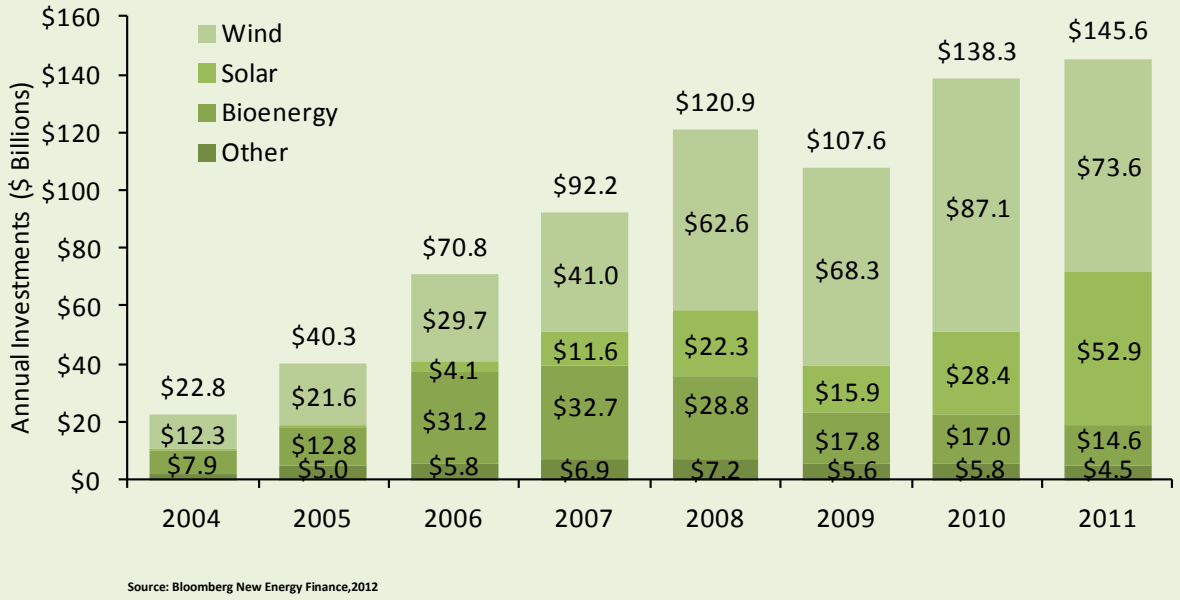
The overwhelming majority of infrastructure investments have been through infrastructure funds so far. A very small number of mega-funds, predominantly located in Australia and Canada, have attracted the lion's share of allocated capital.

2.5 Green Infrastructure Investments

Green projects exhibit the above characteristics, in addition to the benefits of less operational complexity than most general infrastructure assets (perhaps with the exception of offshore wind). Each renewable energy project is also in most instances guaranteed to sell its power and is therefore not hostage to competitive pressures. In Europe in particular, the EU commitment towards de-carbonization has provided a powerful impetus, resulting in a large number of projects across the continent being developed, constructed or entering operation over the past eight years. This implies that green infrastructure portfolios can additionally offer significant diversification opportunities across countries, technologies, project sizes and risk/return profiles, as well as offering an on-going large primary and secondary investment pipeline. Lessons learnt in developed countries can also later be transported to developing countries (taking into account local considerations) which also have ambitious targets on this front. As such, allocations to green projects can be better honed to match investors' considerations compared to other types of infrastructure projects.

Green infrastructure investment has been steadily growing, reaching a record $145.6bn in 2011 (Figure 1) having experienced a staggering sevenfold increase since 2004. What is more, this figure does not include investments in small distributed generation such rooftop solar photovoltaic, which also grew to a record $74bn in 2011, nor smart grid or energy efficiency projects. As Figure 2 demonstrates, cumulatively the majority of this investment has taken place in Europe, although the US and China have been catching up the last 2 years.

Figure 1: Global investment in renewable energy generation assets by technology



Source: Bloomberg New Energy Finance,2012

Figure 2: Investment in renewable energy generation assets by region

Source: Bloomberg New Energy Finance,2012

2.6 Institutional Investors in Green Infrastructure

Tracking institutional investors' participation in this space is not straightforward mainly due to the multiple routes to investment that exist. Additionally, most investments have been in private transactions (such as private equity fund investments) that are not publicly disclosed. Furthermore, some of these investments have not been undertaken as part of an explicit allocation (which can more easily be tracked) but rather through ad hoc investments in various other asset classes. An all-encompassing estimate is provided by OECD[i] citing $12bn of green infrastructure transactions where pension funds have been involved, with a further $10bn of transactions involving insurance companies, since 2004. Please note that these figures represent total asset financing expended on green projects where such investors have been involved, rather than their actual contribution to such projects, meaning that the actual figure will be lower. Nonetheless, there have been some notable commitments and investments in the space recently from large institutional investors.

The Danish pension fund, PensionDanmark with c.€18bn under management, has already invested c.€750mn in a portfolio of solar, offshore and onshore wind farms, with a recent commitment of €800mn to Copenhagen Infrastructure Partners ('CIP') for transmission, water and biomass, and plans to deploy a further c.€1.5bn over the next 4-5 years.

Similarly, Munich Re has announced plans to invest about €2.5bn over the next few years in assets such as wind farms, solar projects and new electricity grids. Other investors with active commitments to green infrastructure include pension funds PGGM, CalPERS, CalSTRS and insurance companies Allianz, Aviva and MetLife.

Given the diverse definitions of green and sustainable investments it is worth taking a step back to specifically identify the context of European green infrastructure within this report, allowing a more precise quantification of institutional investor interest in this asset class.

3 Characterising European Green Infrastructure

For the purposes of this report, we define green infrastructure as installed and operating, revenue generating assets in the following sectors *[we also consider water infrastructure as part of our definition of green infrastructure and as such we track institutional investor interest in this space. Nonetheless, the investment drivers are somewhat different compared to the other sectors and for consistency we have not included water in the analysis presented in the following]*:

- **Renewable Energy**
- **Electricity Transmission**
- **Energy Efficiency**

The amounts invested to date, and those expected going forward in green infrastructure are prompted by the following four main drivers:

- **2020 legally binding targets** - the EU commission has legislated binding decarbonisation targets through the EU Climate and Energy package[ii], which aims to ensure that the European Union meets its ambitious climate and energy targets for 2020. In the longer term the expectation is that Europe's greenhouse gas emissions will reduce by 80-95% by 2050 compared to 1990 levels
- **Energy security** - reducing dependency on foreign energy imports from a limited number of suppliers can be achieved by increasing the use of renewable energy
- **Lower feedstock risks and long term energy price volatility** - many renewable energy technologies utilise free feedstock such as sun and wind, whereas coal, gas and oil generators are dependent for the foreseeable decades on fluctuating and rising costs of such feedstocks, creating volatility in energy output prices
- **Job creation and industrialisation** - renewables tend to be more distributed and local, compared to conventional energy sources. This can and has led to the emergence of national champions in various supply chains and created industrial jobs in countries where such industrialisation has been increasingly needed

3.1 Renewable Energy

3.1.1 Revenue Model

The set 2020 EU targets are interpreted on a local level in each country through the National Renewable Energy Action Plans ('NREAPs'). These NREAPs have led to the rise of various subsidy schemes which guarantee a revenue stream for the majority of the lifetime of each asset. Such subsidies vary in durations, levels and terms across countries and technologies (please see table 2 below). This revenue is tied to the energy production of the plant and its level usually depends on the installed technology. However, other incentives exist, such as VAT discounts and in some instances government grants. In addition to revenue levels, another key aspect

Table 2: Renewable Energy Subsidy Types

Support Scheme	Description
Feed-In-Tariff (FiT)	A FiT guarantees that for a certain term, renewable electricity generated by a qualifying facility must be purchased at a certain fixed price which provides a fixed return to the producer.
Feed-In-Premium (FiP)	A FiP provides a premium above market power rates for renewable electricity over a fixed term
Contract for Difference FiT (CfD-FiT)	Revenue consists of two streams. The first is the variable revenues from the electricity sales in the wholesale market, and the second revenue stream is a top-up or top-down payment calculated as the difference between the market wholesale price (the reference price) and an agreed strike price
Renewable Energy or Green tradable certificates (REC or GTC)	A REC or GTC allows projects to generate environmental benefits that may be traded or sold separately or bundled with the electricity generated. The value of a REC arises from the establishment of environmental goals (such as an RES) which allow compliance through their purchase
Reduced Value-Added Tax (VAT)	A number of nations reduce the level of the VAT for purchases of equipment or services for renewable electricity generating facilities from 20% to 10% or 5%

of some subsidy schemes is the power purchase contract and the counterparty backing it, effectively guaranteeing the revenue. This might be a local utility which buys the produced power or a centralised government agency. The reliability of the technology is another key determinant of the ultimate internal rate of return which can be expected from a project.

3.1.2 Size of Current Market

Renewable energy projects have enjoyed strong growth in Europe, bringing down technology costs with increasing economies of scale. As of mid-2012, Europe has the world's largest installed capacity of renewable energy (excluding hydro) reaching 170GW. The main technologies in Europe are:

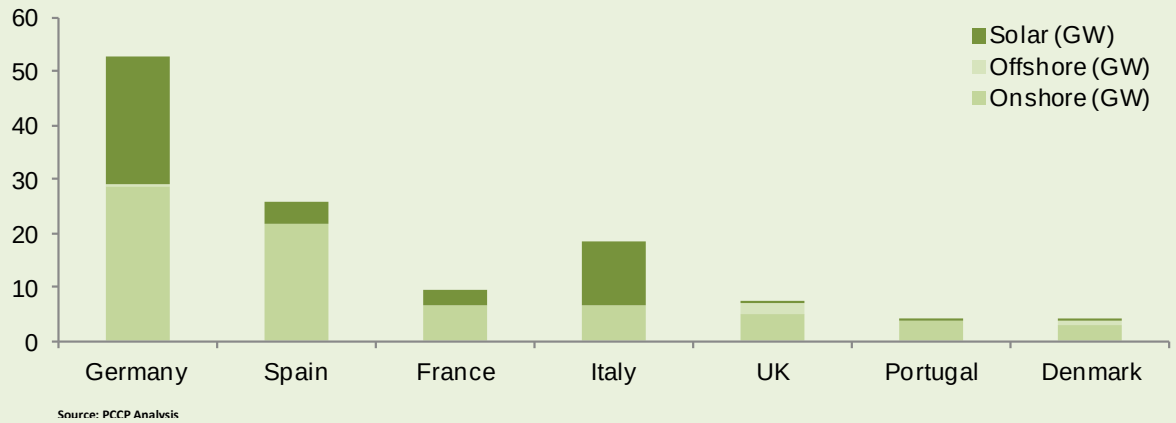
- Offshore and Onshore Wind (93 GW installed)
- Solar (51 GW installed)
- Bioenergy (27 GW installed)

Germany is leading the way in onshore wind and solar installations, whereas the UK has

€567bn

is needed for EU 2020 targets to be met with another €1,028bn needed from 2020 - 2030

Figure 3: Installed renewable capacity by technology across countries



the greatest potential for offshore wind development as depicted in Figure 3.

According to the European Climate Foundation[iii], it is estimated that if the 2020 targets are to be met, investments in renewable energy generation of €567bn need to be mobilised. An additional amount of €1,028bn in the period from 2020 to 2030 will be required, so as to be on a trajectory of achieving the 2050 target, bringing the total capex spend between 2010-2030 to €1,595bn.

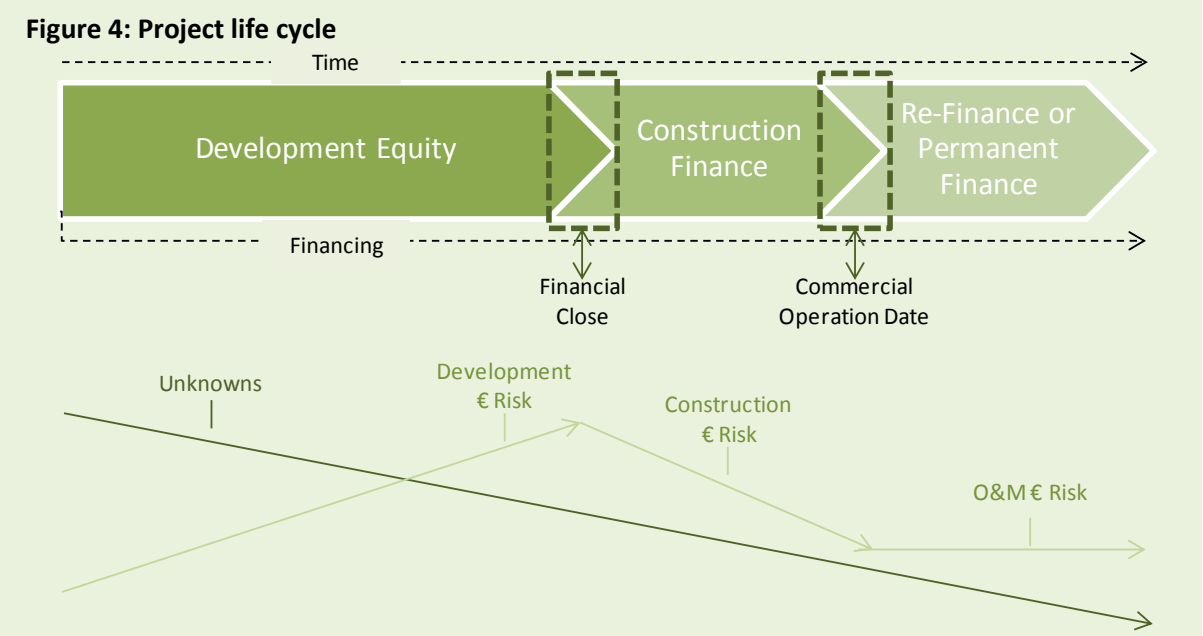
3.1.3 Project Lifecycle

Risks, returns, and policy impacts vary across the lifecycle of renewable energy projects. 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. 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 a c.7 years. Below we have outlined the three significant stages of a project.

Development - focuses on the early stages of feasibility, planning and permitting a project, pre physically building it. It typically involves site selection, assessment of resource availability, environmental studies, establishing a legal and financing framework for the project, securing necessary contracts and a grid connection date as well as regulatory approvals.

The risks in this stage, among others, are that a developer cannot secure certain permits, discovers that the resource is suboptimal or there is an issue with the environmental impact study.

Figure 4: Project life cycle



Capital is generally in the form of equity and typical investors at this stage include private equity funds, utilities and developers' own capital.

Construction - involves finalising the engineering design, contracting an EPC provider and finally building the physical asset. The main risk at this stage is construction delays, which can have a significant impact on the future profitability of the project. Almost all project capex is deployed in this stage and construction finance is typically a mix of equity and debt, usually in the form of bank loans (depending on the technology). 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.

Operational - a project enters this phase once it has been built and connected to the grid, generating power and earning revenue**.** The risks at this stage are tied to dependable operations and maintenance of the asset and resource performance against original assumptions. The longer the asset has been in operation, the more reliable the performance metrics are and therefore the revenue and costs structure. Operational projects have traditionally been financed with significant leverage; however there is an increasing trend to unlevered investments, particularly in view of banking market developments. Equity providers at this stage are infrastructure funds, utilities and institutional investors.

Project IRRs are in constant flux and will vary significantly depending on technology, country and leverage. As a result, we have outlined the typical project IRR matrix on a comparative (rather than absolute) basis in Table 3.

Table 3: IRR comparative matrix across countries and technologies

Country	Onshore Wind	Offshore Wind	Solar PV	Biomass
France		N/A		
Germany				N/A
Italy		N/A		
Portugal		N/A		N/A
Spain		N/A		N/A
Nordics			N/A	N/A
UK				

Lower ○ Higher ●

Source: PCCP Analysis

3.2 Electricity Transmission

3.2.1 Revenue Model

Electricity transmission, being a natural monopoly, is a heavily controlled activity, operating traditionally under a Regulated Asset Base (RAB) business model. In a nutshell, the Transmission System Owners (TSOs) receive a regulated rate of return based on the value of the assets they own. In the UK for example, National Grid earns a 5% real, after-tax return on assets. The cost of transmission (including the TSO return and the O&M costs) is paid by the system users, which in most countries is directly passed on to consumers through their electricity bills. Transmission investment decisions are usually also subject to regulatory approval or firm customer commitment, therefore protecting TSOs from stranded asset risk. This also implies that there is very limited development and construction risk since TSO's will almost always be re-numerated (although in some cases there are efficiency incentives and penalties in place) for the costs they have incurred should a project not proceed.

3.2.2 Size of Market

Traditionally, transmission investment has represented only a small part of the overall electricity sector costs. However integration of renewable energy is driving larger, more volatile power flows, over longer distances across Europe, and as such significant transmission grid expansion will be required. According to the Association of European Transmission Owners ('ENTSO-E')[iv], there is a need to invest €104bn in the refurbishment or construction of roughly 52,300 km of extra high voltage power lines clustered into 100 investment projects across Europe to 2020. 80% of the identified bottlenecks are related to direct or indirect integration of renewable energy sources. This figure does not include the development of offshore transmission grids for the connection of offshore wind plants, which has been estimated at around €84bn to 2030[v].

This number is unparalleled compared to the investment rates in electricity transmission to date, which have almost exclusively been undertaken by utilities. What's more, the recently introduced Third Energy Package requires the unbundling of generation and transmission ownership in effect mandating large utilities to either divest their

transmission assets or demerge into independent entities, which implies a significant shrinkage of transmission companies' access to larger utility balance sheets. Therefore, it is highly unlikely that the TSOs will be able to finance these investments by themselves under the current business model.

3.2.3 Project Lifecycle

Although transmission is usually identified as a homogeneous grid, there are, in effect, three types of transmission assets:

- **National onshore networks** - refer to the majority of the transmission system which connect generating units and load centres either through overhead lines, or underground cables within a country's national boundaries. These assets are almost exclusively financed on a regulated asset basis and are considered extremely low risk investments. However, in national electricity markets with price differentials (such as Italy) transmission assets could be solely financed on the basis of power price arbitrage between regions. This is a merchant business model, the application of which has been very limited. Lastly, individual lines (usually greenfield HVDC links) could occasionally be built and owned by third parties on a tender basis.
- **Interconnectors** - are transmission lines which cross national boundaries. They could be natural extensions of onshore networks or dedicated controllable DC links. Interconnectors are differentiated from national networks mainly due to the different regulatory environment under which they operate and as such are not included in the RAB of TSOs. Moreover, in order to utilise these links users need to purchase transmission rights. Interconnectors are usually joint ventures between adjacent countries' TSOs and are generally financed through one or both methods:
  - The sale of transmission rights and power price arbitrage on either side of the interconnector (merchant model)
  - Explicit RAB agreements with a country's regulator

Table 4: Total expected transmission investment cost per country

Country	€bn
Denmark	1.4
France	8.8
Germany	30.1
Italy	7.1
Netherlands	3.3
Norway	6.5
Poland	2.9
Spain	4.8
Sweden	2.0
Switzerland	1.7
United Kingdom	19.0
RoE	16.4

Source: Ten Year Network Development Plan – entsoe 2012

Clearly, the merchant model will present a higher risk/return profile, vis-à-vis the RAB model.

- **Offshore transmission** - refers to the lines connecting offshore wind farms and the onshore network. Investment on offshore grids to date has been mostly undertaken by offshore wind generators. Nonetheless, three dominant models have emerged concerning the financing and ownership of these assets:
  - **TSO ownership (Germany)**: this concept is in essence an extension of the onshore network arrangements to offshore transmission
  - **Generator ownership (Sweden)**: under these arrangements, the offshore network is considered to be a local asset used solely, now and in the future, by the wind plant that it connects and as such is owned by the wind generator and financed through renewable energy subsidies.
  - **Third part ownership (Great Britain)**: under this arrangement, offshore transmission lines cannot be owned by the offshore wind generator, but must be owned by a third party called the Offshore Transmission Owner ('OFTO'), which excludes the TSO. For existing projects built by the generators to date, the transmission assets are auctioned to investors who then act as an OFTO and undertake the asset operation and maintenance. The revenue stream is also generated on a RAB basis (charged through the TSO's wider system charges) and guaranteed for 20 years. The majority of OFTO cash flows are based on availability of the facilities rather than linked with the level of usage. Therefore, the returns are largely uncorrelated with changes in economic activity. The rate of return is not regulated but is determined through the auction process and is the main element which bidders compete on.

3.3 Energy Efficiency

3.3.1 Revenue Model

Energy efficiency encompasses all assets which bring about decreases in the amount of energy used to produce one unit of economic activity. Energy efficiency is one of the most cost effective ways to enhance security of energy supply, and to reduce emissions of GHG. The largest, cost-effective savings potential lies in residential (households) and commercial buildings sector. The full savings potential in Europe across these two sectors is estimated to be around 27% and 30% of energy use, respectively. The other key sectors are transportation, industrial manufacturing and energy conversion (electricity production mainly) efficiency.

Energy efficiency investments do not require any subsidies in theory, since the energy savings would cover the costs. In fact, in

Europe it is estimated that achieving the 2020 targets would imply net annual benefit of around €20bn. In reality, these investments, which have very long payback periods and high upfront costs, might also involve novel unproven technologies. As such the usually carry a high cost of capital, rendering them uneconomic under these financing terms. As a result, support schemes have focused in subsidising the cost of capital.

3.3.2 Size of Market

In energy efficiency, the expected extra capital requirement for meeting European 2020 targets has been estimated at around €24bn/year.

3.3.3 Project Lifecycle

Energy Service Companies (ESCO's) are key players in the energy efficiency landscape, providing commercial businesses with a broad range of comprehensive energy solutions and usually financing them on balance sheet. The lifecycle phases of an energy efficiency project are quite similar to those of a renewable energy project.

The **development** of an energy savings project often begins with a feasibility study of ideas that would generate energy savings, and in turn, cost savings. This task is usually the responsibility of the ESCO. The ESCO often approaches a potential client with a proposal for an energy savings project and a performance contract. During the initial period of research and investigation, an energy auditor from the ESCO surveys the site and reviews the project's systems to determine areas where cost savings can be achieved, usually free of charge to the client.

This next phase is referred to as **the engineering and design phase**, which further defines the project and can provide more firm cost and savings estimates. These measures can range from highly efficient lighting and heating/air conditioning upgrades, to more productive motors with variable speed drives and centralised energy management systems.

Once the project has been developed and a performance contract signed, the **construction or implementation phase** begins. Following the completion of this phase, the monitoring and maintenance or **Measurement and Verification (M & V) phase** begins. This phase is the verification of the pre-construction calculations and is used to determine the actual cost savings.

ESCOs' activities typically involve:

- Guaranteeing the energy savings and/or the provision of the same level of energy service at a lower cost
- Remuneration which is directly tied to the energy savings achieved, and
- Financing or assisting in arranging financing by providing a savings guarantee

Based on current trends and support schemes, Europe is expected to miss its energy efficiency targets by half. This has prompted the EU Commission to introduce binding legislation for the energy efficiency targets and simultaneously roll out support schemes. Similar to NREAPs, each member

state is expected to come up with a national action plan to achieve its energy efficiency targets, which will include support schemes to overcome the perceived market failures, an example of which is the UK's Green Deal.

4 Gaining Exposure in European Green Infrastructure Across Asset Classes

Having defined what we consider to be green infrastructure, in this section we identify how investors can gain pure and non-pure exposure to these sectors across asset classes. Characteristics such as pure/non-pure, equity/fixed income and public/private can be used to differentiate asset classes.

4.1 Pure Exposure

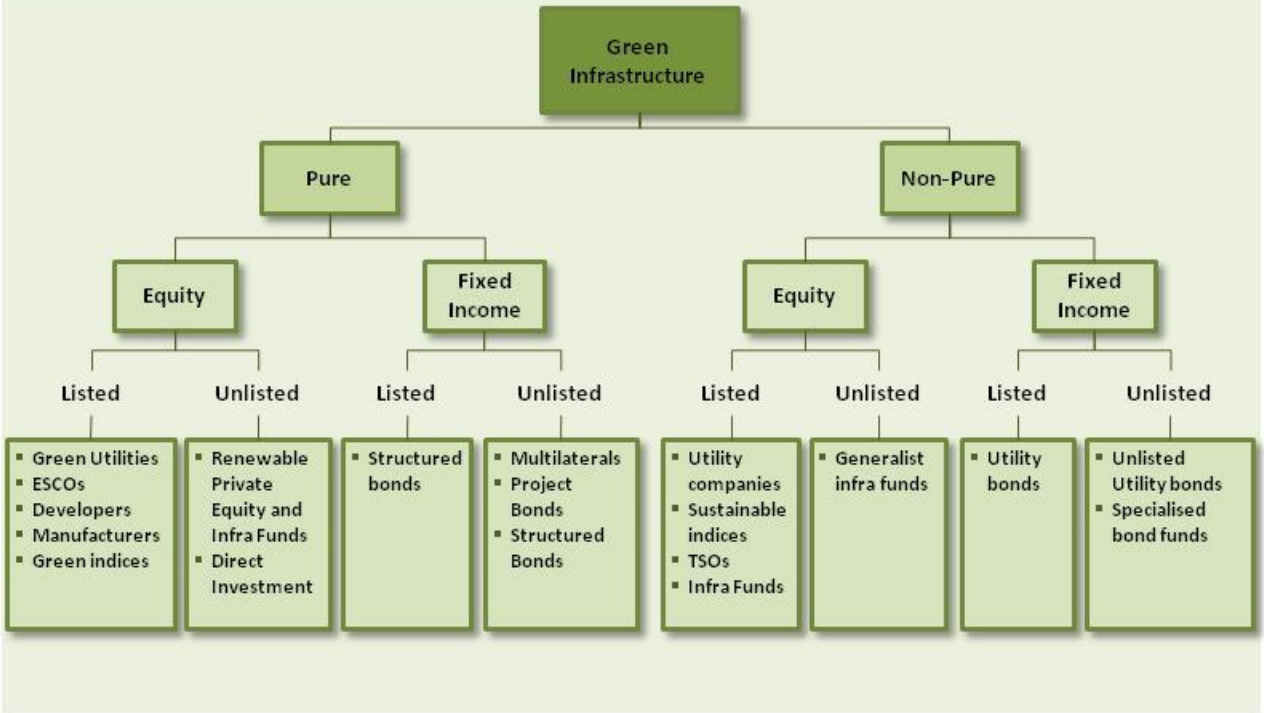
4.1.1 Equity

4.1.1.1 *Listed*

At the time of writing this report, there exist no pure green infrastructure listed equities. There are however, five options which offer pure 'green' listed equities, albeit not pure 'infrastructure' investment opportunities. The examples below incorporate mixed development or industrial exposures:

- The listed shares of green utilities that develop, as well as own and operate renewable energy generation assets (such as Enel Green Power, EDP Renováveis and Falck Renewables)
- ESCOs who advise, install and finance energy efficiency projects

Figure 5: Green infrastructure investment options



- Renewable energy project developers whose main activity is development, with some assets under construction and others in operation (depending on the technology involved), albeit with a heavy bias towards development assets
- Publically listed corporates (predominantly equipment manufacturers such as Vestas and Gamesa), that sometimes invest downstream into projects which utilise their equipment, however these are primarily technology plays
- Green index tracking funds such as Legal and General's Global Environmental Enterprises, which tracks 100 stocks, primarily industrials, with some exposure to green utilities

From the above we can see that listed green equities are quite limited in variety and depth. In addition, these equity investments generally need to compete (on a purely financial basis) with other listed shares, rendering it unlikely that investors would explicitly allocate to green listed equities.

4.1.1.2 Unlisted

Fund Investments - to date investors have predominantly gained pure exposure to green infrastructure through specialist investment vehicles such as renewable energy infrastructure funds. According to Preqin[vi], since 2004, there have been 98 infrastructure fund managers with a specific investment focus on renewable energy industries including solar, wind, biomass, hydro, geothermal power and OFTOs. These 98 firms have launched 124 renewable energy-focused infrastructure vehicles, 72 of which have held a final close, having raised an aggregate $22.3bn in investor capital. Europe is the dominant region in terms of primary fund focus. Forty-three percent of renewable energy fund managers primarily invest in European opportunities, implying that c.$9.6bn has been invested here.

On average, the target net returns for funds have been between 12-18%[vii]. The majority of these were launched in 2008 just before the financial crisis and as such very few funds have reached end of life. Historical net returns have been between -13% and 21%. However, these figures are based only on 15 funds, reflecting the fact that very few exits have occurred so far.

Direct Investments - institutional investors can also gain pure exposure to green infrastructure generation and transmission assets through the direct purchase of stakes in operational projects. We define direct investment platforms as having, at the very least, the first two of the following criteria:

- Investment team is a cost versus profit centre
- The asset owner has full degree of discretion over investments
- Asset owner has ownership of investment team
- The investment manager is exclusive to asset owner and doesn't manage others' assets

Such an investment platform is generally seen by the investment universe as 'in-house' capability, even though the investment team

might not physically sit in the same location. When these arrangements are with a third party, its role is to assess, acquire and monitor a portfolio of such projects. Such an approach is seen as a more cost effective option, with returns dependant on the technology, geography, leverage and structure of specific deals.

Given that a certain level of sophistication is required on the part of an institutional investor to create this process, only a handful of direct investments of significant size have been undertaken in Europe. We estimate the value of these to date to be c.€4bn, however we expect a significant increase in this number as more investors become familiar and experienced with this asset class and platforms emerge to aggregate smaller, less sophisticated investors.

4.1.2 Fixed Income

4.1.2.1 Listed

Listed bonds refer to debentures issued by companies or projects purely focused on green infrastructure. To date, there has only been one such issuance by CRC Breeze Finance SA (better known as one of the 'Breeze Bonds') and which took place before the credit crisis.

Other listed bonds in this space are covered in the non-pure section below

4.1.2.2 Unlisted

Below are examples of pure green infrastructure bonds which have been issued primarily on a private placement basis. However, it is challenging to track the issuance and performance of such bonds due to their private nature.

Multilaterals - have issued 'green' bonds, the funds from which are ring-fenced for on-lending to green infrastructure projects. Around €2.1bn of such green bonds have been directed to date towards European green infrastructure. The main issuer of such bonds has been the European Infrastructure Bank (EIB), which has issued green bonds in a number of currencies, targeting specific investors, with varying coupons and durations. Others include EBRD and Kommunalbanken Norway ('KBN'). For investors, these bonds offer exposure directly to the multilateral and not to the underlying projects (in terms of tenor, rating and performance). We estimate that half of these bonds have been purchased by institutional investors.

Project bonds - are generally the debt issued in bond form by a 'single' project (usually located in a one geographic location). Such bonds are used to finance construction and operation of the asset, but more often are issued to refinance construction loans with a duration that closely matches the expected project lifetime. To date, there has only been one notable deal in Europe, the Andromeda bond [viii], even though institutional bondholders did not actually bear exposure to the project, but in fact took SACE (the Italian export credit agency) risk at Aa2 (at the time of issuance).

Structured bonds - are backed by the cash flows of a portfolio of projects. These tend to

22%

Cumulative return for listed TSO over past 5 years

use securitisation techniques to bucket the risks into various liabilities (tranched bonds), allowing investors to participate across a range of risk/returns. In Europe, the only true securitisations to date have been the Breeze bonds (mentioned earlier, some of which were listed, while others were placed through private placement) and the Alte Liebe 1. These bonds were all issued before the crises of 2008 and none have been issued since.

4.2 Non-Pure Exposure

4.2.1 Equity

4.2.1.1 Listed

The main exposure of institutional investors to green infrastructure has so far been via shares of listed utility companies. Indeed, the primary source of capital for green infrastructure to date has been through the balance sheets of electricity power utilities and developers. The exposure to green infrastructure through these balance sheets has been implicit however, as most utilities do no break out, nor allow direct access to their green operational assets. The exceptions to this are a few European utilities, such as Enel Green Power, EDP Renováveis, who were mentioned in the previous section.

In addition, utilities ownership unbundling in a number of countries[1] and the establishment of independent TSOs provides an emerging opportunity for investors to gain significant exposure to transmission infrastructure. Through TSOs' listed equities, investors can access to the RAB business model that these companies operate. At the time of writing the combined market cap of publicly listed European TSO was €42.6bn with the UK TSO, National Grid, representing roughly half this capitalisation. Adjusted for market cap the average listed equity TSO returns have been 15% year to date, and 22% cumulatively over the past five years.

Additionally, there are Exchange Traded Funds ('ETF's) which track bespoke equity market indices. This customisation is carried out to create a subset of stocks which are either 'sustainable' or sector focused to provide the desired exposure. ETFs are passive instruments and the fee structures are accordingly lower than those of the actively managed funds discussed below.

There are currently several indices tracking cleantech and renewable energy stocks. However these indices include technology companies, utilities, as well as large conglomerates (such as Siemens) which are active in the space and are therefore not providing exclusive green infrastructure, or European exposure. Pre-2008, these indices had outperformed significantly the S&P 500, but since the financial crisis, they have struggled to catch up, as displayed in Figure 6 (on the following page).

Finally green infrastructure exposure can be gained through listed generalist infrastructure (or in rare cases, green property) funds, which do not include technology stocks but do include other types of non-green infrastructure.

[1] The countries with electricity transmission ownership unbundling are Denmark, Finland, Italy, Netherlands, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the UK

4.2.1.2 Unlisted

Given the investment scope and strong government support for green infrastructure, generalist infrastructure funds have been increasingly targeting this sector, thus allowing investors to gain partial exposure.

Other unlisted funds that can provide partial exposure to green infrastructure are green property funds, which manage eco-friendly properties. The predominant features of these properties are conservation methods of scarce resources. Lower carbon emissions are the desired effect of these investments.

4.2.2 Fixed Income

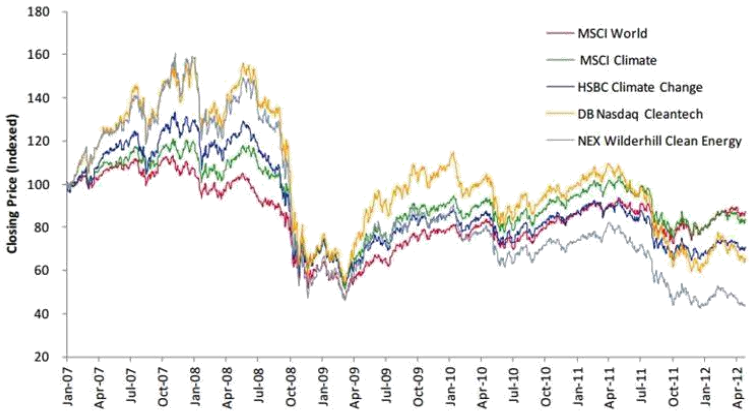
4.2.2.1 Listed

Similarly to public equities, the non-pure choices in listed bonds are generally those of utilities and ESCOs, both of which offer partial exposure to green infrastructure. Some of the utilities, such as EDP Renováveis have issued a listed bond, albeit that includes exposure to development assets, and globally at that. In addition, a few developers (such as Windreich AG) have also issued corporate bonds, which equally provide exposure to development assets. TSO's on the other hand, have been tapping the bond markets to finance their operations for a long time and are established counterparties. In addition, some TSOs, have been offering inflation linked long term dated bonds in a number of currencies.

4.2.2.2 Unlisted

Some utilities and developers have also issued unlisted bonds (eg. Airticity), albeit these are corporate bonds and include exposure to global and development risks (many of these have been targeted at retail investors). On a project level, specialised bond funds aiming at filling the gap of diminishing European project finance and the demise of the monolines, have also emerged. One such example is Aviva Investors' Hadrian Capital Fund[ix], which aims to channel c.£10bn towards general European infrastructure. Hadrian Capital Fund had its first close of £150mn in May 2012, with EIB, Aviva and Development Bank of Japan acting as seed investors.

Figure 6: Performance of various green indices



Source: Bloomberg New Energy Finance,2012

5 Evolution of The Market: Trends & Opportunities

The green infrastructure market is maturing in several areas, bringing transparency and improved performance metrics. Combined with innovation in investment platforms, we foresee a substantial change in how investors will allocate to, and access, this space going forward. This will be driven by general green infrastructure market trends as well as changes in institutional investor allocation and investment practices.

5.1 General Market Trends

There are a number of key project trends that will drive the market going forward:

5.1.1 Renewable Energy

Regulatory developments - after a substantial expansion in renewable energy capacity, combined with a steep reduction in equipment costs, national governments have realised that support schemes have to be more dynamically re-valued in order to protect consumers from rising costs.

Most countries have announced planned subsidy reductions in advance, allowing markets to react in a considered fashion. Due to severe budget constraints and sudden drops in technology prices, however, a few countries have chosen more damaging retroactive or sudden changes. Regulatory risks and subsidy levels are key concerns for investors and require close monitoring across a number of countries, with varying transparency levels.

Resource predictability - simultaneously, renewable energy resource prediction and modelling has improved substantially. This reduces one of the key risks of renewable energy investments, allowing investors to gain a much higher certainty of their expected future revenue streams.

Equipment performance and pricing - lastly, there has been significant over-capacity in turbine and solar panel manufacturing, leading to substantial equipment price drops (which contribute a majority of project capex), driving project costs lower on a per MW basis. Simultaneously, industrial, technological and construction improvements have increased the performance of equipment, as better materials, processes and understanding of ambient conditions have been more thoroughly seasoned across a wide range of conditions.

These effects in aggregate have created a diverse risk/return matrix across countries and technologies.

5.1.2 Transmission

As discussed in 3.1.2, we anticipate a substantial capital requirement for transmission build out over the next two decades. Even though transmission builds have long lead times, constrained TSOs will need to recycle capital once assets are operational and we foresee a role for institutional investors in these assets.

In the meantime, the Third Package unbundling provision creates a more immediate need for utilities to hive off portfolios of transmission assets, particularly in Europe. This is an on-going trend which anticipate will run its course over the next 2-3 years.

In addition, the OFTO regime has proved quite successful in Great Britain offering very attractive risk adjusted rates of return, which we expect to decrease as more investors pursue this sector, particularly on a direct investment basis.

5.1.3 Energy Efficiency

Energy efficiency remains a grey area given the unclear support schemes which countries have yet to develop, following the legislation of mandatory EU targets to 2020, as well as the disaggregated nature of debt, let alone equity financing arrangements.

5.1.4 Shrinking Bank Lending

The majority of European green infrastructure project finance to date has come from bank lending. The on-going crisis, as well as Basel III regulation has significantly impacted the project finance market. This is being felt in the reduced quantum of credit available to renewable energy projects as a whole. In addition, renewable energy project borrowing costs have risen considerably due to banks' higher funding costs, with credit spreads now some 25-50% above where they were last year (depending on country and technology). This is rendering debt almost as costly as equity in certain instances. Furthermore, tenors are coming down, with hard mini perm structures [2] becoming the new standard, creating meaningful re-finance risk for project sponsors, particularly in view of the historical lows we are currently experiencing in short term rates.

5.1.5 Low Carbon Bonds

Following the financial crisis, there have been no new asset linked bond issuances in Europe (across the sectors examined in this report). This is due to several impediments, some of which are:

- Infrastructure bonds in Europe have traditionally been largely monoline wrapped. This has negated the need for investors to conduct due diligence on infrastructure assets and risks directly, as they were taking the mostly AAA rated monoline risk
- Complexity, timing constraints and more expensive pricing of the bond market has traditionally discouraged project sponsors from issuing bonds
- Borrowers have a preference for the terms and conditions of loans compared to bonds (an example would be repayment terms)

These issues and others will require structural changes in the market and necessitate significant time to resolve.

[2] There are two types of mini-perms: A hard mini-perm is a project finance structure where legal maturity is set typically around 7 years, forcing the borrower to refinance before maturity or face default. A soft mini-perm is a structure without this default risk, where the loan maturity remains long-term but whereby increasing incentives are in place to encourage the borrower to refinance

5.1.6 Operating Asset Divestments

Another trend we foresee taking place in the near to medium term is the increase in secondary activity, as utilities and private equity funds look to exit operational assets:

- **Utilities** - are under pressure to optimise their balance sheets and are now recycling out of the more conservative, low yielding investments, into upstream development activities and new markets
- **Private Equity funds** - increasing numbers of older funds are now fully invested and looking to realise exits on portfolios they have developed and aggregated

Alongside these two trends remain greenfield projects maturing into operational farms looking for a home. However we see this trend temporarily slowing down due to downward pressure on tariffs and the need for European governments to digest and assimilate (particularly on grids) the fast build up from renewables.

5.2 Changes in Institutional Investor Asset Allocation Practices

Investment patterns show that institutional investors (in particular pension funds) are opting for an increased allocation to bonds and alternative assets. However with government yields at historical lows and not always commensurate with their risk, investors are searching for alternatives with real asset exposure, which provide both transparency to ring-fenced revenue generation, and better overall returns.

5.2.1 Increasing Alternatives Allocation

Allocation to alternative assets has been increasing over the past sixteen years, with a significant pick up in pace since 2007. This trend has been particularly acute for pension funds, which have increased their allocations from c.5% to 20% between 1995-2011[x].

However, allocation to alternative assets remains relatively small within some investors and we expect this to increase further in the long term as they become more sophisticated and new channels for investment in alternative asset classes become easier to access.

5.2.2 Increasing Infrastructure Allocation

To date within alternative asset class, the majority of active investors in infrastructure have been pension funds and it is envisaged that they will remain the largest source of investment capital for this asset class over the long term. Estimates suggest that the percentage of pension fund assets devoted to infrastructure projects will rise more than five-fold over the next decade from some 2 per cent of funds currently, to as much as 15 per cent[xi].

5.2.3 Changing Attitudes Towards Infrastructure Investment

Institutional investors have a competitive advantage in their ability to invest over inter-generational time scales, potentially in long-

term, illiquid assets such as infrastructure (albeit current proposed Solvency II regulations could dampen this ability). To date, they have achieved this exposure primarily through infrastructure funds, which are not perfectly aligned to investor needs or asset profiles.

Infrastructure funds, while charging fees not too dissimilar to those of private equity, do not claim to deliver the same asset valuation increases. Due to the yield based nature of infrastructure assets, capital appreciation (and the carried interest which is charged to it accordingly) could perversely incentivise risky asset selection and excess leverage. This is further aggravated by the mismatch between the lifecycle of infrastructure assets and that of the fund.

As a result, investors are increasingly looking to cost based investment platforms, better known as direct investment, sometimes internal teams. Such platforms can be dedicated to one investor, or established to aggregate third party funds (some begin dedicated and migrate to accepting third party investors). A key attribute of direct investment platforms is the full discretion investors have over the investments. A potential example of an aggregation platform is the UK's Pensions Infrastructure Platform, a proposed £2bn vehicle to invest in UK core infrastructure projects on behalf of UK pension funds, albeit no real details have yet emerged.

5.3 Green Infrastructure Asset Allocation Trends

5.3.1 Renewable Energy

Generalist utility balance sheets, through share and bond issuance, will continue to be a primary intermediary vehicle via which institutional money is channelled towards renewable energy projects. Nonetheless, we expect that the changes in asset allocation practices, utility focus and market opportunities will prompt institutional investors to progressively seek pure exposure to renewable energy infrastructure.

The move away from investment in private equity and infrastructure funds is further demonstrated through the on-going struggle of these funds in fundraising and achieving targeted closures (several have recently abandoned such efforts).

This general trend is particularly acute in green infrastructure due to the fast changing opportunities across technologies, regulatory jurisdictions and secondary trends. As a result, a ten year commitment to a close ended fund with a pre-defined investment strategy could leave investors vulnerable to overpaying when asset valuations within the boundaries of such mandate inflate considerably. Direct investment platforms have the flexibility to pursue a more opportunistic investment strategy.

Due to its recent advent as a separate asset type, green infrastructure has the ability to reinvent current, misaligned investment platforms, which were built for other types of

assets and investment horizons. As a result, we anticipate that emergent platforms allowing direct investment (and which can also act as aggregators for smaller investors), will become more mainstream. Examples of larger investors which have already embarked upon this path are:

- **Allianz** - has invested €1.3bn in onshore wind and solar and plans to invest a further €200mm by end of 2012
- **PensionDanmark** - has invested c.€750mn in a portfolio of solar, offshore and onshore wind farms with a recent commitment to transmission, water and biomass of €800 via CIP, a direct platform
- **MunichRe** - has invested €800mn of an allocated €2.5bn in solar and wind

An additional advantage of these emergent platforms is their ability to negotiate tailored risk sharing arrangements for their investors on an asset by asset basis (this is particularly relevant for larger exposures). This allows investors to participate to their preferred comfort level and attracts a wider range of capital to the space.

Such platforms can also assist investors with access to debt, as well as equity investments, albeit debt platforms would entail significantly higher complexity.

5.3.2 Transmission

As detailed in the preceding sections, the OFTO regime has been quite successful in attracting financial investors. In fact, one of the recent bidding consortia for a UK operating OFTO included the Universities Superannuation Scheme and BT Pension Funds Scheme. Given the expected growth in UK offshore wind transmission, we anticipate that we will increasingly see institutional investors co-invest with strong operational partners in this sector. However to date, only the UK has adopted this approach and as such the depth of the market will depend on the regulations governing offshore transmission investment put in place by other nations and at the EU level.

Regarding interconnectors, no definite business model has emerged and as such they are uncertainties regarding their financing. Institutional investors are unlikely to be involved directly in pure merchant interconnectors and any funds will be channelled either through TSO balance sheet financing or private equity/infrastructure fund allocations.

5.3.3 Energy Efficiency

In our view, institutional investors are unlikely to be involved in this space on a project level but rather through private equity specialist funds, balance sheet financing of ESCO's and/or other aggregation vehicles. One such UK vehicle is The Green Deal Finance Company, an industry led consortium, the aim of which is to provide the lowest cost of finance to energy companies (Green Deal Providers) undertaking energy efficiency projects in Great Britain.

In order for these identified trends to materialise on a significant scale, on-going institutional investor education in the sector will be critical, so that interested parties can

gain a good understanding of the fast changing opportunities and risks.

Notwithstanding, we expect the current investments by larger institutions to act as a catalyst for further green infrastructure investments by a wider range of investors and increasingly through the described platforms.

6 Conclusions

As has been widely recognised and highlighted in this report, institutional investors' involvement in financing European green infrastructure will bring about significant benefits for investors, as well as help in filling the so called funding gap.

This dynamic and continuously evolving asset type demonstrates the following three key trends:

Industrial – we expect a continued improvement in technology pricing in the short to medium term, as well as improved performance and resource measurements, contributing to better security over revenue streams

Financing opportunities – will increase in view of secondary portfolio shifts, with sophisticated investors moving down the technology and lifecycle frontiers to extract

Investment platforms – investors are now in a position to evaluate the performance and alignment of historical fund structures, resulting in a growing move towards new and better aligned channels to investment which are cost effective and provide the desired control.

We hope you will have found this report enlightening and educational. PCCP would be delighted to hear your feedback and welcome any questions about the report at: research@paradigmchangecp.com

References

[i]Kaminker, C. and F. Stewart (2012), "The Role of Institutional Investors in Financing Clean Energy", *OECD Working Papers on Finance, Insurance and Private Pensions*, No. 23, OECD Publishing http://dx.doi.org/10.1787/5k9312v21l6f-en

[ii] European Comission (2007), accessed October 2012 http://ec.europa.eu/clima/policies/package/index_en.htm

[iii] European Climate Foundation (2010), "Power Perspectives 2030", Available at: http://www.roadmap2050.eu/attachments/files/PowerPerspectives2030_FullReport.pdf

[iv] European Network of Transmission System Operators for Electricity (entsoe) (5 July 2012), "10-Year Network Development Plan 2012", https://www.entsoe.eu/fileadmin/user_upload/_library/SDC/TYNDP/2012/TYNDP_2012_report.pdf

[v] De Decker, J. and Kreutzkamp, P (October 2011) "Offshore ElectricityGrid Infrastructure in Europe, A Techno-Economic Assessment 3E (coordinator), dena, EWEA, ForWind, IEO, NTUA, Senergy, SINTEF" http://www.offshoregrid.eu/images/FinalReport/offshoregrid_fullfinalreport.pdf

[vi] Preqin 2012, "Renewable Energy-Focused Infrastructure Fund Managers", [online] (Last updated 17 Jul 2012) Available at, http://www.preqin.com/blog/101/5434/renewable-energy-focused-infra

[vii] DB Climate Change Advisors (May 2012), "Investing in Climate Change 2012. Investmetns Markets & Strategic Asset Allocation: Broadening and Diversifying the Approach", http://www.dbcca.com/dbcca/EN/_media/Inv_in_CC_2012.pdf

[viii] http://www.projectfinancemagazine.com/Article/2738981/Andromeda-SunPower-opens-up-Italian-and-solar-bond-markets.html

[ix] KPMG (2010), "Project Finance and kpmg.com the Capital Markets Bridging the divide, " http://www.kpmg.com/UK/en/IssuesAndInsights/ArticlesPublications/Documents/PDF/Advisory/Project%20finance%20and%20Capital%20Markets_web%20accessible.pdf

[x] Towers Watson (January 2012), "Global Pension Assets Study 2012", http://www.towerswatson.com/assets/pdf/6267/Global-Pensions-Asset-Study-2012.pdf

[xi] Sebastian Walsh 2012, "Pension funds tipped for $3.5trn infrastructure spree", eFinancialnews ,[online] (Last updated 16 Apr 2012) Available at, http://www.efinancialnews.com/story/2012-04-16/pensions-tipped-for-infrastructure-spree

Disclaimer

'The purpose of this document is to provide information only to professional parties. This document is issued in the United Kingdom by Paradigm Change Capital Partners LLP ('PCCP'). It is intended for the recipient only and may not be distributed to any third party without the written consent of the author. The information in this document is derived from sources believed to be reliable but which have not been independently verified. PCCP makes no guarantee of its accuracy and completeness and is not responsible for errors of transmission, of factual or analytical data, nor is it liable for damages arising out of any person's reliance upon this information. All charts and graphs are from publicly available sources, private research or proprietary data. Any reference to companies is to illustrate the strategy, based on publicly available data and may not be considered financial analysis or seen as an advice to invest or divest. The opinions in this document constitute the present judgement of PCCP, which is subject to change without notice.

The value of investments and the income from them can fluctuate (this may partly be the result of exchange rate fluctuations) and investors may not get back the full amount invested. Assets and cash flow valuations can be illiquid and shares difficult to sell. The value of the investment is generally a matter of a valuer's opinion. Past performance is not a guide to future performance.

This document is neither an offer to sell, purchase or subscribe for any investment nor a solicitation of such an offer. This document is intended to be distributed in its entirety. No consideration has been given to the particular investment objectives, financial situation or particular needs of any recipient. Any transaction will be subject to PCCP's terms of business.

Paradigm Change Capital Partners LLP is an appointed representative of Internos Real Investors Limited which is authorised and regulated by the Financial Services Authority.'

Paradigm Change Capital Partners LLP

63 Grosvenor Street
London W1K 3JG

T: +44 (0) 203 178 5086
F: +44 (0) 203 178 5116
E: info@paradigmchangecp.com

PARADIGM CHANGE
CAPITAL PARTNERS