
FINANCE GUIDE FOR POLICY-MAKERS: RENEWABLE ENERGY, GREEN INFRASTRUCTURE

2016 UPDATE

Kirsty Hamilton, Low Carbon Finance Group, Chatham House and Ethan Zindler, Bloomberg New Energy Finance (BNEF) have written and produced this updated guide.

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First edition written and produced by Kirsty Hamilton and Sophie Justice, 2009.

Kirsty Hamilton has more than 25 years' experience in climate and energy policy. She initiated work with renewable energy finance practitioners in 2004, as an Associate Fellow at Chatham House, examining 'investment grade' policy, and then led the policy work of the Low Carbon Finance Group from 2010 to 2015. khamilton@chathamhouse.org

Sophie Justice, PhD is a financial consultant with extensive international banking experience.

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Frankfurt School of Finance & Management is a research-led business school offering educational programmes covering financial, economic and management subjects. The Frankfurt School - UNEP Collaborating Centre is a strategic cooperation with the United Nations Environment Programme to catalyse the private financing of clean energy in support of the transformation to resilient low-carbon and resource-efficient economies. <http://fs-unesp-centre.org/>.

[Low Carbon Finance Group](#)

The Low Carbon Finance Group, a non-political network of senior energy finance practitioners drawn from across the finance spectrum, was formed by financiers to provide policy-makers with the factual basis for understanding conditions for attracting capital to renewable energy and other low-carbon energy infrastructure. It worked extensively on electricity market design from 2010 to 2015.



“As the world focuses on implementing the Paris Agreement, attracting scaled-up investment to climate solutions will be critical.

For those of us who do not come from the finance world but need to understand it better – this Guide provides an excellent foundation to the key aspects of who does what and why in finance. It has become a favourite reference for me.”

Christiana Figueres

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INTRODUCTION

The Paris UN Climate Agreement in 2015 refocused attention on the need to mobilize substantial private capital flows into climate solutions at the accelerated pace and at the required scale to combat climate change.

Implementation of national clean energy or 'green' infrastructure plans will require unprecedented levels of private investment, not only for climate reasons but also to deliver energy security and access to energy for those who lack them, as well as creating the conditions for sustainable development.

Now, more than ever, it is critically important for policy-makers and non-financiers to understand and interface with the financial community to establish effective conditions.

As a practical contribution, this guide provides a factual overview of the landscape of finance – sources of capital, what the capital markets do, how transactions work – and more broadly to set common finance terms in context.

The original guide was written in 2009. Since then evidence of climate change has continued to build, with successive temperature records broken. A substantive transition is now well under way in the energy sector and the economics of solutions such as renewable energy, energy efficiency have improved dramatically, and new low-carbon technologies are becoming ever more affordable.

This updated guide reflects changes in market conditions, financing structures and relevant policy debates. Topics covered include:

- How finance generally works, with updated finance variables;
- What the different parts of the finance sector do;
- What issues financiers consider when investing, including the role of policy and regulation;
- Capital markets and where, for example, 'green bonds' fit in – an expanded section;
- The variables affecting finance decisions;
- Energy efficiency – an expanded section, and an update on issues relating to emerging or developing-country markets;

- A practical focus on 'climate finance', especially finance-sector-led initiatives that are accelerating actions at both the low- and high-carbon end of the spectrum.

The starting point is an explanation of the financial institutions – what they do and how they make decisions – concentrating on those relevant to the more mature end of the renewable energy infrastructure market, using proven technologies that are being financed now and at scale.

While the focus is on renewable energy, the underpinning approach applies to other parts of the energy sector, and 'green infrastructure' more generally.

SCALE & TIMING

There are multiple assessments of the large-scale financing requirements to deliver sustainable energy at the necessary scale to tackle climate change. According to the UN's Sustainable Energy for All 2015 scenarios, US\$1 trillion per year is needed to 2030.¹ Bloomberg New Energy Finance (BNEF) and the institutional investor group CERES estimate that a US\$12.1 trillion 'opportunity' exists for the power sector alone to 2040 to deliver a 2°C scenario,² with a very substantial scale-up of renewables.³ That top-down analysis of the volume of capital needs to be matched by conditions on the ground that attract and enable capital to be invested.

CURRENT CONDITIONS

Global investment continues to grow strongly, fuelling further appetite in an increasingly mature sector, as well as interest in emerging technologies.

Global investment in clean energy (renewable energy, energy efficiency and low-carbon services) has grown exponentially: from US\$62 billion in 2004 to close to US\$330 billion by 2015 notwithstanding fluctuation,

1. This scenario delivers universal access to modern energy and results in a doubling of renewable energy consumption and a doubling of the rate of improvement of energy efficiency by 2030. See <http://www.se4all.org/sites/default/files/SE4All-Advisory-Board-Finance-Committee-Report.pdf>.

2. That is, restricting global average temperature rise to 2°C above pre-industrial levels (noting that the UN Paris Agreement aims to keep temperatures to 'well below' 2°C, with efforts to achieve a tighter 1.5°C limit).

3. BNEF, CERES 'Mapping the Gap: The Road from Paris, Finance Paths for a 2-Degree Future', 27 January 2016. Available from: http://about.bnef.com/content/uploads/sites/4/2016/01/CERES_BNEF_MTG_Overview_Deck_27January.pdf.

geographic variation and a changing market context – oil and gas prices, for example.⁴ Attention paid to investment risk in high-carbon sectors is only reinforcing this trend.

A transformation in the world's power mix is also seen to be under way – investment data confirm that by 2015 annual investment in new renewable energy generation was more than double investment in coal and gas generation; furthermore renewables added more to global energy generation capacity than all other technologies combined.⁵ Investment is increasingly global, with the balance shifting to emerging markets for the first time also in 2015.

Long-term drivers are having an impact: steadily falling costs driving cost competitiveness; global climate change imperatives; increased use of indigenous resources for security of supply in the face of volatile international energy markets; and renewed efforts to deliver access to modern energy for those who currently lack it.

Illustrating this momentum are the continent-scale renewable energy initiatives launched in Paris by the governments of African countries and India. The goals are ambitious: the aim is to deliver an identified potential of 300GW by 2030 in Africa; and US\$1 trillion of new investment under the International Solar Alliance of governments, led by India.

DELIVERING INVESTMENT

Investors want to understand what further action will be taken to meet the climate change goals in the 2015 Paris Agreement – to hold temperatures to 'well below 2 degrees' and pursue efforts to achieve a 1.5°C threshold.

The timing is acute: the global long-term goals imply that the energy system must substantively decarbonize globally, if not move towards 'negative emissions', by mid-century or not long after, well within the lifetime of infrastructure invested in today.

The investment case on the ground will be driven by how effectively climate and energy goals are translated into national conditions.

4. Bloomberg New Energy Finance 14 January 2016, Press Release and Clean Energy Factpack, <http://about.bnef.com/press-releases/clean-energy-defies-fossil-fuel-price-crash-to-attract-record-329bn-global-investment-in-2015/>.

5. UNEP, BNEF, 'Global Trends in Renewable Energy Investment 2016', March 2016. Available at http://fs-unep-centre.org/sites/default/files/publications/globaltrendsinrenewableenergyinvestment2016lowres_0.pdf.

Understanding how those in the finance sector make decisions will help to create 'investment grade' policies and plans, conditions that deliver a healthy pipeline of opportunities, build investor confidence and attract a diverse ecosystem of finance. This guide is intended as a tool in that process.

SUMMARY

- Across debt and equity there is a diverse ecosystem of sources of capital for financing renewable energy and the wider set of new low-carbon technologies. This includes investors from across the finance sector with different appetites for risk and different return expectations. The capital markets receive considerable attention as a platform for a very significant volume of global capital, however, as renewable energy projects are often small, relative to other investment opportunities, and generally more complex than conventional generation. The key is to match risk and return expectations of different sources of capital along the different stages of a project pipeline (development, construction, operation) and from there to larger lower-risk portfolios of operating assets.
- Making investments is a complex process involving a number of stages. Once opportunities have been sourced, these must be evaluated against internal rate of return or yield expectations, a deal must be structured involving debt and/or equity. A detailed due diligence process will take place involving scrutiny of a range of potential risk factors – technical, economic, market, political and policy-related – ahead of securing internal approval through credit or investment committees. Capital is often competing not only against other investment options within a firm, but also against other sources of capital for the project.
- Policy, politics and regulation can have both a positive and negative impact on renewable energy investment. Overarching policy signals sector growth which is important for setting the scale of a pipeline of investable opportunities, and the detail of power markets and specific support (including the pathway out of subsidies) will be instrumental in determining project economics and the attractiveness of the proposition. Conversely, policy uncertainties create investment risk, with retroactive changes being the most damaging. Public finance instruments can play an important role in enabling investment under particular conditions, or facilitating specific pools of capital to invest.

- Wider changes in financial markets, economic conditions and in the power sector in the current decade have had a significant impact on renewable energy investment in different geographies, both presenting challenges and attracting new sources of capital.
- Within the power sector, higher penetration of renewable energy on the back of technology cost reductions, strong policy and a clear track record, plus projected cost reductions for new 'disruptive' technologies (e.g. energy storage) is now having an impact on traditional utility businesses. A structural change in the power sector is already stimulating new business models and new opportunities for a wider set of investors.
- The Paris Agreement on Climate Change and its long-term goals imply very substantive changes to energy provision globally, within the lifetime of energy and other infrastructure investment decisions today. It will be important that this direction becomes clear from an investment perspective – through national plans, policies and markets – as rapidly as possible.

This guide does not cover these wider trends in detail, but highlights those factors that may affect the appetite for and allocation of capital to renewable energy, and infrastructure more generally.

SECTION 1:

**FINANCE BASICS
& SOURCES OF
CAPITAL**

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INTRODUCTION

The finance sector approaches investing in renewable energy in much the same manner as it does in any other industry. However, this type of investment has certain characteristics that require an additional level of understanding. A number of other factors are layered on top of the basic financial analysis that will be conducted. These include the influence of policy and regulation on the viability or attractiveness of an investment, including the detail of any support regime and, as the penetration of renewable energy rises, the broader design and infrastructure of the energy market. Energy efficiency encompasses a wide range of investment options, from the delivery of energy savings at industrial level, which may be combined with direct renewable energy generation, retrofits of housing and building infrastructure, to sophisticated demand management to provide flexibility in power system balancing, for example. For many types of energy efficiency projects, investment revenue streams may be less straightforward than those related to energy generation. This is discussed in [Section 2.5](#).

GREEN INFRASTRUCTURE

The term 'green finance' or 'green infrastructure' is increasingly used as a catch-all for investment into a broad category of low or zero-carbon infrastructure from renewable energy projects, transportation options to energy efficiency (buildings for example) and energy storage. It can also indicate assessment of consistency with broader sustainability, 'ESG' (environment, social and governance) factors and climate resilience, although this is not examined further here. The original version of this guide focused on renewable energy, but the basic perspective of financiers when considering transactions will be relevant to these broader categories. Standardization of definitions such as 'green bonds' is also dealt with below. It is useful to note that, for financiers, 'infrastructure' often refers to a range of investments normally characterized by a long-term stable revenue stream.

RISK & RETURN

Central to any finance and investment decision is risk and return. Financial institutions have to make a return proportional to the risk they undertake: greater risk means a greater return will be expected.

As outlined below, different financial institutions will take different levels of risk: from the high risk associated with investing in new

technology companies, to the lower risk of mature technologies, such as onshore wind. The renewable energy sector utilizes an 'ecosystem' of finance from across the entire risk-reward spectrum.

All financiers will want to understand the risks they face and will aim to minimize or mitigate them through, for example, legal means or financial structuring. The track record and performance of deals involving any given technology will be important in defining these risks. Policy and regulatory risk is also a key category in policy-driven energy markets and is discussed in [Section 2.1.2](#).

SOURCES OF CAPITAL

There are two ways in which a renewable energy company can source capital: either through debt – by borrowing from a bank or other financial institution – or through raising equity capital by selling a stake in the business or project itself.

Banks that lend money to renewable energy projects will focus on getting that debt repaid in full and on time. The amount they will be prepared to lend ('debt sizing', see [Section 2.4.1](#)), and the cost, will be linked to the risk assessment. They earn a relatively small return, or 'margin', on the loan.

Equity capital (various categories are described in [Section 1.2.1](#)) seeks opportunities to invest (take an equity position) in companies, projects or a portfolio of projects. Equity investors also expect a return proportionate to the level of risk they take.

In addition, certain investors and companies such as utilities regularly finance projects 'on balance sheet', i.e. from their own company funds rather than external sources of finance for a specific transaction. These are often referred to as 'strategic' investors or 'industrial' investors (as opposed to financial investors) and may play a central role in some markets or sectors. Those corporate funds may involve monies raised from the financial markets through bonds (a form of loan) issued by their internal treasury departments, or through general corporate bank facilities that are available to the business as a whole.

Often a company will choose the method of financing a project, e.g. project finance (described below), corporate facilities or other sources of capital, depending largely on which option offers the cheapest source of funding and the conditions required by the capital

provider. Utilities with low corporate borrowing costs have typically financed renewable energy activity on balance sheet. The decision to do so takes into account a number of factors, including the company's credit rating (the role of ratings agencies is covered in [Section 1.2.3](#)), as well as market conditions, with companies looking to access debt markets when pricing is advantageous.

Increasingly, those that have financed projects all the way through to construction and operation seek to sell one or more projects in a portfolio to a long-term investor, such as a pension fund (the role of institutional investors such as pension funds, including how they allocate capital, is covered in [Sections 1.1.2, 1.2, 1.3](#) and [2.4.2](#)). There are two main reasons for refinancing: are principally i) accessing cheaper capital, because by this time many of the risks have been removed; and ii) giving the original investors the ability to reinvest at a stage of the investment cycle where they have expertise (see also [Sections 1.1.1](#) and [2.4.1](#)).

An important part of the risk side of the equation is what happens if a company that the investor or bank has funded becomes insolvent. In this situation, the insolvent company or project typically has some residual value determined by its existing assets such as manufacturing equipment, inventory or contracts. These assets can be sold to generate cash, and there is a clearly defined hierarchy determining which class of capital gets its money out first. Debt (banks and other lenders) takes precedence over equity. Lenders provide money to a company for a fixed return (margin) with no further 'upside' (i.e. profit), while equity takes greater risk, as payment is received only after all debt claims have been met. Equity investors will factor that risk into their return expectations. There is also an assumption that equity investors receive the additional upside if the project exceeds expectations.

In general, a company or project vehicle seeking finance will be looking for the lowest overall cost for that capital – often, but not always, using a mix of debt and equity in turn linked to the risk involved in the underlying project or company. The gearing, or leverage, of a project is the amount of debt raised relative to a given amount of equity. However, lowering the cost of capital is more complex than simply increasing the amount of debt in projects, and some equity investors prefer an all equity (unleveraged) structure (see also [Section 1.4](#)).

The descriptions in this guide are simplified. In reality, there is a wide variety of equity investors, and debt also comes from a variety of

sources including banks, insurance companies, funds and individual investors, as will be discussed further below. Indeed, this can be described as an ecosystem of finance: the different sources of capital involved at different stages of the project chain, and financial institutions themselves, including banks, also perform multiple functions. Matching the risk/return requirements of a source of equity or debt with a specific renewable energy project, portfolio or company is central to understanding financing and routes to scaling up capital in the renewable energy sector.

All investors, whether they provide debt or equity, make investment decisions on a comparative basis by assessing the risk and return of a specific project or investment opportunity relative to other investments available (usually including those outside the renewable energy sector).

1.1 THE FINANCIAL INSTITUTIONS - WHAT THEY DO

This section provides a simplified categorization of who does what and what instruments they typically offer that are relevant for clean energy. In practice, financial institutions across banks, institutional investors, funds and independent players offer a range of services.

1.1.1 BANKS

CORPORATE LENDING

Banks provide loans to companies to support everyday operations (typically through a 'working capital facility'), as well as loans for longer-term investments. After a bank assesses a company's financial strength and stability, it prices the debt (sets the interest rate and repayment terms) accordingly. These bank facilities, usually for a 1-5 year tenor⁶ (sometimes with an annual renewal option), typically place relatively few restrictions on how the company can use the funds, provided certain general conditions, or 'covenants', are met. The lender will have recourse to the borrower's balance sheet in the case of default. The assessment of the company's creditworthiness (i.e. ability to repay) is made by an analysis of its overall business – i.e. the sum of net cash flow from all of its various (diversified) operations.

6. A loan tenor is the length of the lending period.

PROJECT FINANCE OR NON-RECOURSE/LIMITED-RECOURSE FINANCE

Debt is borrowed for a specific project, legally established as a standalone entity (usually using a special purpose vehicle, 'SPV', company). The amount of debt made available will be linked to the cash flow that the project is forecast to generate over a period of time, as this is the means to pay back the debt. This amount is then adjusted to reflect inherent risks, e.g. fluctuations in the production and sale of power, operational risks or power price variations. In the event of a problem with loan repayment, or insolvency of the business, the banks will have first 'charge' or claim over the assets of a business (rather like in a typical mortgage payment default). The first tranche of debt to get repaid from the project is called 'senior debt'.

'Limited-recourse' or 'non-recourse' finance refers to the fact that financiers of the project have limited or no recourse to the balance sheets of sponsor companies, nor to assets outside the specific project company, should something go wrong. Accordingly, considerable attention is paid to forecasting the project cash flow, the collateral package (elements that provide further security for the lender) and the risks that may affect repayment. Lenders will often require sufficient agreements, such as Power Purchase Agreements, to be in place to de-risk the cash flows. Further key aspects of 'debt sizing' – how much banks will be willing to lend, at what cost and for how long (i.e. the loan tenor) – are discussed in [Section 2.4.1](#).

Another important source of funding in the United States, and certain other jurisdictions, is 'tax equity': a tax-based instrument that banks and other firms can use to provide project finance for renewable energy projects. Clean energy projects typically generate tax credits in addition to cash flows and these can be sold to large third-party tax equity investors. Typically, these investors have been banks or large corporations which provide capital and then get repaid in tax credits rather than cash, thereby reducing their tax bill. Google is an example of a company that has used this avenue to invest in renewable energy, through its US\$300 million contribution to SolarCity's US\$750 million rooftop solar photo-voltaic (PV) fund in 2015.

MEZZANINE FINANCE

As its name implies, this type of lending sits between senior bank debt and the equity ownership of a project or company. This is essentially referring to the order – or 'waterfall' – of who gets repaid first after senior debt. Mezzanine loans take more risk than senior debt, because their regular repayments are made after those for senior debt, and

should the company or project suffer cash-flow problems, or go bankrupt, the mezzanine financier will be second in line to recover its cash. However, the risk is less than that of equity ownership in the company. Mezzanine loans are usually more expensive for the borrowers, but from the lenders' perspective they pay a greater return, or margin, than senior debt (they may be provided by a bank or other financial institution, often through specialist mezzanine funds). A renewable energy project may seek mezzanine finance if the amount of bank debt it can access is insufficient: the mezzanine loan is typically a cheaper way of providing some of the additional equity needed, and therefore lowers the cost of capital for the overall project, although it may also come with more stringent conditions from the lender.

REFINANCING

This is where a project or a business which has already borrowed money decides, or needs, to replace existing debt arrangements with new ones, similar to refinancing a mortgage. Reasons for refinancing may include more attractive terms become available in the market, or a situation where the duration of the original loan facility may be short relative to the project timeframe, since loans are often structured to become more expensive over time owing to the increasing uncertainty. This forces projects that require longer-term loans to refinance at a specific point in the future, with the risk that the terms available at the time of refinancing may be worse, or that, *in extremis*, there might be no refinancing available owing to poor market conditions.

Refinancing may also be attractive once a project or group of projects is operating and delivering a stable revenue stream. At this point the lower risk profile of an operating asset, all things being equal, should make access to lower-cost finance possible, such as that from institutional investors and infrastructure funds. This enables the original providers of capital to exit and make their return or get fully repaid, with the potential to reinvest in further project development.

INVESTMENT BANKING

In most cases, investment banking involves relatively little actual lending of capital. Investment bankers do a number of things, such as undertaking mergers and acquisitions (M&A) – brokering the sale of major assets such as projects or companies, working for either the buyers or sellers; underwriting Initial Public Offerings (IPOs – first issue of shares onto a stock exchange) for companies; and issuing bonds. The banks providing 'underwriting' of an issue to the market (whether debt

on a bond market or equity on a stock market) take the risk that the investment may not sell to investors; if it does not, the underwriters are committed to provide the proceeds to the issuing company and will only be able to sell the investment at a later stage, often at a significant loss if the market price has moved significantly against them. Investment bankers typically are compensated by receiving some percentage of the transaction they have brokered. This may be for a fee or in the form of shares if it is linked to IPO services.

ADVISERS, MARKET ANALYSTS

Market analysts, sometimes within banks, do not invest capital. Rather they provide research (e.g. on publicly listed utilities), presenting analyses of their performance and prospects (or sector performance and projects), along with recommendations to buy, sell or hold the shares or bonds of those companies. Research reports are used by a range of investors but most often by professional institutional investors including hedge funds, mutual funds and others.

1.1.2 INSTITUTIONAL INVESTORS, VENTURE CAPITAL, PRIVATE EQUITY & INFRASTRUCTURE FUNDS

This section broadly covers sources of equity, again in simplified form. The institutions and funds outlined below may do more than provide equity. For example, institutional investors also invest in bonds – a form of loan – as part of their investment strategy.

Renewable energy equity investments take an ownership stake in a project, company or portfolio of assets, and can be sought from a range of sources. Institutional investors, such as pension funds and insurance companies, are ‘at the top of the food chain’ and are a primary source of capital for the range of equity funds described in this section. Institutional investors are sometimes referred to as asset owners – in this case referring to financial assets. Their financial assets are allocated to the various funds below as part of an investment strategy in order to deliver an overall return for the company as a whole; this will vary by firm (see [Section 2.4.2](#)).

Which types of equity investor will be attracted to renewable energy will depend on the type of business, the stage of development of the technology and project, and the degree of risk associated with it. As summarized in [Table 2](#), venture capital (VC) tends to focus on ‘early stage’ or ‘growth stage’ technology companies (depending on the distance from the laboratory and commercial roll-out); private equity

firms focus on later stage and more mature technology or projects, and generally expect to 'exit' their investment and make their returns in a timeframe of 3 to 7 years. Infrastructure funds are traditionally interested in lower-risk assets, have a longer-term investment horizon (often 15 years or more) and will accept lower returns over this period given the lower risk taken.

Funds use an internal rate of return (IRR, or 'rate of return')⁷ as a key tool in reaching investment decisions. This is used to measure and compare the profitability of different investments. It is simply the percentage gain the fund earns on a specific investment over the life of that investment, expressed in the form of an annual rate of interest. Funds generally have an expectation of what IRR they need to achieve, in order to satisfy their investors or investment criteria. This is also known as the hurdle rate and generally determines the level of risk that can be taken and the types of companies or assets it will support (see also [Section 1.4](#) on Cost of Capital). Other ratios are typically used alongside IRR to assess the attractiveness of investment decisions.

While lenders make a return through the margin attached to their loans and any associated fees they charge, equity investors earn returns from, for example:

- Taking a percentage of the profits generated by the company in which they have invested in the form of dividends;
- 'Exiting' a company (which may be a project-specific company or special purpose vehicle, SPV) either i) through selling their shares to another financial sponsor at a higher price than they paid for them (a secondary buy-out), or ii) when the company concerned goes fully or partly public on the stock exchange through an IPO; or
- Selling the stake in an operating project or portfolio of assets that the investor has funded.

Institutional investors, and infrastructure funds, may be looking for a reliable year-on-year yield over a number of years, rather than a one-off exit payment at the end of a period of investment (private equity funds typically have an active exit strategy and do not remain as long-term owners).

⁷ More technically it is the discount rate that returns a net present value of an investment cash flow as zero. Net present value (NPV) is an assessment of investment value in current time; it is calculated from an analysis of the future cash flows generated from the investment adjusted for time and risk (by applying a discount rate), less the initial investment.

1.1.3 OTHER SOURCES OF CAPITAL

The main sources of new capital for private financial institutions are savings and pension or insurance contributions.

Other sources of capital, or instruments, include endowments, 'family offices' (managing family wealth), foundations, high-net-worth individuals and corporates – these last may be investing in renewables for their own energy use. Sub-national public finance – by local authorities or cities – is another potential source of funds. In addition, renewable energy or new low-carbon energy may be of interest to investors with specialist themes such as community energy funds. Other channels such as crowd-funding and products that target retail markets (individual investors) are also emerging as the range of opportunities and demand for finance diversifies.

Overall, these invest in smaller volumes, but the specialized focus may be applicable to particular types of project that would otherwise find mainstream sources difficult to access (not detailed in this guide). This diversification of power-sector players and investment opportunities can be expected to continue.

IMPACT INVESTING

Impact investing is a relatively new term for a growing category of investment. It broadly covers investments made into companies, organizations and funds with the intention to generate social and environmental impact alongside a financial return.

Impact investors are not restricted to any particular source of capital and exhibit a diverse set of financial return expectations. A range of asset classes and sectors in both OECD and developing countries may be considered, with renewable energy a contender depending on the starting point of the investor. Impact investment is not further referred to explicitly in this guide.⁸

As with specific funds for 'responsible investing', this categorization can facilitate access to capital for companies or developers with assets that fit the 'impact' definition being used.

8. For example, refer to Global Impact Investing Network, www.thegiin.org.

1.1.4 KEY FEATURES OF FUNDS PROVIDING EQUITY

INSTITUTIONAL INVESTORS: PENSION FUNDS AND INSURANCE COMPANIES

These companies invest pension or insurance contributions to match their long-term liabilities (to pay policy-holders); as financial 'asset owners' they are primary contributors to the funds mentioned below. Investment strategies will vary between institutions depending on their liabilities; if one area of their portfolio is underperforming – for instance, with low yields from government bonds – they may increase funds to other segments to ensure the overall return is upheld at an appropriate risk level. Sovereign wealth funds (SWFs) share many of these characteristics, and are covered in a separate section below.

Typical investments include:

- Public, or listed, equity (via stock markets) and government or corporate bonds;
- Real estate;
- Cash and cash equivalents (e.g. highly liquid investments – those that are easily converted to cash);
- 'Alternative investments': these offer access to a different segment of the market from those above, and usually include unlisted equity investments in private equity and venture capital, infrastructure funds and hedge funds. Real estate may be included in this category although generally it is considered separately. A further feature is that these are usually long-dated, illiquid assets (liquidity is explained in [Section 1.2, Box 1](#)) that cannot be traded easily, and therefore carry more risk and expect greater return.

Further features of these investors, and their investments, include the following:

- There is a low appetite for risk, reflected in expectations of stable returns at around the 6–8% level across the *overall* investment portfolio.
- Institutional investors seek 'cash yielding' investments, i.e. those that generate a stream of cash year on year ('running yield') to support their long-term liabilities.
- If they are investing directly on an ungeared basis (i.e. without debt), a return in the 7–10% range is to be expected, although this category may be a small part of their investments and would not be a standalone part of the portfolio.

- The 'alternatives' category, which may include infrastructure and renewable energy, may account for a very wide range – from 0% to 50% – of the overall portfolio depending on what is included and the investment strategy, and will be expected to deliver a higher target level of return.
- Under the 'alternatives' category, monies may be allocated to private equity or infrastructure funds (see below) with specialist expertise in the sector, that manage the funds for a certain level of return.
- The share of 'green investments' such as renewable energy (including listed and unlisted renewables) in the overall portfolio is under 20% and for most institutional investors is in the 5-10% range.

There are now vehicles that facilitate investment by institutional investors in renewable energy and energy efficiency on both the debt and equity side. Specialized bonds (debt) or 'yieldcos' (equity), for example, are discussed further in [Section 1.3.1](#).

VENTURE CAPITAL FUNDS

- Raise the funds they invest from a wide range of sources looking for a high-risk/high-return opportunity for at least a part of their portfolio, including insurance companies, pension funds, mutual funds and high-net-worth individuals;
- Target new technologies, new higher-risk markets;
- Interested in early-stage companies;
- Expect high risk of failure (8 or 9 out of 10 investments might be expected to fail) and therefore fund in smaller amounts, but to a large number of opportunities (compared with e.g. private equity funds);
- Anticipate their investment in a company (their investment horizon) to last 3–5 years;
- Return requirement, many multiples of original investment (50–500% IRR) on those companies that succeed on an aggregate basis, thereby delivering positive returns for the investor across the entire portfolio.

PRIVATE EQUITY FUNDS

- Raise capital from a wide range of sources with medium risk appetite, including institutional investors and high-net-worth individuals;
- Target opportunities with possibility for enhanced returns (or 'upside');

- Interested in companies and projects with more mature technology, including those preparing to raise capital on public stock exchanges ('pre-IPO'), demonstrator companies, or under-performing public companies;
- Like venture capital funds, a typical 10-year fund will look to fully invest capital within the first five years and fully exit within 10 years;
- Range of investment styles from buy-outs to growth capital;
- High return requirement, 15–25% IRR.

INFRASTRUCTURE FUNDS

- Funds drawn from a range of institutional investors and pension funds;
- Target 'infrastructure' i.e. an essential asset, long duration, steady, low-risk cash flow;
- Interested in roads, railways, ports, information communication technology (ICT), distribution facilities, power-generating facilities;
- Medium- to long-term duration, of 10 years or more;
- Lower risk and return expectations, 9–13% IRR (varies by market conditions and risk factors).

For investors, the term infrastructure typically implies durable assets with long-term, predictable revenue streams attached, often with a level of government regulation underpinning returns. This is commonly split into economic infrastructure, such as transport networks (road, rail), or water and energy transmission networks; and social infrastructure, such as hospitals, schools and education facilities. These investments often have high up-front construction costs that are balanced by increasing revenues, or long-term government-regulated – or government-contracted – payments over time.⁹

Renewable energy projects, as such, do not always have infrastructure characteristics, particularly during the development and construction phases (pre-revenue generation), where risks may be too high for a majority of infrastructure investors. This situation is changing as the renewable energy asset class, and its sub-sectors, demonstrate maturity and establish a track record.

9. Note that the EU's Solvency II regulations for investments held by EU insurers defines 'infrastructure assets' as: 'physical structures or facilities, systems and networks that provide or support essential public services'. This will require interpretation of 'essential public services'.

SOVEREIGN WEALTH FUNDS

Typically these are national state-owned funds set up to invest current-account surpluses derived from the sale of commodities (most notably oil and gas) or large foreign exchange reserves held by central banks.

Owing to wide variations in geographic focus, distribution of resources and economic factors, these funds often differ in strategy and aims.

Typical investments may look typically similar to institutional investors and include:

- Alternative investment vehicles (as above);
- Bonds and equities;
- Direct investments in companies, real estate and infrastructure.

There is an emerging interest in pooled, operating renewable energy assets as part of an overall strategy. In addition, certain sovereign wealth funds may have policy-driven priorities, for instance to acquire access to certain commodities or infrastructure deemed to be of national interest to the fund-owning state.

[Table 1](#) summarizes the different sources of finance (and two types of bank debt), outlining the type of risk taken, and provides an indication of the level of return, or margin, expected. The table includes institutional investors (pension funds, insurance companies) investing directly into a project, which they may do as part of an overall investment strategy.

Note that there is some overlap between the categories; for example, infrastructure units within some banks, the institutional investor category and infrastructure funds.

Table 1: Summary*

PENSION FUNDS/ INSURANCE	VENTURE CAPITAL	PRIVATE EQUITY	PUBLIC EQUITY	INFRA-STRUCTURE FUNDS	BANK MEZZANINE DEBT	BANK SENIOR DEBT
Proven technology. If investing direct in projects will look for sizeable, low-risk assets delivering predictable yield.	Start-ups; new technology prototypes.	Growth PE: pre-IPO companies; PE funds also cover mature-technology projects or company equity investments which take on more risk, such as greenfield development.	Proven technology; low-risk assets with predictable yield.	Proven technology; private companies. Assets with a low risk profile. Unlikely to take substantial construction risk.	Higher leverage for proven technology.	Proven technology, established companies.
15% overall return for institution; 6-7% for low-risk assets or vehicles.	>50% IRR ^a	15-25% IRR	6-8%	9-13% IRR	LIBOR ^b + 600-650bps ^c	LIBOR + 215-250bps ^c

* All numbers in this table are indicative.

- VC firms expect >50% return on investments as they recognize that over half of the companies they invest in will fail.
- LIBOR is the London Inter-Bank Offer Rate used internationally which is the most frequently used reference rate for the cost of borrowing (akin to a 'base rate'); bps are basis points, which are 100th of 1% (i.e. 700 bps is 7%). The convention to express interest rate margins on debt is to use a base reference rate (usually LIBOR for bank debt or a government bond price for bonds) plus a 'risk premium' or margin which varies according to the assessed level of risk of the corporate or project borrower.
- The final number will reflect geography, project and wider market trends - in this context the spread of this range given in the table can be wider.

1.1.5 PROJECT PIPELINE & THE ECOSYSTEM OF FINANCE

Different sources of finance will often be involved in project phases from development to construction to operation. The two earlier stages are higher risk, as revenue is yet not being generated to service debt repayments or deliver returns, and capital costs are not fixed until construction is complete. As individual technologies mature and gain a track record, the perception of risk will be reduced.

Bottlenecks in finance can occur at different points along the chain, depending on market or policy conditions. A strong project pipeline is the foundation for attracting a variety of sources of capital, including institutional investors.

Table 2: Renewable energy project stages & investor ecosystem¹⁰

PROJECT DEVELOPMENT & PRE-CONSTRUCTION	CONSTRUCTION	OPERATING PROJECTS
<ul style="list-style-type: none"> ▪ Corporates using 'on balance sheet' funding – debt and/or equity (applies to both integrated utilities as well as independent developers) ▪ Some private equity funds ▪ Some renewable infrastructure funds 	<ul style="list-style-type: none"> ▪ On balance sheet funding by corporates (company funds) ▪ Private equity funds ▪ Renewable infrastructure funds ▪ Some general infrastructure funds ▪ A few pension & insurance companies as direct investors ▪ Project finance debt 	<ul style="list-style-type: none"> ▪ Renewable infrastructure funds ▪ General infrastructure funds ▪ Pension funds ▪ Insurance companies ▪ Family offices ▪ Bonds ▪ Debt funds ▪ Corporate debt; project finance debt

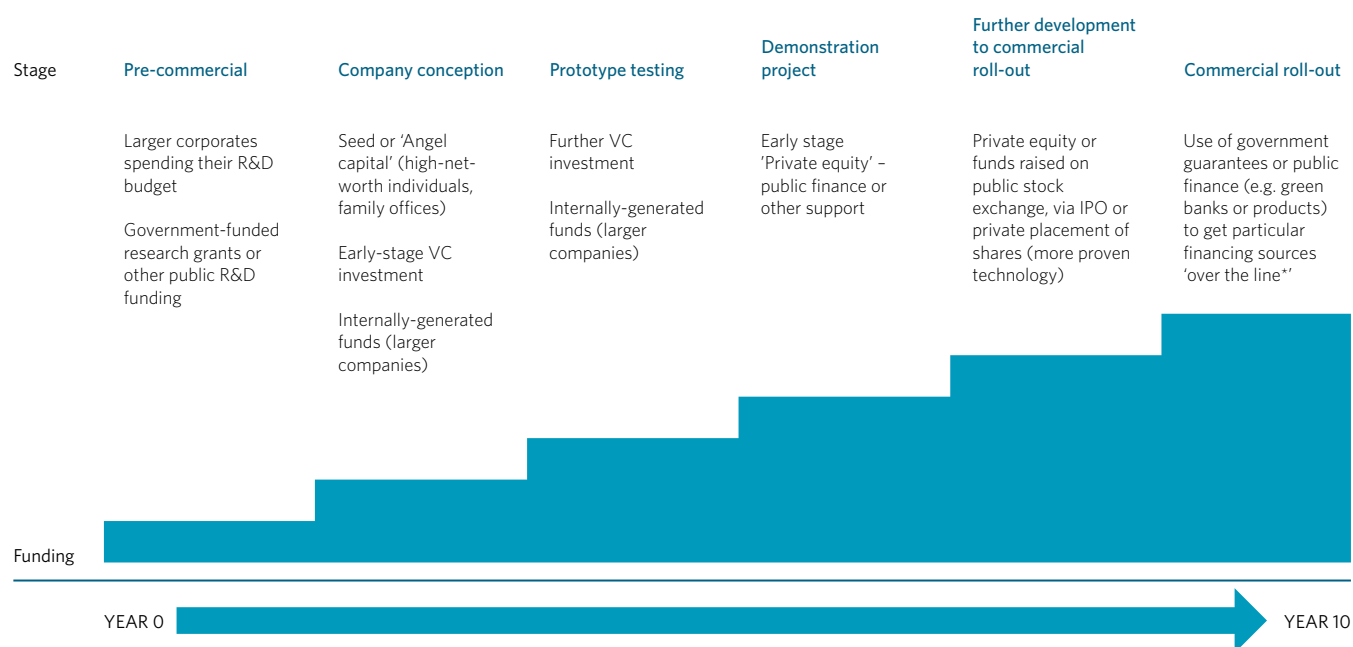
1.1.6 SOURCES OF FINANCE FOR TECHNOLOGY DEVELOPMENT

This guide focuses on the financing of mature, or close to mature, technologies. However, to put this in the context of the financing of less mature technologies (e.g. wave or tidal), [Figure 1](#) summarizes the types of financing likely to be involved in the earlier stages of technology development: from the point at which it comes out of the laboratory (or equivalent), when public grants or other forms of support, and seed or 'angel' capital from high-net-worth individuals or family offices may be important, and when venture capital, which is interested in start-ups and early-stage development, is likely to get involved. From there readiness for commercial roll-out as proven technology (which works and has a track record of operation) will start to attract private equity (non-VC) and other funds will begin to become interested, banks may get involved as the technology is

10. Credit to HgCapital for the Ecosystem of Finance approach used as the basis for this table.

increasingly regarded as mature, and companies may go to raise funds on public markets or through credit (bond) markets at the point of substantial deployment or scale-up

Figure 1: Finance for early-stage technology investment e.g. wave power



* At this stage, companies may also raise funds over capital markets, via IPOs or through acquisition by a larger company with greater financial resources to fund the roll-out.

VALLEY OF DEATH

The term 'valley of death' is often used to describe the challenge between the phases illustrated above, specifically the difficulties of accessing commercial finance between the initial VC investment and demonstration; or from demonstration to commercial roll-out with secondary VC investment. The challenge may arise from the fact that the company developing the technology is less well known and does not have a track record of operation in the field, or in scaling-up to the next level of development. For example, a small company with a successfully demonstrated technology that is moving to commercial roll-out and seeking significantly larger capital requirements may still be relatively unknown as a commercial operator with a technology that is still nascent. In this situation, public finance or other support may be required to facilitate progress along this chain.

1.2 THE CAPITAL MARKETS

Since the years following the financial crisis and its particular impact on the banking sector, greater attention has been paid to raising debt from the capital markets, and more generally, to accessing the substantial capital held by institutional investors for energy infrastructure investment. These larger volumes of capital will be needed to tackle climate change and the shift to low-carbon economic development.

BOX 1: PENSION FUNDS & INSURANCE COMPANIES - THREE CORE INVESTMENT OBJECTIVES

1. Diversification – spread investments among many companies and ‘asset classes’ to avoid impairing the ability to pay pensions or insurance claims arising from investment losses in any single investment or industry.
2. Liquidity* and yield – investments need to earn income or be readily saleable (liquid) to pay pensions and insurance claims. Liquidity requirements drive defined benefit pension schemes and insurance companies to allocate the vast majority of their capital to listed securities and government and corporate bonds.
3. Prudence – pension funds are not risk-takers, and have a fiduciary responsibility to act solely in the best interests of their beneficiaries. They are rarely at the vanguard of new investment areas.¹¹

* **Liquidity** of assets refers to their ability to be bought or sold relatively quickly, if not instantaneously, so that, if need be, they are available to their investors at short notice. Illiquidity may be a result of capital being tied up for a period of time (this could be in a project, or funds that invest in projects), or a circumstance where an active trading market is not available. Illiquid assets include real estate, private equity, venture capital and infrastructure funds, as well as project finance loans or private bonds (unrated). These may be less attractive, or not attractive at all to some investors, or come at a premium. Most investors will have set limits on illiquid assets built into their investment strategies.

Institutional investors own and control very large pools of capital from insurance and pension contributions, which must be invested to match long-term liabilities – insurance payouts or pension payments. As such, they generally seek to invest across a broad, diversified portfolio to deliver a predictable, low-risk overall return. The vast majority of capital

11. LCFG Submission to UK Government’s Electricity Market Reform consultation, Annex 1. Available from the author.

from these institutions will be deployed through the capital markets. Investment strategies will vary between firms, for example, pension funds may be managing funds linked either to 'defined benefit' – final salary – schemes, or 'defined contribution' schemes, which in turn will have a bearing on their investment strategy.

The term capital markets generally refers to platforms for raising long-term capital – capital available for more than a year – in the form of either debt or equity, offering a wide variety of options for investors (there are also other shorter-term capital markets options, e.g. commercial paper, not discussed further here).

The capital markets operate in two tiers – primary and secondary markets. In practice, these are regulated marketplaces, where individuals, businesses and institutions buy, sell and trade stocks, bonds, commodities or more complex assets such as derivatives – all are known as 'securities'.¹² Public and private institutions often raise money through the secondary sale of securities.

There is also an active market for non-listed securities, for example 'private placements' of equity and bonds, in which pension funds and institutional investors are an important investor segment.

1.2.1 EQUITY CAPITAL MARKETS

The 'equity capital markets', sometimes called the stock market, deal with stocks or shares of companies or listed equities (the terms are often used interchangeably) that investors can buy or sell. This is where companies raise money and investors take a portion of ownership. These are generally liquid and tradable. There is a large variety of specialized funds, mutual funds and exchange-traded funds (ETFs) that track certain baskets of stocks, in both a 'passive' and an 'active' way. Passive means a fund that simply mirrors the composition of a benchmark index of companies e.g. the FTSE 100 or Dow Jones Industrial Average, aiming to track the index's performance. 'Active' means a fund that employs its own strategy to try to beat the benchmark. In either case, it can be by any number of factors, such as sector, region, size (mid-cap/small-cap i.e. small or mid-sized companies) or asset class. There are a very small but growing number of specialized funds or indices that invest in baskets of companies that are focused on clean energy or other features of low-carbon development (see [Section 3.2](#) on Climate Finance).

12. A security is simply a financial instrument that is tradable on the secondary market.

To raise funds on the equity capital markets, a company can undertake an 'initial public offering' of its shares on a public stock exchange. A company generally uses an IPO to issue new shares to the public and raise new funds to support the company's expansion. Once a company has floated its shares on a stock exchange, it can issue more stock and raise further capital via a 'secondary offering'. However, this comes with the potential downside of 'dilution', in that the more shares there are available in a company, the less value each may have. Stocks typically are analysed and rated by public equity analysts – buy/sell/hold – and these ratings can have an impact on which investors will find them attractive. (Note that companies are rated by credit rating agencies – see [Section 1.2.3.](#))

Renewable energy sector IPOs have been created in both fund-style and corporate-style structures. Newer structures have also emerged since the financial crisis, such as 'yieldcos', outlined below ([Section 1.3](#), 'Capital Markets: where renewables fit in').

The secondary markets are where subsequent trading of stocks and shares is done, after the initial capital raising or new share offers have taken place on the primary market.

1.2.2 DEBT CAPITAL MARKETS

As the name indicates, the 'debt capital markets' are where funds are loaned with a view to getting these paid back in return for a predictable, fixed return. For those looking to raise capital in the form of debt (i.e. borrow), this typically involves volumes that are much larger than can be provided by a single bank or even by a syndicate of multiple banks (and they are typically sought by governments or large, high-grade credit, companies).

There are a variety of debt instruments available, including:

- Bonds – these are a form of loan which is tradable, and which appeals to a different set of lenders ('bondholders') from those for conventional bank debt; includes corporate and government bonds.
- Asset-backed securities (ABS) – these generally involve pooling of multiple, smaller, illiquid loans which are backed by physical assets. These can range from mortgage and automobile loans to bank loans for infrastructure, structured into a form that investors can purchase.
- Project bonds – these refer to bonds linked to debt for a single project, likely to be fairly large-scale.

- Infrastructure debt funds – these pool infrastructure project finance loans into a product offering a floating interest rate and margin.

More complex vehicles, such as credit derivatives and credit default swaps, let investors mitigate, or assume, the risk that a borrower will default on a loan (essentially providing a side bet, or form of insurance). These products have risk characteristics that need to be carefully managed.

Traditionally, governments raise capital through the issue of bonds, also known as ‘gilt-edged securities’ or ‘gilts’ in the United Kingdom and ‘treasuries’ in the United States, via the debt capital markets.

Institutional investors often hold a substantial proportion of their funds in government bonds as they provide safe, if low-yielding returns, with excellent liquidity, and provide a tradable, long-term match to their liabilities. However the attractiveness of those bonds will change if there is a risk of, or actual, downgrading of sovereign credit rating. There is also the risk posed by inflation. If a bond’s yield is below a country’s inflation rate, then the value of such funds diminishes, yields are reduced and the value of that investment is eroded. Such a scenario can prompt a bond investor to seek higher-yielding opportunities. For example, when the yield offered on the benchmark 10-year US Treasury Note dropped to a very low level in the years immediately following the financial crisis, this contributed to growing investor demand for infrastructure debt – that is, opportunities to invest in bonds that underwrite infrastructure (‘real assets’), including large-scale operating wind and solar projects.

Given the range of risks that must be understood and managed in the context of renewable energy transactions, investors considering debt instruments have different avenues open to them, including i) building up in-house expertise when they see a sufficiently attractive opportunity over time; ii) utilizing specialized funds (debt or equity) in return for a fee; or iii) seeking suitable products based on the credit rating awarded by a ratings agency.

1.2.3 THE RATING AGENCIES

Credit rating agencies are private companies that assess the financial strength of countries, companies and certain financial products (for example, projects, portfolios or project bonds), and that provide what are intended to be impartial, rational analyses ('ratings') that allow investors to compare the relative risk of default of any rated loan against a set of standard criteria. The three major ratings agencies are Standard & Poor's (S&P), Moody's and Fitch. The credit ratings are forward-looking opinions about credit risk: an investment grade rating is awarded when a bond, for example, is judged very likely to meet its repayment obligations on time. Standard & Poor's and Moody's describe investment grade to be between AAA and BBB- and Aaa and Baa3 respectively (see [Table 3](#)).

IMPACT OF CREDIT RATING

Bonds: ratings have a direct impact on how a bond offering gets priced through the interest rate that investors demand of it. A lower-rated bond indicates higher risk and thus investors will demand a higher rate of return or 'coupon' (a higher interest rate). Conversely, higher-rated bonds are lower-yielding. Given that institutional investors are typically as interested in preserving yield as they are in capital growth, a number are, by charter, only allowed to invest in bonds at or above a certain rating.

Corporate bonds: these are regularly graded by the ratings agencies and have a direct impact on the cost at which a company can borrow, which in turn can affect a company's strategy. If a company is viewed as having a low risk of default on its debt, it can borrow at inexpensive rates. Low borrowing costs can mean greater leeway for balance sheet financing by a company, or the direct financing of a clean energy project from its own resources. However, if, for example, an energy company has a high level of debt on its books, it would be concerned that further borrowing could have a negative impact on its credit rating, and may decide to delay further capital investments, including in renewable energy projects, until it has reduced its liabilities.

Table 3: Labelling used by three main ratings agencies

	S&P	MOODY'S	FITCH
Investment Grade			
Prime	AAA	Aaa	AAA
High Grade	AA+, AA, AA-	Aa1, Aa2, Aa3	AA+, AA, AA-
Upper Medium Grade	A+, A, A-	A1, A2, A3	A+, A, A-
Lower Medium Grade	BBB+, BBB, BBB-	Baa1, Baa2, Baa1	BBB+, BBB, BBB-
Below Investment Grade*			
Speculative	BB+, BB, BB-	Ba1, Ba2, Ba3	BB+, BB, BB-
Highly speculative	B+, B, B-	B1, B2, B3	B+, B, B-
Substantial risk - imminent default	CCC+ down to C	Caa1, down to Ca	CCC+ down to C
In default	D	C	D

* Bonds that are not investment grade are sometimes referred to as 'junk bonds'.

RENEWABLE ENERGY & CREDITWORTHINESS OF POLICY

As part of rating renewable energy companies or products, rating agencies will assess a range of factors specific to renewable energy. For renewable energy project finance transactions, for example, S&P examines different factors relating to the construction phase and the operational phase of the project, as well as government support, any public finance tools such as guarantees, and non-renewables specific factors such as the sovereign ratings of the country.

Assessment of construction risk is likely to include technology risk and counterparty risk (where there are contracts with other companies), additional cost overruns and delay risks, if not embedded in contracts with other companies; the importance of different risks will vary with technology.

Assessment of the operational phase of a project is likely to include performance risk (whether the technology will perform as determined, one element of which is the resource assessment); market risk; and country risk, including political and policy risks.

The policy environment and its stability are crucial to the extent that they have a material impact on project economics - for example, a project or portfolio where the revenues are subject to

government regulation and support, which is the case in a majority of renewable energy projects/portfolios to date. Policy changes, especially retroactive changes, can have a negative impact on existing investments (notably in Spain in 2011). Ratings agencies themselves are building the capacity to assess policy and regulatory factors in detail as part of the risk profile of the various renewable energy technologies.

As an example, Standard & Poor's assesses factors in the following areas in determining the creditworthiness of renewable energy incentive schemes:¹³

- Regulatory support and predictability;
- History (increase or decrease in renewable energy over period of incentive);
- Sustainability of the incentive scheme;
- Long-term profitability and whether this is predictable and consistent;
- Cost recovery of investors' costs (in near to medium term);
- Grid access;
- External risks – e.g. weather dependence;
- National economy, including growth, political stability and investor-friendliness.

The methodologies of the ratings agencies are published to allow investors to understand key assessment criteria.¹⁴ The broader approach to climate risk, and implications for both corporate and sovereign ratings, are also laid out,¹⁵ including the development of renewable energy, and non-fossil fuel or low-carbon indices¹⁶ (see [Section 3.2.1](#) on Climate Finance).

13. 'Assessing the Credit-Supportiveness of Europe's Renewable Energy Frameworks', Standard & Poor's Ratings Services, May 2014.

14. See, for example, footnote 13 above.

15. 'Insights, Climate Risk: Rising Tides Raise the Stakes', Standard & Poor's Ratings Services, December 2015.

16. 'Credit FAQ: Standard & Poor's Approach to Rating Renewable Energy Project Finance Transactions', Standard & Poor's RatingsDirect, April 2015.

1.3 CAPITAL MARKETS: WHERE RENEWABLES FIT IN

Renewable energy has the potential to offer certain attractive features for institutional investors, including:

- Stable cash flows from long-term regulatory backing, subject to low policy risk;
- Long-term inflation linkage – this ‘escalator’ might be built into government revenue support, for example, and would see prices step up year by year. It is a feature sought by institutional investors to avoid a deterioration of the value of assets to match the long-term nature of their liabilities to plan holders;
- Low correlation with other asset classes, e.g. government bonds, which is important for the diversity of the overall portfolio;
- Relatively low risk and displaying infrastructure characteristics, generally when operational and backed by a stable policy regime, or otherwise achieving investment grade credit ratings;
- Scale – the potential to deploy large amounts of capital, e.g. assets may be pooled into a portfolio or a vehicle with the right characteristics to enable larger-scale investment.

However, despite the overall volume of capital in the capital markets, the stock markets and debt markets have played a relatively small role in overall renewable energy financing, as has been tracked since 2002 by BNEF. The vast majority of renewable energy projects to date have been financed using developer or utility equity and bank debt, together with additional sources of equity such as specialized funds, with a small number of examples of refinancing via the capital markets. Part of the reason is that renewable energy assets have been unfamiliar and generally too small at individual project level, and have different attributes, and therefore risks, from conventional power generation, requiring an often detailed knowledge of regulation.

However, by mid-decade the volume of investment coming into the sector via the capital markets has started to grow more strongly. This is anticipated to continue as a result of financial conditions increasing demand, alongside growing investor familiarity with the technologies and their performance, and with the development of in-house expertise (alongside a view that there is sufficient policy stability). The emergence of tailored structures to facilitate both the debt and equity capital markets to invest at the right risk profile and scale is another important

factor, in addition to changing financial conditions resulting in, for example, the search for yield (the capacity to deliver year-on-year returns) from investors.

REFINANCING & SECURITIZATION

The opportunity to tap into the capital markets to refinance renewable energy projects that are already operating is a particular area of attention. In a situation where investors and banks have provided higher-risk-taking capital and loans to get projects through development and construction and after demonstrated operation, the lower-risk, revenue-generating project can access lower-cost capital through the capital markets. There are also increasing examples of institutional investors taking a level of construction risk, where the risks involved are carefully managed.

There are a number of ways of refinancing: portfolio aggregation and 'securitization' are avenues for pooling and structuring a number of projects or project loans into a form that is familiar and large-scale, to make it more straightforward for investors to provide capital. An overview of this and other vehicles appearing in the market is provided in [Sections 1.3.1](#) and [1.3.2](#). Where this does not involve a public listing, it is also known as 'private placement'.

Refinancing also allows the banks and equity investors to be fully or partially paid back, to gain their return, together with the potential to recycle or 'churn' that capital into a new round of loans or investments, depending on whether this is attractive at the time and in line with their investment strategy.

While institutional investors are often referred to as a homogeneous block, in fact insurance funds and pension funds differ in attitudes and strategy with regard to aspects of renewable energy investments and their preferred vehicles.¹⁷

17. See, for example, the EY institutional investor survey results: 'Pension and insurance fund attitudes toward investment in renewable energy infrastructure', EY, November 2013. The OECD has also completed a body of research in this area, www.oecd.org.

1.3.1 EQUITY

The public equity markets offer a number of avenues for investing in renewable energy, including:

- Investment in firms via stock (share) offerings: the renewable energy industry has seen IPOs and other offerings from clean energy developers and equipment makers internationally. In many cases, these companies represent a major opportunity but also a risk, as they require investors to take a view on a new technology or new market. As a result, these stocks may not appeal to relatively risk-averse institutional investors.
- Specialized new vehicles to access long-term, low-risk equity from the capital markets are emerging for renewable energy, one notable example being the yield company, or 'yieldco' (see below).

YIELDCOS

The structure generally involves a portfolio of operating renewable energy projects bundled together by the yieldco (which takes the risk) and then publicly floated via an IPO, giving investors the opportunity to buy shares in a listed company. For institutional investors, a yieldco can offer a stake in low-risk, already operating renewable energy assets with stable revenue streams in order to earn a specified dividend or yield (as the name indicates), providing certain bond-like features. Early movers appeared in this field in the US and UK in 2013, albeit with different characteristics.

In the UK, public finance was deployed in the first yieldco IPO listing in order to increase market confidence in the vehicle and its underlying assets. This involved both an equity investment in an operating offshore windfarm by the publicly owned Green Investment Bank, as well as the purchase of a portion of shares in the fund itself. Subsequently, a number of renewable energy yieldcos successfully listed in the UK, mirroring activity in North America. The first continental European yieldco listed in 2015. By the middle of the decade, the track record, mainly for US yieldcos, was proving to be mixed, and there was some criticism for venturing into higher-risk assets than originally stated. Nevertheless, the model itself is a viable one for collecting and holding safe, operating assets.

PRIVATE EQUITY

Some institutional investors with in-house expertise invest directly in projects or portfolios of projects with the right characteristics; others do so through general infrastructure and specialized renewable energy infrastructure or private equity funds, managed by specialist teams. To deploy capital, the underlying projects or portfolios, the stage of development (construction/operating), the technology and the policy environment in which they sit must all fit the risk profile and investment strategy of those funds. Increasing investor interest in infrastructure and 'real assets' in the period following the financial crisis has resulted in some increase in allocations to renewable energy assets.

Emerging and frontier markets are a higher risk from a capital markets perspective, with the latter less economically developed and stable and therefore an even higher risk. Most equity capital in these countries is currently deployed alongside development finance institutions (DFIs) or multilateral development banks (MDBs). Some of the latter, in both industrialized and emerging markets, are providing tranches of equity into privately managed funds, to increase confidence and attract equity investors. Export credit agencies (ECAs) can also play an important role, almost invariably linked to the country of origin of the technology or service provided.

Retail (individual) investors invest directly in clean energy stocks or via, for example, specialized platforms. A wider range of options for equity investors at different scales is emerging, such as community energy funds (very well established in countries such as Germany and Denmark) or savings or retail products that can be aggregated by specialist funds to use for renewable energy investment. Crowd-funding is another small but growing source of funds, mostly used for higher risk, smaller-scale endeavours such as start-ups.

1.3.2 DEBT

BONDS

The use of bonds as a means to raise debt for renewable energy is an increasing focus of attention. These are sometimes referred to as 'green bonds' (see [Section 1.3.3](#)). There is a range of options for this type of investment:

- Corporate bonds issued to fund corporate activities, which can be specifically labelled for renewable energy investment, and are backed by the corporate balance sheet;

- General infrastructure bonds which could be used for certain types of renewable energy projects;
- Specific project bonds to directly fund individual projects or a group of projects;
- Asset-backed securities – as already mentioned, a refinancing vehicle which can be used for a bundle of renewable energy project loans to produce a security that can be sold through the secondary markets;
- Government-backed bonds: either international public finance institutions, or from national or municipal/local government institutions, the latter is an increasing area of activity.

As indicated above, an investment-grade rating is likely to be essential for institutional investors interested in renewable energy-linked bonds. This will either be from a ratings agency or from their own internal assessment. Investors will be looking for a low-risk profile and long-term yield and scale. Project-specific bond repayments will be linked to cash flows from the underlying project or portfolio, and attention will be paid to a range of factors, including technology risk and the policy regime in the context of any potential impact on revenue generation. This explains the damage caused by retroactive or sudden, unanticipated changes to a policy regime, which can raise the perception of policy risk across the sector internationally.

The use of other public finance instruments, for example guarantees underpinning debt repayment, can contribute to lifting the rating by mitigating certain elements of risk that would otherwise be a barrier, until such time as the asset class itself gains a stronger track record. However, renewable energy is likely to be competing with more conventional, familiar, infrastructure options and must deliver attractive returns to bondholders, in the context of the overall investment portfolio.

[Box 2](#) summarizes the emerging financial vehicles being used in the capital markets, as outlined in these sections.

BOX 2: EMERGING FINANCIAL VEHICLES IN THE CAPITAL MARKETS FOR RENEWABLE ENERGY: SUMMARY

New financial vehicles for public markets (often existing vehicles modified for renewable energy) have emerged in the past few years and are designed to facilitate investors with a potential interest in renewable energy to enter the market.

Examples include:

- Equity: 'yieldcos' consisting of a portfolio of operating clean energy projects which are bundled together as a new stand-alone entity that is traded on the stock exchange, offering investors a steady yield via a dividend.
- Bonds: 'green bonds' are an emerging asset class (e.g. multilateral development banks, corporate bonds, municipal bonds) - see [Section 1.3.3](#). A smaller number of project bonds and asset backed securities have also been issued.
- Infrastructure debt funds: project finance bank loans are pooled into a portfolio, and the fund buys the loans in return for a floating interest rate and margin.
- Bond issuance for refinancing debt at individual project level (likely to be large-scale, e.g. offshore wind).
- Renewable energy securitization: avenues that enable the refinancing of loans to illiquid renewable energy assets with predictable revenue streams, into tradable securities.

In the US, attention has focused on extending the use of so-called single-taxation entities to renewable energy. These could potentially allow more liquid and tax-efficient investment and pooling of capital in direct investments, including, for example real estate investment trusts (REITs) and master limited partnerships (MLPs) to refinance operating projects currently on developers' balance sheets.

1.3.3 THE GREEN IN 'GREEN BONDS'

A steadily increasing volume of 'green bonds' is being issued to provide debt, some of which is being raised for renewable energy investment. This is emerging as a distinct class of bonds which by mid-decade has been experiencing rapid growth in issuance and demand (over US\$40 billion by the end of in 2015, depending on definition¹⁸). The market has been deepening and diversifying in terms of geography (with issuances in China, Brazil, India, Mexico), currency and issuance characteristics, and there is an expectation of strong growth, as evidenced by demand from investors when these labelled bonds come to market. Other areas of potential include sovereign green bonds and green *sukuk* (Islamic or Shari'ah-compliant bonds¹⁹).

However, the use of the label 'green' can both help and hinder mainstream investors: it can make these bonds look less attractive if, for example, mainstream investors assume the it implies lower returns or higher risk. Today, the definition of green is undergoing a process of market standardization and tracking to build greater confidence among investors that bonds qualify for the label, and avoiding a risk of backlash if the attributes are not found to be truly green. Initiatives are actively under way to assist this market development and standardization around terms like 'green bonds' or 'climate bonds' (see [Box 3](#)).

Public finance institutions, such as the World Bank and the European Investment Bank, led a first wave of green-labelled bonds in this area early in the current decade; the institutions took on the risk of selecting the underlying assets and leaving the investors with a known return. A next wave of activity, towards mid-decade, was corporate issuance of labelled bonds, including those targeted for renewable energy investment, and the emergence a variety of green bonds (sometimes known as 'Muni' bonds in the US) issued by municipal or local government/cities. These have attracted a high level of interest from investors, indicating that demand is there at the right risk profile. In these two categories, the risk being taken by the investor is linked to the corporate balance sheet or the local government entity rather than the underlying renewable energy assets, and a range of methods and entities have been involved in verifying the green element. This period also saw the emergence of green bonds issued in a wider range of

18. Climate Bonds Initiative, end of 2015 review: www.climatebonds.net/2016/01/2015-year-end-review-tall-trees-many-green-shoots-evolution-green-bond-market-continues-2015/.

19. See www.climatebonds.net/projects/facilitation/green-sukuk/.

currencies, and a wider range of products, for example those targeting retail investors as well as institutional investors.

Understanding the constituent assets included under the term green, and having confidence in the performance of these bonds, will ultimately define their attractiveness to mainstream investors, as will their relative return compared with mainstream investments. As with renewable energy, investors will generally look for i) investment-grade rating; ii) tradability and liquidity; and iii) interest rates (returns) at or superior to other government and corporate bonds, relative to risk. This is likely to continue to be the case until such time as green or 'climate' become well understood as an asset class from a mainstream perspective; this is likely to mean both confidence in both project selection and verification of the green label. The transparency, monitoring and track record of performance will be central to the attractiveness and growth of the market at this stage of its development.

BOX 3: BOND MARKET DEVELOPMENT & STANDARDIZATION

A number of activities are seeking to standardize definitions, or to consider the practical development of green, 'climate' or 'low-carbon' instruments, such as bonds, to facilitate recognition of and investment into this asset class.

- The 'Green Bond Principles': a rapidly growing initiative at the centre of standardization, launched originally by four international banks in January 2014.
- The Principles define voluntary process guidelines, including disclosure and transparency, to promote integrity in the development of the green bond market for market participants (issuers, investors and underwriters). The International Capital Market Association is host and secretariat for their development. The Climate Bond Initiative aims to access the debt capital markets for climate solutions, and is also a lead player on standardization of definitions across a range of sectors, under the broader 'climate' theme, including renewable energy, transport, such as railways, and buildings. This initiative regularly analyses and publishes data on market developments.

- In 2016, Moody's Investors Service launched a Green Bonds Assessment methodology – to evaluate a green bond based on five key factors: (i) organization; (ii) use of proceeds; (iii) disclosure on the use of proceeds; (iv) management of proceeds; and (v) ongoing reporting and disclosure on projects financed or refinanced with such securities.
- Development of green bond specific indices: in 2014, S&P Dow Jones, Bank of America Merrill Lynch, and Barclays and MSCI were at the forefront of developing benchmark indices for green bonds (and green project bonds in the case of S&P Dow Jones), reflecting a view that this is a growing and maturing market. As S&P Dow Jones states: 'Indices have been an integral part of market development and maturation. They aim to provide transparency into the characteristics of markets they represent and independently track their performance.'

FURTHER INFORMATION:

- www.icmagroup.org/Regulatory-Policy-and-Market-Practice/green-bonds/green-bond-principles/.
- www.climatebonds.net.
- 'Climate Change, Green Bonds and Index Investing', S&P Dow Jones Indices Research and Infra Credit, August 2014.

The growth of interest in capital markets instruments and vehicles will need to be underpinned by a healthy pipeline of assets – or projects – for that capital to invest in.

1.4 COST OF CAPITAL

Given an emphasis on cost reduction and the competitiveness of renewable energy in many countries, there is interest in understanding how to attract lower-cost capital to the sector, often focused on institutional investors seeking long-term, low-risk investments.

At project level, some modelled analysis is often expressed as WACC, the weighted average cost of capital, reflecting the different types of finance at different stages of a project (see [Table 2](#) above). This can suggest that reducing very specific risks, for instance in policy, feeds directly through to a lower risk premium and a proportional reduction in the cost of capital.

However, this theoretical result will need to be understood in the context of how cost of capital works in practice.

Investors normally think of the return, or hurdle rate, as the 'risk-free' rate plus a premium to reflect risks. The risk-free rate is typically assessed against sovereign bonds of highly rated countries and in some cases against public equity indices such as S&P 500 or FTSE100. For some investors this will be a relative rate of return - i.e. can they earn more in renewable energy than with conventional technologies; or can they earn more on a specific renewable energy project rather than on another, given the opportunities available?

For investors at project level, a premium over the risk-free rate will be based on an assessment of each category of risk (such as equity risk, illiquidity risk, regulatory risk and development and construction risks). The internal aggregation of this cost breakdown produces the return or hurdle rate that the project investor would expect for that investment, taking into account other factors, for example the level of debt involved. This will have to meet hurdle rate expectations and fit with the kind of risks that the investor can accept.

For a project seeking investment, its overall cost of capital will depend on both the type of finance it can attract and the hurdle rates for each type.

Operating renewable energy assets with infrastructure characteristics (long-term regulated or government-backed revenue streams, inflation linkage etc.) can now attract sources of finance that themselves have lower costs of capital, including from institutional investors.

However, different stages of a project (development, construction, operation) are likely to attract different sources of capital, taking different levels of risk and with their own hurdle rate requirements. Some investors may not be able to take certain categories of risk at all – for instance, development or construction risk (pre-revenue generation) or power price risk (merchant risk), or indeed specific country or currency exposure. In such a case it would be a binary equation: since under those specific conditions they would not be able to invest at all, the theoretical reduction in cost of capital would not be achieved, notwithstanding other interventions intended to lower risk.

Cost of capital assumptions and the impact of any risk mitigation interventions, including policy modifications or public finance tools such as guarantees, need to be tested with practitioners – for example, if interventions are intended to attract specific sources of capital or to scale capital to particular technologies or countries.²⁰

20. Low Carbon Finance Group Briefing: 'Investors' perspective on Cost of Capital and Risk: Implications for Policy to Stimulate Investment in Renewable Power Generation', November 2012. This briefing includes an overview of Weighted Average Cost of Capital (WACC) calculations in the context of infrastructure investment. Available from the author.

SECTION 2:

**HOW
TRANSACTIONS
WORK**

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*See also [Annex 1](#).

INTRODUCTION

This section focuses on the mechanics of how a transaction works to give a more granular idea of what kind of detail matters and why. It does not cover what might be termed the 'human dimension' of investing although this is important: it requires skill to build an experienced investment team with a track record that will create the confidence in those seeking to deploy funds. This is not restricted to equity investment as it also holds true for project and asset finance on the lending side; many banks have strong sponsor relationships which are central to ongoing business. Relationships, 'counterparty chemistry' and management track record are important inputs into the investment decision-making process, alongside the more mechanical financial analysis and technical due diligence inputs, covered below.

2.1 RISK & RETURN: KEY FACTORS

Risk and return are central considerations for financiers when investing in renewable energy assets, starting at the project level. Even with changing financial conditions and/or changing financial models, these considerations will be typical for most infrastructure financing. A range of variables will have an impact on project success and many that will change over the project lifespan need to be understood and managed or mitigated in the context of the deal structure. Before investing, both debt and equity providers will undertake a detailed due diligence assessment of these risk factors. Technical experts and advisors will be brought in during this process, where specific technical knowledge or insight is needed. The information in this section applies to both industrialized and developing-country/emerging markets, but some additional factors for the latter are covered in [Section 3.1](#). This is where energy policy fits in, as will be covered in more detail below.

Typical risk assessment will include country & financial risk; policy & regulatory risk; technical & project-specific risk; and market risk.

2.1.1 COUNTRY & FINANCIAL RISK

- Country risk – this is a broad term and covers a range of macroeconomic and political risks including government stability, status and maturity of the legal system, transparency of business dealings and currency risks. It also includes general instability due to wars, famine and strikes.
- Economic risks – inflation, local regulation.

- Financial risks – interest rates,²¹ refinancing risk, insurance (business interruption, asset rebuild), asset liquidity.
- Currency risks – exchange rate risks, currency controls, devaluation. Exchange rate risk, for example, is faced by investors in emerging markets if revenue is generated in local currency and loans are to be serviced in hard currencies. In this situation, the lenders are likely to require the project to ‘hedge’ the risk using a financial contract, but in many emerging countries these contracts can be expensive and for short durations. Equally, a UK or US investor buying plant or equipment in euros finds project costs rise as a result of the falling sterling/euro or dollar/euro exchange rate. Often purchasers will arrange a concurrent currency hedge with the supplier or a bank, at the time when the supply contract is signed, to manage this risk for an individual project.
- Political risk – this incorporates not only the stability and durability of political regimes but also the risk that, for example, tax laws are suddenly changed or central bank rates are increased, directly affecting project viability. Policy and regulatory risk are subsets of political risk; changes to financial regulation are also a regulatory risk that falls under the political risk category.
- Security risks – can the lender actually take possession of a project if there is a default on the loan, and will the lender be permitted to operate the plant and maintain the revenue generation? Although in most developed countries the right to security over an asset has a solid legal basis, this is not always the case in some emerging markets and can add significant complications.
- Emerging markets – see also [Section 2.3](#).

2.1.2 POLICY & REGULATORY RISK

As the policy framework and any incentive mechanism may be a key part of making project economics attractive, changes to these factors pose a risk, particularly if project revenue is affected. A long-term, stable policy regime with a sound legal basis is essential for serious investment to occur. Regulatory risk is also considered in depth for the permits, authorizations and licences required to plan, construct, operate and decommission renewable energy projects, including cross-border policies or regulations that are material to any given project or portfolio, and developments such as transmission grids for offshore wind.

²¹ Banks lend on a floating interest rate basis: e.g. the LIBOR inter-bank rate, which will change throughout the life of the loan to reflect the current market rate. It is typical for a bank to oblige a borrower to ‘fix’ around minimum 70–80% of the floating rate at a fixed rate to reduce the risk of project insolvency in conditions where interest rates rise rapidly.

In areas such as energy storage and distributed renewable energy (connecting inside the distribution network or to micro-grids) there will be a particular focus on the detail of regulatory conditions.

A sound track record of stable and consistent policy, a transparent process for amending government budget allocation tariffs or other support mechanisms that have an impact on revenue generation, and clarity over detailed market regulation will be sought. The basis for government Treasury or consumer funding arrangements of support mechanisms will be carefully scrutinized. In addition, an understanding of friction in the planning regime (indicating likelihood of delay) and factors in the power market that may have an impact on connection to the transmission or distribution network, or sales of power, is important. This is considered in more detail in the next section.

2.1.3 TECHNICAL & PROJECT-SPECIFIC RISK

Typically, this will include a review of the technology, its suitability for the proposed conditions, operational track record, source and accessibility of spares, a feedstock (for example, in the case of biomass or biofuels) or energy resource assessment (for example, in the case of wind and solar power) and a capital expenditure cost review for the construction project. These factors are generally assessed by a technical expert on behalf of lenders or investors.

- Construction risk – this includes the risks involved with the build, the interfacing of different EPC (engineering, procurement and construction) contracts, the degree of protection from liquidated damages for project delays, other damages, and build timing.
- Technological risk – each renewable energy technology will be assessed in the light of its maturity, operating history, fitness for purpose and warranties. The assessment will be undertaken by appropriate specialists, often working closely with the technology supplier.
- Environmental risk – environmental and social risks associated with the project, often subject to a legal requirement for an impact assessment in order to be granted the permits required under local law. In emerging markets, lenders will typically require compliance with internationally agreed environmental standards where the local standards are either viewed as weak or do not exist at all. The World Bank’s International Finance Corporation standards are usually regarded as the standard to apply.
- Operation and maintenance (O&M) risk – once a project has been commissioned the plant will need to be properly maintained to ensure

optimal performance. An assessment will be made of staffing and costs, as well as contracts required during the operational period and provisions required for decommissioning. This is likely to be an area of particular attention for certain technologies, such as offshore wind, as developments move to deeper waters and further offshore where costs may be higher (for example, there are likely to be more limited windows for e.g. maintenance).

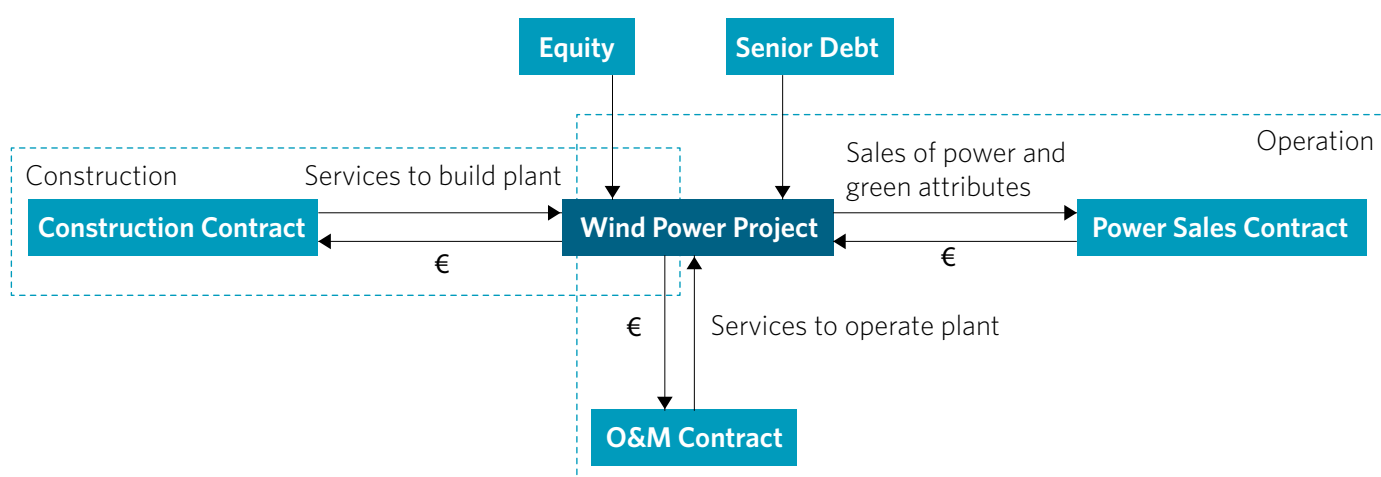
2.1.4 MARKET RISK

These assessments are typically provided by market specialists who report on topics including forecast electricity prices (and factors that might influence these including oil, gas and coal prices), forecast green subsidy prices, forecast carbon prices, and the prospect of new entrants.

Examples A and B below show finance and contractual arrangements for a wind-power and a biomass project. They illustrate differences in the renewable energy subsectors, and the types of issues that financiers will examine. This highlights that broad categories, such as ‘green infrastructure’, will need to be understood in terms of the characteristics of the technologies or sub-sectors.

2.1.5 DEAL STRUCTURES: DIAGRAMMATIC PRESENTATION OF TRANSACTIONS

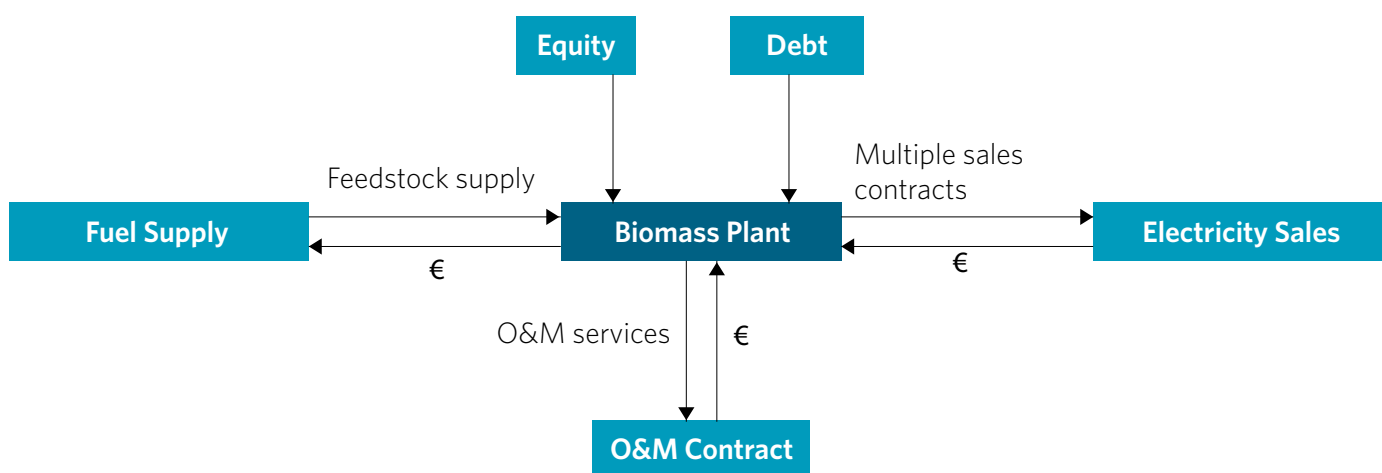
Example A: Structure of an operational onshore wind-power project



Example A illustrates the typical contractual structure for a wind-power project. Note that some support mechanisms would require an additional box representing a regulatory authority. This would be the case if a contract that is separate from power sales is signed with a regulated authority in order to access the support.

Technical studies of the wind resource, a review of the proposed technology and the construction, operations and maintenance arrangements will have been completed. The construction contract may well feature multiple contracts, in which case a detailed analysis of how these interact will be completed. Legal due diligence including all land title and permitting will be reviewed, and there will also be a full review of the rights and obligations under all project contracts, plus the ability of lenders to step in to perform in the place of the project company if the latter fails to meet its obligations. If the project is only viable use because of the power and green attributes it sells, a thorough review of the offtake contract and subsidy regime will be undertaken. For offshore wind, additional factors include vessel availability for construction and operations, and a detailed review of electrical connection to shore.

Example B: Structure of a biomass power generation plant



As with Example A, for some type of support mechanisms there may be a separate box for a regulatory authority in cases where the support mechanism is contracted separately from power sales, through such a regulated authority.

This example of a biomass electricity generation project structure serves to highlight some of the challenges that project developers often face (not including risks linked to the sustainability of feedstock).

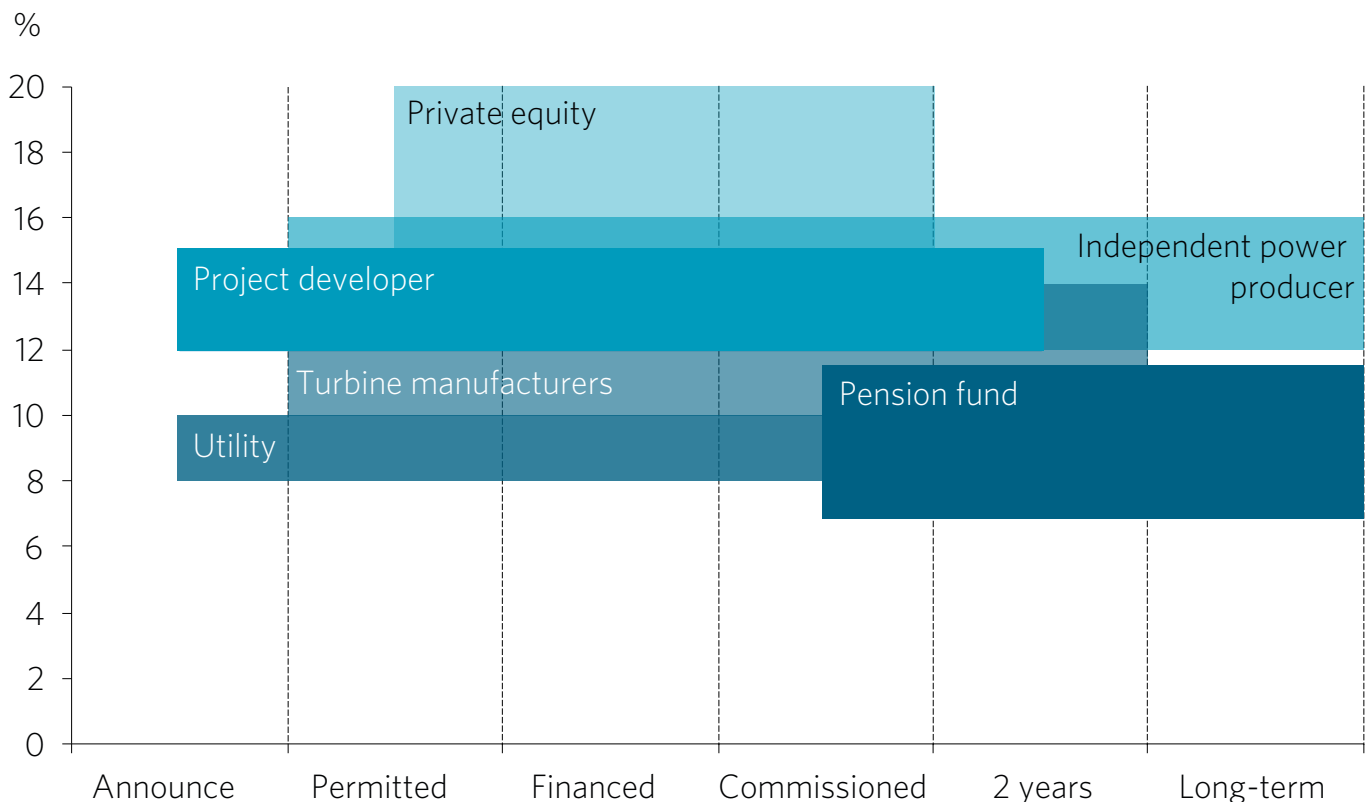
Issues include:

- Maintaining stable feedstock supply: if multiple contracts with suppliers are involved, the actual ability of the plant to produce the electricity at a forecast production capacity, and price, carries a greater risk.
- Technology risk: this is carefully assessed, including fire risk.

- Sales contracts: on the output side, producers will want to find sales contracts for electricity generated (e.g. power purchase agreements or PPAs) that have similar maturity or maturity that is longer than the long-term project finance debt; and to establish that the purchaser can be viewed as a reliable counterparty (creditworthy) over the expected duration of the contract (or that alternative scenarios can be assessed). This can be challenging. There is also revenue from green certificate or feed-in tariff regimes.

The economics of biomass power can be squeezed between two separate markets which are not directly correlated – the prices for the feedstock on the commodity markets, for example, and the final product being sold in the power market. Example C illustrates the type of finance against the difference stages of an offshore wind farm, and the kind of partnering up of providers of equity. There is increasing evidence of both debt and equity from the capital markets being deployed.

Example C: Offshore wind: investment profile across timeframe of project



Source: Bloomberg New Energy Finance.

2.2 POLICY & REGULATORY RISK IN DEPTH

Typically, renewable energy generation has been most attractive in a policy-driven market, and that continues to be the case as it moves steadily towards cost competitiveness with conventional power. As technology costs steadily fall, renewable energy is moving closer to 'grid parity' and is already competitive in specific market segments in certain countries. However, where this is not the case, some form of support remains necessary to make the investment attractive to equity investors and lenders relative to alternative uses of their capital that may provide higher returns, including conventional forms of energy.

At the same time, in some countries climate legislation, including carbon pricing policies, as well as high penetrations of renewable energy, are starting to fundamentally change the outlook and business case for the conventional power sector (see also [Sections 3.1.2](#) and [3.2.1](#)).

POLICY TRACK RECORD & LESSONS

There is now a substantial track record of regulatory frameworks in both developed and developing countries,²² including a range of support mechanisms that stabilize or lift revenues and make returns more commercially attractive. The latter have been instrumental in the growth of renewable power generation over the last decade. These include, for example, feed-in tariffs and variations; renewable obligations or portfolio standards on power suppliers (often with an associated certificate trading), tax-based incentives (for example, the production or investment tax credit (PTC, ITC) in the US). Competitive bidding through auctions is now widespread; auction processes range from procuring a certain volume of generation or technology to allocating a specific budget. In bidding-based systems, close attention is paid to which actors bear the risk in an auction, including allocation risk, and penalties for failure to deliver projects. At the small-scale end of the market policies to ensure net metering are highlighted as important factor, particularly for off-grid projects.

As cost reductions become more visible, these can be factored in through planned 'degression' to reduce support, against specific criteria, or through an auctioning process. The most important consideration for financiers is that this is done on a fully transparent basis.

²² For a comprehensive overview of policy developments, see the *Renewable Energy Global Status Report* from REN21. Available at <http://www.ren21.net/gsr-online>.

Where regulatory frameworks without a subsidy element are adequate for renewable energy, investors will still pay close attention to broader energy or power market policy, particularly for on-grid projects, including overall market growth (the potential pipeline of projects to invest in) as well as regulatory and contractual detail (see also [Section 1.2.3](#), subsection on 'Renewable Energy and Creditworthiness of Policy').

STABILITY AND GRANDFATHERING

Keeping policy regimes effective, simple and stable across a time-horizon relevant to investments is crucial, given that assumptions about revenue, and factors that can affect this, will be key to investment decisions. One critical condition for financiers is 'grandfathering', meaning that policy conditions existing at the time of a particular investment are carried over for that investment, even in the event of any subsequent policy change.

POLICY RISK ASSESSMENT

Every bank and equity investor will complete a detailed risk assessment on the policy and regulatory environment before authorizing an investment or a loan. This will include an analysis of the duration of the regime, its legal basis, its ability to be amended, a country's track record of adjusting or replacing legislation (and whether this is planned and transparent), and the impact of a change of political party in government.

In addition, financiers will assess the affordability of any support regime to the government and consumers. If economically unsustainable, it is less likely to be stable, with the possibility of public or political backlash leading to policy change. This would not be attractive to investors, particularly those looking for a low-risk environment.

INVESTMENT HIATUS

Retroactive changes that affect the terms of an existing investment (incentives or tax regime, for example) will significantly raise policy risk, often far beyond the individual market or country concerned. It may also lead some investors to avoid investments backed by revenue support from government. If risk in this area is too high, investors may simply exit a market or sector, or wait until new approaches are fully reflected in law. This results in an investment hiatus. Retroactive policy changes in Europe have also led to a number of lengthy legal battles as investors seek compensation for lost revenues.

SCOPE OF DUE DILIGENCE

Due diligence will cover all the elements that affect project economics and revenue generation. As outlined above, this is not just the support mechanism but also the planning and approval process (given the potential for delays) and project construction, both of which have an impact on cost and can defer the point at which a project will start generating revenue;²³ grid or infrastructure availability, access and cost of connection (e.g. offshore grid, or distribution networks for solar PV); terms of the power purchase agreements (PPAs) or any other 'route to market' factors that have a bearing on revenue; and other factors such as the tax environment.

THE CHANGING POWER SYSTEM

As much higher penetration levels for renewable energy are being achieved, the focus is now on the overall power market and the integration of higher levels of variable generation, whether national or regional in scope. Integration involves approaches to the allocation of system and balancing costs, offtake arrangements, grid interconnection (as a method of managing variability) and regulatory alignment across connected markets. How a changing regulatory environment may allocate costs (and who pays them) is of direct relevance.

DEMAND-SIDE MANAGEMENT & STORAGE

Understanding the role of demand-side management and storage as a planned part of system operation is also important, and will focus investor attention on distribution network operation and regulation. For example, what impact might an increase of distributed energy such as solar PV (connecting inside the distribution network) have on regulated costs in this area? Are there regulatory barriers to direct generation by corporates, or direct supply to end-users from a developer's perspective? A separate set of questions arises around standalone renewable energy generation integrated with packages of energy storage including, for example, the definition and licensing of storage. Renewable heat, renewable gas and transport infrastructure (for example for electric vehicles, public transport, city planning and 'future' developments such as autonomous vehicles) also present investment opportunities but will focus attention on regulatory questions in those areas.

23. IEA report, 'Documenting the Cost of Regulatory Delays', March 2016. Available at iea-retd.org/archives/publications/re-delays.

PRACTITIONER ENGAGEMENT

To the extent that policy-makers are looking to influence investment decisions, it is useful to clarify the investment-related objectives at the outset to ensure that policy can be designed effectively. For example, policy may be intended to incentivize new generation and the project pipeline (attracting capital at the development or construction phase); or to attract particular sources of capital at points later in the project cycle (for instance, facilitating the 'recycling' of investment into the capital markets when assets are operational).

In addition, the use of public finance tools, such as guarantees or co-investment, to reduce risk or attract lower-cost capital, needs to be examined carefully: how long will these take to implement, are they targeted effectively, are they straightforward to access and is there a risk that they may crowd out private capital?

These objectives and policy design will benefit from being tested with financiers, in particular those sources of capital that policy-makers are anticipating will respond.

2.3 DUE DILIGENCE – EMERGING MARKETS

ADDITIONAL FINANCE ISSUES FOR EMERGING MARKETS

As outlined above, investors assess a range of factors common to all markets. However, in the context of typical due diligence and investment scrutiny in emerging markets, there will be particular emphasis on a set of risks requiring careful mitigation:

- **The stability and maturity of the political system:** this influences the ability for projects to reach a successful conclusion, as the greater the instability, the smaller the pool of investors and commercial lenders to fund the project. Political risks, for example contract frustration (CF) and confiscation, nationalization, expropriation and deprivation (CNED), can be transferred to a range of public- and private-sector insurers, including the Multilateral Insurance Guarantee Agency (MIGA, part of the World Bank Group), Lloyd's of London and the international insurance market. The ability or willingness of these providers to accept risk, and the premium charged for it, will similarly be determined by the stability and maturity of the political system.

Not all of these options are well designed for renewable energy project developers. For example, many will not provide coverage for changes in law affecting policy-backed revenue streams, such as feed-in tariffs or renewable energy credits, unless the changes can be demonstrated to have been contrary to international law and consequently deemed to fall within definitions for CF and CNED as above. A limited number of providers, such as OPIC (the Overseas Private Investment Corporation, the US government's development finance institution), have been willing to specifically include changes in law related to policy-backed revenue streams.

- **Overall legal, regulatory, tax and business environment:** if it is difficult to transact business on a legal and transparent basis, implementing a renewable energy project for long-term power generation will prove challenging. Investors will naturally favour countries which engage in standard business practices, for example for board appointments and annual reporting. The availability of long-term power offtake contracts and concessions, the existence of creditworthy offtakers, and sound legal rights over project land all improve the overall risk profile.
- **Economy size:** emerging markets and developing countries with smaller economies tend to have less mature stock markets and supporting regulation and therefore experience comparative liquidity restrictions. As a response, investments can be structured in a manner that recognizes this - for example, with strong government or sponsor guarantees confirming the on-going revenue stream.
- **Local currency:** investments made in local currency can be subject to exchange rate fluctuations, devaluation or the vagaries of domestic monetary policy. Partnering with local financial institutions, potentially to structure dual currency loans, can provide the required mitigation to the lenders and project sponsors. Local financial institutions can also play an important role in aggregation and performing due diligence functions. Alternatively, projects can be structured with credit guarantees, risk guarantees and hedging products provided by development banks and export credit agencies.
- **Energy market and infrastructure:** lenders and investors will scrutinize electricity market design and regulation as well as the government's objectives (and any plans for market or policy changes). As well as large-scale power generation, there may be

a need for different technologies, off-grid solutions and smaller or discrete renewable energy projects. Consideration needs to be given to the challenges posed by inadequate infrastructure – not only grid or distribution networks but also, for example, roads – and its potential impact on project construction and ongoing operation.

- **Domestic finance:** linked to the above is the importance of domestic/local finance as a source of debt and equity capital for local-currency-based lending – and partnering with overseas capital providers. There is also a significant role for domestic institutional investors (e.g. pension funds) both as a source of capital and for potential partnering with external sources of capital. Some national financial institutions may lack experience of managing the risk profiles of what may be seen as newer technologies. However, investment figures demonstrate how much this is changing as renewable energy markets grow strongly in developing countries. Where relevant, additional technical and capacity-building can be useful. Investing alongside multilateral development banks (MDBs) or national development institutions can also help overcome hurdles, as the green bank examples also illustrate in OECD countries.
- **Smaller deal size:** deals under the equivalent of US\$2 million, and for some institutions under the equivalent of US\$10 million, are complex for mainstream private financiers given that the expenditure of time and resource on due diligence will be the same whatever the size of project. This represents a significant but under-developed market segment in emerging markets, as well as the potential for aggregation. Financing of off-grid renewable energy and energy solutions for basic needs, as well as the emerging avenues that allow non-domestic finance to enter this segment at scale, are not dealt with further here. (See [Annex 2](#), Resources for further information, and [Section 3.1.1](#) for public finance.)

Given the extent of the due diligence assessment, investors are very likely to look for a potential pipeline of opportunities rather than a single project, especially when entering a market for the first time (see also [Section 3.1.1](#) subsection on Market Entry & Pipeline).

2.4 COMPLETING A TRANSACTION

The process of completing a transaction for a project generally follows a similar path for both equity and debt. All financial institutions will have a process of review to check against their own internal risk and return criteria. Depending on the precise nature of the organization, there will be more or fewer steps in the process.

PROJECT FINANCE

Project finance (PF) is generally an option used for large projects. There is little substantial difference in the transaction costs of external due diligence between small and large projects, thus it is usually not economic for banks or sponsors to put in place PF below £15 million (c. US\$25 million), if they are domestic/locally experienced institutions; if they are not, it may be a higher amount. For external institutional investors the bar will be higher still, perhaps in excess of US\$300 million. For smaller projects the track record, credit status and assets of the sponsor company involved will be particularly important.

For an outline of a typical project transaction process, with a summary of steps taken, see [Annex 1](#).

It is useful to note that not all projects are financed using both debt and equity, although this is common. Some equity investors will prefer an all-equity (unleveraged) structure. This may be the case, for example, where the investor has a low cost of equity and debt finance will not significantly enhance returns.

INSTITUTIONAL INVESTORS

An institutional investor will perform a similar set of checks on a project's or portfolio's cash flow and risks when considering whether to make an investment in, for example, operating assets, or when assessing an investment earlier in the project process. However, as many do not have specific in-house expert teams investment may typically take place through specialized funds or via standardized metrics such as credit ratings. Smaller projects may be bundled or aggregated as one method of responding to the need for larger-scale transactions.

This is changing particularly where institutions expand their internal capacity including through education or training, together with new structures that mean renewable energy fits into more familiar

investment categories (noting that ratings would still be required in the case of bonds). It is also important to note, however, that there is no 'one size fits all' among institutional investors and some will use external advisors to provide input (see [Section 1.3](#)).

2.4.1 DEBT SIZING

One issue at project level is how banks determine the amount of debt they will provide. Debt sizing criteria vary depending on the specific conditions relating to a project, taking into account, for example, the type of revenue stream, the degree of volatility in the actual power generated, the price received for each MWh, and the fixed and variable operating costs. The overall risk profile of the project is also important: the greater the risk, the higher the margins and the less debt is provided; tenors may be shortened, as is the case with 'mini-perms' outlined below.

There are three key parameters:

- **Gearing**
Lenders will want to see that the sponsors have some money at stake in the project – this is typically done through testing the debt-to-equity ratio, comparing the total amount of term loan-type facilities with the amount of equity invested. The ratio will vary depending on the perceived risks including, for example, the availability of debt finance.
- **Offtake arrangements**
Lenders will require generators, particularly independent generators, to have a defined 'route to market' for selling power (and any associated green benefits if a green certificate system is operating) – typically in the form of a power purchase agreement (PPA) with a creditworthy offtaker. Lenders may attribute no value to revenues after the term of the PPA. The period over which the debt is sized is also critical to the amount of debt raised.
- **Base-case and downside-case cover ratios**
Lenders will expect debt to be sized such that the project is able to meet its debt service – principal plus interest – obligations in all reasonable downside scenarios (for example, those that may mean the project does not perform as expected, or market prices deviate from expectations). This is usually expressed as the 'debt service cover ratio' (DSCR) – often the factor that actually limits the amount of debt available, as banks want to make sure they are repaid.

A financial model is developed, typically using base-case assumptions about energy yield and central case price forecasts (taking into account the features of any PPA). The ratio between the cash flow available for debt service and the principal, interest and other costs is tested on a projected basis, for the length of the loan. The robustness of the ratios is then tested under a variety of 'downside' sensitivity scenarios, for example, 'low' power prices or other factors that might reduce revenues, depending on context. Other ratios that may be used include the loan life cover ratio or project life cover ratio, and also usually the debt-to-equity ratio.

As mentioned above, for smaller companies seeking debt for balance sheet or projects, additional criteria such as their asset base and track record will be particularly important.

LOAN TENORS, 'MINI PERMS' AND REFINANCING

A further issue that is particularly relevant for renewable energy projects is the length of the loan that is available. When bank balance sheets are constrained, loan tenors may be shortened (or a higher margin charged for longer tenors). The so-called 'mini-perm' is one short-term loan structure, typically around a 7-year duration (it can have variations that add security to repayment and that lower credit risk). Debt may be sized over the 15-year life of a project (for the term of its PPA) but the 7-year loan tenor leaves an amount of debt outstanding at the end of the contracted period that will need to be refinanced in a new debt arrangement.

Project developers and their equity investors then take the risk of market conditions at the point of refinancing. If the borrower is unable to refinance the project debt at this stage, lenders would typically step in and look to sell the project to another entity to recover as much of the remaining loan balance as possible; equity investors also face recovering less than their initial investment in this case. That said, banks will analyse the long-term viability of the assets and the feasibility of refinancing at the outset, as they will want to avoid a scenario where refinancing fails.

2.4.2 ALLOCATING CAPITAL

This section explains how institutions typically decide to allocate capital to an individual project. It also outlines how large institutional investors approach the allocations within their overall strategy.

CREDIT COMMITTEES AND INVESTMENT COMMITTEES

Specialized committees in banks and investment funds make the final decision to release the funds sought in a transaction – these are generally known as credit committees in banks, and investment committees for investment funds. In banks, credit committees are composed of senior management, with a range of experience and expertise, and include representatives from the lending business, and crucially the risk officers who manage the institutions' overall risk exposure.

Investment committees of funds are broadly similar. This committee does not include the transaction teams that specialize in product types or sectors. Given their risk management obligations, their comparative remoteness from the market and their probable lack of familiarity with renewable energy or the nuance of power markets, credit and investment committees tend to be conservative in their views. Ultimately they are assessing risk and return against hurdle rates and portfolio diversification. It will be up to the transactions team to explain the investment case for the use of those funds.

For international institutions where committees are based in the home market with transactions occurring overseas, an added layer of complication is introduced. The committee is unlikely to be familiar with the business environment, nor will it have a general appreciation of the politics and current affairs in the country where that transaction is occurring, or indeed the detail of energy policy. This can lead to a yet more conservative approach being taken than would otherwise be achieved in a more familiar environment.

International news headlines that have potential consequences for a transaction or sector – for example a statement by a government minister – may prompt a call from a credit committee to the transactions team to explain the significance of the reportage.

In presenting a new transaction, it is crucial to clearly state the entire deal, covering its rationale, revenue generation, and risk assessment and mitigation. Often when covering a new country or technology,

a very detailed level of introduction to the market mechanics is required in order for the committee to engage properly with the transaction. Renewable energy can be a complex area for credit committees to understand given that most countries have different support regimes and different power market regulations – for example, a different process and legal standing for items such as grid connections, generation licences and securing offtake arrangements. This can make renewable energy projects appear less attractive, on a relative basis, than projects with which the committee is already familiar. Simplicity, clarity and consistency – and investor education – around the policy and support regime are very helpful in attracting investment.

Whereas credit and investment committees are central to approving funding at the level of individual transactions, the internal process of allocating capital to deliver the overall investment strategy of a given institution will be formed in different ways.

CAPITAL ALLOCATION: INSTITUTIONAL INVESTORS

For institutional investors, it is the fiduciaries or trustees that determine the investment strategy and asset allocation (assets, in this case, meaning the capital from the insurance or pension contributions). The different institutional investors – insurance companies, pension funds (which may be defined benefit (DB) or defined contribution (DC)), sovereign wealth funds – may have very different investment objectives and strategies.

The investment strategy will seek to deliver an overall level of return that enables the institution to match its particular liabilities, at any point in time, on behalf of its beneficiaries – those whose have paid for insurance or pension services (or requirements of the government in the case of sovereign wealth funds).

An asset allocation model may be used to guide weightings in categories of investment. These generally include listed equities (stock market), fixed income such as government bonds, real estate and alternative investments, including infrastructure funds and specialized renewable energy funds (these options and the return expectations in each are outlined in [Section 1.1](#)). In aggregate, the overall portfolio will be expected to meet the return required.

Trustees of the institution have a legal obligation to fulfil fiduciary responsibilities, outlined in the trust deed and rules. This includes acting solely in the best interests of the beneficiaries, acting impartially,

and acting prudently and responsibly. Trustees can seek additional fiduciary advice from external parties, including investment consultants, in determining and executing the strategy.

Trustees have been generally conservative in their interpretation of their fiduciary duty – for example, in responding to a long-term issue like climate change, which may appear in conflict with short-term objectives. However, there is a growing view starting to emerge from investment consultants on the implications of climate change for portfolios of institutional investors and how those risks can be taken into account in asset allocation.²⁴ Environment, social and governance (ESG) themes are also rising up the agenda.

2.5 ENERGY EFFICIENCY

Despite the very significant potential for energy efficiency in delivering a low-carbon future, improving energy security and bringing multiple non-energy benefits, it is under-developed as a sector, highly diverse, and thus far lacking the scale and attractiveness of supply-side options. That situation is changing given the considerably greater attention from both investors and policy-makers.

Energy efficiency (EE) is used here to mean both demand management (permanent reduction of demand) and demand response (temporary shifting of demand). The efficiency of generation and of transmission and distribution is also important but not covered here.

Higher penetration of variable renewable energy in power systems focuses attention on technologies that will enable much greater interactivity between supply and demand to smooth peaks and facilitate balancing of the power system.

Investors in both the supply and demand side will look for a clear understanding of how demand management and demand response fit into energy policy and regulation more widely, particularly in relation to the electricity sector, as well as a broader category of infrastructure. In addition, building infrastructure is a major user of energy and is another focus of attention.

²⁴ Mercer, 'Investing in a time of Climate Change - 2015 Study', June 2015; see also [Section 3.2](#), 'Climate Finance', below.

For financiers, the energy efficiency sector presents more challenges than the relatively straightforward energy generation sector. There are a number of reasons, including the following:

- There is no single EE market, nor is EE a recognized asset class.
- EE deals are generally small. For example, while the building-retrofit market potential as a whole is large, individual investment opportunities are relatively small.
- Revenues derived from savings are not always as well understood as a traditional asset (although the EE technologies delivering the savings may be).
- Property and real estate investors highlight the need to overcome barriers such as the complex management arrangements and conflict of interest between parties - notably landlords and tenants; and delineating who has control over energy consumption and control over capital allocation in a building's life-cycle.
- Other risks or barriers that must be managed in addition to standard concerns about collateral and counter-party risk include high transaction costs; complex contracting models; uncertainty over savings streams (for external investors); accountancy treatment of energy efficiency (lease or service); and fragmentation in the policy and regulatory environment.²⁵
- Despite the large potential for improving EE in most sectors, a lack of demand for financed solutions is noted.

Tackling challenges:

- Greater standardization within the different market segments, involving finance, service providers and energy users, can facilitate investment of larger volumes of capital, including from capital market sources.
- Market-wide policy approaches, together with standardization, can facilitate aggregation to a more attractive proposition for financial institutions looking for larger-scale investments.
- Increasing revenue certainty can be facilitated through third-party entities such as energy service companies (ESCOs) that analyse and mitigate risk, as well as demonstrating the ability to deliver revenues and investment outcomes (this risk mitigation is more difficult if the ESCO itself is a relatively unknown company with no performance record).

25. Energy Efficiency Finance Roundtable at the 2012 Clean Energy Ministerial, London, co-organized by the UK government and the Low Carbon Finance Group.

- Strong regulatory frameworks are seen as key to scaling up investment.
- The data monitoring and performance record, as well as clarity on regulation in areas such as privacy, can be important to underpin greater demand and interest.

EXPERIENCE OF WHAT WORKS

There are now numerous examples of financing models that work in the market, generally driven by national or local government policies or instruments, as well as new structures. These depend on the market segment, and on the scale and features of the investment.

For example, at the individual deal level, in cases where the customer/end-user is not financing the initial investment, the financial structures are typically based on (i) a shared savings/ESCO model; (ii) leasing; or (iii) hire-purchase financing, whereby the financing comes from the vendor or a third-party investor. The shared savings/ESCO model is the riskiest for the investor owing to the potential volatility of monitored savings; leasing is less risky; and hire purchase the least risky.

Attention is also being focused on the development of securitization or bond structures to enable large investment in multiple small loans. Examples include WHEEL – the Warehouse for Energy Efficiency Loans – in the US and a regional Energy Efficiency Green Bond Facility established in Mexico²⁶ (with funds from the Inter-American Development Bank and the Green Climate Fund). Different approaches are also being developed to create secure repayment of the up-front investment, for example through property tax (such as PACE, Property Assessed Clean Energy, also in the US) or through energy bills in housing retrofits.

New actors are also coming in – for example offering bundles of products including phone plus energy services which break into the conventional electricity supplier model. Demand-side ‘flexibility’ services are also competing in power-sector ‘capacity markets’ or providing balancing and ancillary services for the short-term management of the system.

One trend is corporates looking for onsite renewable generation and energy efficiency packages. Here, other technologies such as storage are creating new possibilities, alongside more mature options such as combined heat and power. New business models are emerging, and as the diverse set of opportunities becomes identifiable and these new

26. See www.iadb.org/en/news/news-releases/2015-11-24/latin-america-boosts-energy-efficiency,11334.html.

approaches are backed by a successful track record, they will in turn attract more capital.

The need for greater standardization in the investment process for the building renovation/retrofit sector has resulted in investor-focused initiatives such as the international Investor Confidence Project.²⁷ This is aimed at fostering standardized approaches to the way projects are developed and measured in order to streamline transactions and increase the reliability of projected energy savings from a financing perspective.

To financiers, the clear, stable policy framework that has attracted capital to the renewable energy market is not always evident for energy efficiency. To create these conditions, policies or interventions will need to be designed for the characteristics of the targeted sectors, and in some cases embedded in power-sector regulation and integrated with renewable energy and storage. This process needs to be as straightforward and coordinated as possible to stimulate activity and investment at scale.

Within financial institutions, various pools of capital can potentially be deployed, including mortgage finance, industry corporate finance, finance for small to medium-sized enterprises or household loans. There are equity funds that specialize in energy efficiency. New types of activity and actors looking for capital can be anticipated – for financial institutions this creates an opportunity to develop new products, although the internal case will have to be made that this is an attractive opportunity with good growth potential, given alternative uses for that capital.

In this context, key drivers for policy development, corporate strategy and consumer uptake and payment rates are likely to be important factors.²⁸

27. See Investor Confidence Project: www.eepformance.org.

28. See also the Energy Efficiency Financial Institutions Group, a Permanent Working Group to the European Commission, established in 2013. Its report on buildings is available at www.ec.europa.eu/energy/sites/ener/files/documents/2014_fig_how_drive_finance_for_economy_0.pdf.

SECTION 3:
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FINANCIAL
CONDITIONS

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The Paris Agreement in December 2015, under the UN Framework Convention on Climate Change (UNFCCC), will mean a trajectory towards the full decarbonization of global energy supply. Governments effectively agreed they would achieve zero net emissions, globally, 'in the second half of the century' in order to hold the global temperature to 'well below 2°C above pre-industrial levels' and 'to pursue efforts' to keep that to a 1.5°C rise. This can only be achieved with a substantive shift to a renewable energy-based system underpinned by 'green infrastructure' and with a central role for energy efficiency by mid-century. Notable around the UN Paris Agreement were large, continent-scale renewable energy initiatives launched by some African governments, and India, as well as corporate commitments to use 100% renewable energy and multi-billion dollar commitments from financial institutions to decarbonize their portfolios.

INTRODUCTION

The original Guide to Finance covered the immediate aftermath of the 2008–09 financial crisis: the 'credit crunch' that hit the banking sector in particular. Features of this period included the introduction of short-term stimulus packages by some governments, and an emergent focus on boosting investment through public finance tools and institutions as attention turned to attracting new sources of capital such as institutional investors.

The ensuing period has been characterized by both economic and financial conditions that have been uncertain, if not turbulent, in many countries, and an increasing role for public finance in many markets.

Features of the current market that have a bearing on energy infrastructure/renewable energy investment, and that can be expected to continue to play out throughout the current decade, include the following.

GENERAL MARKET CONDITIONS

Shorter-term

- Interest rates: base interest rates remain low as central bankers seek to accelerate economic growth. This means that cost of capital is low: even with the higher risk margins charged on top of base interest rates, the overall interest cost for projects has not changed much since before the financial crisis. Interest rate increases in the future are likely to raise the cost of capital once more.

- Bank liquidity: this has largely returned (compared with the financial crisis period). There is appetite for well-structured renewable energy projects in stable markets with credible counterparties or core clients. A larger number of banks are, once again, offering long-term tenors of more than 10 years, notwithstanding variation among banks.
- Institutional investor appetite for infrastructure and real assets: this has risen following the financial crisis. The very low yields from government bonds in the low interest-rate environment have resulted in a 'flight to yield' with traditionally risk-averse investors becoming increasingly interested in 'real assets' such as infrastructure.
- Progress towards direct institutional investment in the higher-risk (pre-revenue generation) construction phase of projects has been slower, although activity is picking up, and is reinforced by greater competition between investors for the lower-risk renewable energy assets.

Medium-term

- New financial regulations: the development and introduction of financial-sector regulations such as Basel III²⁹ for international banking (in the early years of the decade and Solvency II in Europe for the insurance industry,³⁰ raised concerns over potential impacts on long-term lending to, or the attractiveness of investing in, sectors such as infrastructure and renewable energy. These complex regulations defined new risk management obligations, for example the requirement to hold additional security to cover long-term assets. They resulted in a period of uncertainty as financial institutions assessed the consequences and implemented necessary reforms.
- Alignment of financial regulations and broader policy objectives: linked to the point above, there is now greater focus on achieving coherence between financial regulation and broader policies to drive investment towards low or zero-carbon economic development. There is also growing attention to the risks that climate change itself poses for financial stability. The latter is a relatively new and important area, characterized by the governor of the Bank of England, the UK's central bank, as the 'Tragedy of the Horizon' (see [Box 4](#)).³¹

29. See <http://www.bis.org/bcbs/basel3.htm>.

30. See <https://eiopa.europa.eu/regulation-supervision/insurance/solvency-ii>.

31. A two-year international inquiry under a UN Finance Initiative was established to examine these issues. The final report in the series, 'Aligning the Financial System with Sustainable Development', UNEP, May 2015, is available at www.unep.org/greeneconomy/financialinquiry. The inquiry is ongoing.

ENERGY MARKET CONDITIONS

Linked with economic and financial conditions, the underlying drivers of energy policy are a central point of attention for renewable energy financiers, given the occurrence of fundamental changes including the future direction of the conventional utility model, international energy market trends and decarbonization. Two additional features of power-sector investment are notable as they highlight longer-term trends that are now under way: first, more than half of new additions to power-sector capacity are in renewable energy; and secondly, the balance of renewable energy investment has shifted towards emerging markets, where over 60–65% of investments were directed at the end of 2015; one feature of this trend is the large number of smaller investments.

International energy market conditions affect the price of fuels (coal, oil and gas) for electricity generation and, in turn, wholesale electricity prices in markets without price regulation. Market fundamentals, meaning underlying energy and power supply and demand, are going through a period of substantive change. The rapid fall in oil prices in mid-decade and questions over the forward energy demand profile are on the radar – particularly as energy efficiency strategies are increasingly credited more permanently influencing trends ('demand destruction') in some countries, notwithstanding ongoing growth in others.

This adds complexity for investors who want to understand the market within which renewable energy investments may be competing. In deregulated power markets with forward hedging of power prices, investors are used to managing power-price volatility. However, the range of moving parts that are uncertain is making forward power-price projections increasingly difficult even in those markets.

Perception of policy risk remains high, particularly in countries where tight economic conditions and political debate about affordability have been associated with changes to renewable energy tariffs and other policy support (including the fiscal regime), at worst involving retroactive revisions. Confidence in and clarity on the underlying drivers of government energy policy and the growth potential of the renewable energy sector (or specific technologies), together with features that ensure policy stability, are central to creating a lower-risk environment and attracting lower-cost capital, despite the clear trajectory to cost competitiveness.

In power markets where the installed capacity of renewable energy is rising, financiers want to understand how the power market will

develop to be able to manage a high volume of variable generation. Factors include the availability of grid and network infrastructure and regulations around system balancing and pricing, even as subsidy regimes are being reduced or phased out as technology costs fall. Decarbonization and security of supply strategies reinforce the need to take a system-wide, long-term approach. The relative role of cross-boundary transmission interconnection between national or regional markets, distributed generation regulation and electricity storage will have an impact on market operation and risk allocation among market players. Storage, distributed energy and demand flexibility may require considerable attention to the detailed regulatory environment. Investors considering investments with a long lead time will look for policy and regulatory clarity, as well as the impact on wholesale power prices as outlined above. In particular, higher levels of renewable energy can 'cannibalize' peak power prices (such as solar PV in Germany) with different impacts on different market actors.

Linked to this, there is widespread agreement that structural change is under way in the conventional power sector, reflecting the underlying shift in how power is generated, distributed, traded, priced and consumed, and increasingly in its ownership structures. This is demonstrated in markets with higher volumes of variable renewable energy generation. Utility business models are affected, and equities analysts point to the threat to the centralized utility business created by the combination of solar PV and steadily decreasing storage costs. Others add a rise of electric vehicles (EVs) into that mix, producing further storage potential for distributed generation.

While any transition creates uncertainty and will be uneven across geographies and markets, it also creates significant medium-term potential for a new range of players and multiple investment opportunities at different scales.

Innovation within the financial sector is evident as instruments and structures are adapted or developed to enable a wider variety of sources of capital to be deployed, at ever larger scale. In many cases, this is through the use of well-known instruments that are familiar to investors (e.g. labelled bonds or yieldcos). In others, where investors may lack in-house expertise, there may be a corresponding need for education about the opportunities. Financial regulation itself is coming under increasing scrutiny to ensure that this does not create barriers and that it is in line with objectives; targeted use of public finance may facilitate developments.

More generally, it must be said that the word ‘innovation’, beloved in policy world, can sound like ‘new’ or ‘prototype’ and therefore be associated with higher risk. Investors looking for lower-risk, straightforward opportunities often describe a preference for ‘plain vanilla’.

Public finance instruments and institutions are a central feature of the financing landscape in both OECD and emerging markets (see [Section 3.1](#)). This includes national and regional institutions, multilaterals, export credit agencies and new institutions specifically focused on green investment or infrastructure, as well as the range of approaches and instruments those institutions are providing. The role of those institutions in constraining support for high-carbon investments is also being examined (see [Sections 3.1.2](#) and [3.2](#)).

3.1 THE ROLE OF PUBLIC FINANCE

Public finance interventions and instruments have remained a core part of the post-financial crisis landscape. In the period 2009–11, the focus was on short-term economic stimulus packages, some of which included renewable energy and ‘green growth’. This has evolved in many countries, reflecting national objectives to secure investment to deliver broader economic growth, infrastructure (including energy) and industrial strategies, increasingly by facilitating private capital to enter sectors (or geographies) at greater scale where this is not otherwise happening. The development of new types of instruments, products and, in some cases, new institutions has been a feature in both OECD and emerging markets. (For particular due diligence considerations for emerging markets see [Section 2.3](#).)

Investors will generally look for public finance interventions that are:

1. Specifically targeted to avoid supplanting available private investment, and with clear eligibility criteria (for example, what is included in ‘green’);
2. Flexible enough to respond to changing market conditions, given the time needed to design and implement a new instrument;
3. Streamlined with wider policy design;
4. Offering products that are available, structured and delivered in a commercial and timely manner consistent with the project or portfolio development and the timelines of the other project investors;
5. Able to provide long-term certainty and addressing the specific risks and barriers of a specific market (one size does not fit all).

The acceptance of a common risk profile between all participants will help address concerns over onerous documentation, and the track record of implementation and delivery will be important.

If policy-makers intend new instruments to contribute to meeting targeted, time-bound, public policy goals, or to mobilize specific sources of finance, those objectives will benefit from being market-tested with the target segments of the finance sector to ensure their effectiveness. It will also be useful for policy-makers to monitor closely what innovation is under way in the finance sector itself to close those gaps.

GREEN INVESTMENT BANKS

Of note is the emergence of new, specialized 'green investment' institutions – for example the Green Investment Bank (UK), the Clean Energy Finance Corporation (Australia) and the NY Green Bank (New York) – designed to enable greater capital flow or to overcome barriers to projects or portfolios, depending on eligibility criteria.

In 2014, the OECD established an international forum of domestically focused public green investment banks to facilitate exchange on strategies, products and best practice in order to mobilize private investment. In December 2015, a Global Green Bank Network was founded by the six leading green banks – from Australia, Japan, Malaysia, UK and two states in the US – 'to combine [the] power of green banks to mobilize private investment in renewable energy and energy efficiency' with an intention to expand the network.³²

Policy-makers can determine the best way to address specific gaps in the availability of finance by analysing where the risks lie. Where the risk is linked to policy itself, it may be more efficient to tackle the problem by improving policy design. The balance of stable, well-designed policy and targeted use of public finance tools (both against clear objectives) will be best achieved in an integrated manner, at national level (or the appropriate jurisdiction).

32. For more information on the OECD Forum and a December 2015 overview publication by OECD and Bloomberg Philanthropies, see www.oecd.org/greengrowth/green-investment-banks.htm. For more information on the Global Green Bank Network, see www.greeninvestmentbank.com/news-and-insight/2015/first-global-green-bank-network-will-speed-shift-to-clean-energy.

3.1.1 PUBLIC FINANCE IN EMERGING MARKETS

The division between developed and developing countries/emerging markets may be artificial as the same factors need to be assessed in many of the issues affecting their energy and power markets and infrastructure. This is particularly the case for power connected to grid and distribution networks (see also [Section 2.3](#), 'Due Diligence – Emerging Markets').

There is the important additional area of finance and finance structures for very small-scale, off-grid sustainable energy provision. This has seen some interesting developments, including how strong growth of mobile telephony is creating new opportunities for the delivery and payment of modern energy solutions, but is not covered further here.³³

In general, even for the more mature technologies, the higher level of risk associated with developing-country and 'frontier' markets means that public finance remains a very important tool to enable private finance for renewable energy projects and wider sector development.

In the past, public finance has mostly comprised direct grants and soft loans. However, while these still play an important role in, for example, capacity-building or technical assistance, there is now much greater focus on using – or 'investing' – public funds to facilitate the entry of private capital on a more commercial basis in larger volumes, as a more sustainable way of building longer-term delivery and scale.

A wider variety of products and instruments is now being offered by domestic development or industrial banks as well as bilateral and multilateral development banks. These range from the provision of commercial or 'patient' (long-term, lower-return) loans, guarantees and risk insurance, to newer options for debt or equity, such as the provision of public equity tranches to commercially managed funds and the issuance of green-labelled bonds for targeted deployment.

To be effective, these instruments need to tackle specific obstacles such as funding gaps, currency risk or specific risk areas for a given project, market or sub-sector seeking finance. Some may be structured to enable particular sources of private capital to come in at the right risk profile – for example, to attract institutional capital, including from domestic sources such as pension funds in the country concerned.

³³ For an overview of this area, see Sustainable Energy for All Advisory Board's Finance Committee report, July 2015 (details in [Annex 2](#)).

Other specific barriers may benefit from non-financial support. Examples are working with developers or other entities to smooth the way to a strong project pipeline; facilitating the aggregation of this into an 'investment-ready' stage (overcoming transaction cost hurdles that small projects face); or building understanding and experience in domestic financial institutions.

There is considerable experience and documentation on using public finance to mobilize private capital – not only on the part of multilateral development banks (MDBs), but also within national and regional industrial development institutions, newer 'green banks' and export credit agencies.

MDBs, together with private financial institutions, are also examining their internal processes for 'mainstreaming climate action within financial institutions' across strategy and decision-making, tracking and reporting performance as well as the development of financial instruments and products.³⁴

MARKET ENTRY & PIPELINE

When entering a market for the first time, renewable energy investors are likely to look at the potential for a pipeline of deals, rather than a single opportunity, to justify the time and cost of due diligence, for example, in a renewable energy auction where there is not a guaranteed investment at the end of the process. For this reason a broader energy policy, nationally and often regionally, remains crucial as this has a direct bearing on the growth potential, alongside other factors.

As with the situation in OECD markets, technologies perceived as marginal may be shelved during financial troubles. Working with a respected local party frequently improves project quality and accelerates delivery.

34. Institutions including IADB, EBRD, World Bank, Credit Agricole and HSBC have been involved in an initiative called Mainstreaming Principles for Climate Action within Financial Institutions. Information and background reports available at EIB host site: <http://www.eib.org/projects/priorities/climate-action/road-to-paris/fi-climate-mainstreaming.htm>. See also [Annex 2](#).

3.1.2 PUBLIC FINANCE & HIGH-CARBON ENERGY

On the carbon-intensive side of the energy equation, policy-makers, and the public finance institutions they manage, are paying much greater attention to constraining and removing public finance for fossil fuel investment. These moves are being closely observed by private investors.

The US and UK governments, among others, have committed to fund no further coal plant construction through their development finance agencies (except in rare exceptions in which the poorest countries have no feasible alternative).

Further reflecting this, by the mid-decade major public finance institutions including the World Bank, the EIB (European Investment Bank), US Ex-Im (the US Export-Import Bank), the EBRD (European Bank for Reconstruction and Development) and the Nordic Investment Bank have all adopted new policies which excluded, or constrained, finance provision to power plants with unabated coal or high fossil fuel intensity (again, other than clearly defined exceptional circumstances, generally in least-developed recipient countries).

This is relevant not only to the lending or investment strategies of public finance institutions, but also to the assets of other government-associated institutions such as public pension funds or sovereign wealth funds. They may face exposure to the risks associated with conventional or high-carbon assets, depending on their own investment strategies.

In one prominent example, in 2015 the Norwegian parliament determined that its Government Pension Fund Global, managing close to US\$900 billion, should exclude 'companies whose conduct to an unacceptable degree entails greenhouse gas emissions',³⁵ further defining that to mean companies that 'base 30 percent or more of their activities on coal, and/or derive 30 percent of their revenue from coal'.³⁶

The OECD's formal 'Arrangement' for export credit agencies will 'substantially limit' ECA support for coal-fired power plant (from 1 January 2017), first targeting least efficient plant and with a formal ratchet mechanism for tightening this agreement.³⁷

35. See www.regjeringen.no/en/aktuelt/nytt-klimakriterium-for-utelukkelse-av-selskaper/id2405205/.

36. See www.regjeringen.no/en/aktuelt/the-government-pension-fund-global-investments-in-coal-companies/id2413829/.

37. See www.oecd.org/newsroom/statement-from-participants-to-the-arrangement-on-officially-supported-export-credits.htm, 18 November 2015.

STRANDED ASSETS

Private financiers are also exposed to risks when investing in fossil fuel assets. Holding temperature rise to well below 2°C results in a quantifiable constraint on the extraction and use of global fossil fuel reserves. A precautionary approach suggests 80% of reserves will have to remain unexploited, with 1.5°C scenarios foreseeing full decarbonization of energy before 2050. Given asset lifetimes, this has implications for investments in fossil fuels and related infrastructure today.

Such an approach further increases the risk attached to those classes of investment, raising the prospect of stranded fossil fuel assets – where the economic life of the asset is curtailed, affecting the original investment assumptions. This risk is being reinforced by private investors assessing exposure; some are already withdrawing or reducing capital from fossil fuel investments (see [Section 3.2](#) below).

3.2 CLIMATE FINANCE

The term ‘climate finance’ is now increasingly used to refer to public and private capital for solutions to climate change, and adaptation to the adverse impacts of climate change. At times it is used to refer to specific public funds that are intended to leverage greater private finance.

As the term can encompass capital sought for, or deployed into, a very wide range of projects or activities, further definition from policy-makers will be important in any specific situation. This is in order for investors to understand how strategies will be operationalized, including through available public funds or tools; for example, the Green Climate Fund of the UNFCCC has developed detailed investment criteria.

Investors will want to know, among other details, what is available, in what form (funds, tools for de-risking), what type of activity will be eligible, deal size, any time-specific or geography-specific criteria. One issue will be to clarify definitions of the climate element and whether it has a direct (and measurable) or indirect, ‘consistent with’, impact on greenhouse gas emissions. Additional criteria may also apply, for example measurable green metrics used by the emerging set of ‘green banks’.³⁸

38. For example the UK Green Investment Bank – www.greeninvestmentbank.com/media/44790/green-impact-reporting-criteria_june-2015.pdf.

Given the importance of the national or regional energy and infrastructure policy and planning for attracting investment, the national plans linked to the Paris Agreement – Nationally Determined Contributions (NDCs) – are likely to be central to understanding investment needs and structuring the ‘opportunity’ for investors, to the extent that NDCs are seen to drive wider policy in any given country. As described above, investors are likely to be interested in a visible pipeline of investable projects set within a clear domestic policy framework so that forward energy, power, transport and urban developments, as well as access to public finance, can be clearly understood. Specific plans for domestic or regional carbon pricing or the removal of subsidies to fossil fuels will also be very relevant.

Financiers may wait until related legislative processes are completed or public funding is opened before being able to invest.

Engagement with domestic and international finance practitioners will enable policy-makers to sharpen the effectiveness of national policies, planning and public finance tools. To the extent that policy-makers seek to mobilize specific parts of the private finance sector, or that a certain volume of investment is sought in an area of activity, this engagement is even more important to gain insight and an accurate evidence base on finance gaps, risks and responses.

3.2.1 CLIMATE-RELATED ACTIVITIES WITHIN THE FINANCIAL SECTOR

Momentum is steadily building around activities led by, or involving, financiers and investors, linked to both understanding and responding to climate-related risk and mobilizing capital into climate solutions.

This section briefly highlights initiatives in four areas:

- Climate risk and market-related carbon disclosure metrics;
- Tracking ‘climate finance’ flows;
- High-carbon risk, decarbonization and divestment; and
- Facilitating the decarbonization of capital flows – climate and clean energy indices.

BOX 4: CLIMATE CHANGE, PORTFOLIOS & FINANCIAL STABILITY

“The horizon for monetary policy extends out 2-3 years. For financial stability it is a bit longer, but typically only to the outer boundaries of the credit cycle – about a decade.

In other words, once climate change becomes a defining issue for financial stability, it may already be too late.”

Mark Carney, Governor of the Bank of England, and Chairman of the Financial Stability Board

Key risks identified for financial stability:

- Physical risks – impacts today on insurance liabilities and the value of financial assets;
- Liability risks – potential impacts if parties who have suffered loss or damage from the effects of climate change seek compensation from those they hold responsible;
- Transition risks – financial risks from the process of adjustment towards a lower-carbon economy; the value of a large range of assets could be reassessed as costs and opportunities become apparent.

Source: From speech ‘Breaking the Tragedy of the Horizon – climate change and financial stability’ 29 September 2015, www.bankofengland.co.uk/publications/Documents/speeches/2015/speech844.pdf.

CARBON DISCLOSURE - CLIMATE METRICS FOR COMPANIES AND INVESTORS

Market data and analysis, including the disclosure of corporate carbon ‘footprints’, can help financial market investors understand and manage climate-related risk in their portfolios as well as specific investments. Initiatives include the following:

- A prominent Taskforce on Climate-related Financial Disclosures was established in December 2015 by the Financial Stability Board (FSB). It has a focus on formalizing voluntary, consistent climate-related financial risk disclosures for use by companies in providing information to lenders, insurers, investors and other stakeholders.³⁹ The FSB promotes international financial stability by coordinating national financial authorities and international standard-setting bodies, and is the highest-level global oversight body in this area.

39. The Taskforce was launched by Mark Carney, the Chair of FSB and Governor of the Bank of England, and is chaired by Michael Bloomberg, former Mayor of New York and founder of Bloomberg. See press release: www.financialstabilityboard.org/2015/12/fsb-to-establish-task-force-on-climate-related-financial-disclosures/.

- Legislation: the French government's 'Energy Transition Law' is preparing for mandatory disclosure from companies in the areas of investment policies, the carbon footprint, alignment with climate goals and climate risk.⁴⁰
- The Investor Platform for Climate Actions: this is an institutional investor-led hub focused on i) measurement and disclosure of portfolio carbon footprints; ii) asset owner engagement with fossil fuel and energy-intensive companies; and iii) reallocation – shifting capital and investment in low-carbon assets – with a public registry of those actions.⁴¹
- A number of finance-orientated organizations are leading initiatives involving climate-related disclosure, data, risk analysis and development of metrics linked to corporate portfolio management. They include Two Degrees Investing; CDP and the associated Carbon Disclosure Standards Board; UN PRI (Principles for Responsible Investment); the Asset Owners Disclosure Project; UNEP Finance Initiative.⁴²

CLIMATE FINANCE FLOWS

Tracking overall investment flows linked to tackling climate change can provide a benchmark for assessing progress against different metrics. It is a complex area, however, given different definitions and starting points. Increased attention can be anticipated, linked to monitoring and verification of government financial commitments and needs. Examples include:

- Annual assessments of global financial flows to climate finance, by the Climate Policy Institute based on data from BNEF and the OECD through its Working Papers on Finance, Insurance and Private Pensions.⁴³

40. Article 173, draft guidelines had been published for public consultation in November 2015.

41. See www.investorsonclimatechange.org, institutional investor organisations involved include: www.incr.org; www.iigcc.org; www.ceres.org.

42. See www.2degrees-investing.org/; www.cdp.net; www.cdsb.net; www.aodproject.net; www.unpri.org; www.unepfi.org.

43. See www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2014/; www.oecd-ilibrary.org/finance-and-investment/oecd-working-papers-on-finance-insurance-and-private-pensions_20797117. See also OECD, 'Climate finance in 2013-14 and the USD 100 billion goal', a report by the OECD in collaboration with Climate Policy Initiative (CPI), October 2015, available at <http://www.oecd.org/env/cc/Climate-Finance-in-2013-14-and-the-USD-billion-goal.pdf>.

- Annual market assessments in the green bond and climate bonds markets by the Climate Bond Initiative and BNEF (www.bnef.com/; www.climatebonds.net/resources/publications).

DECARBONIZATION, DIVESTMENT AND HIGH-CARBON RISK

There is a steadily growing body of analysis and investor-led activity on stranded assets and so-called 'unburnable carbon' as well as coordination around engagement and divestment strategies for investors.⁴⁴

Examples of the move away from, or pressure on high-carbon assets include:

- The 'Portfolio Decarbonisation Coalition': this brings together investors that have committed to quantifiable carbon-footprinting and targets for decarbonizing their portfolio; at the end of 2015 this amounted to a commitment of US\$600 billion of assets to decarbonize.⁴⁵
- The Divest-Invest movement, bringing together a wider range of small as well as large investors, intent on a level of decarbonization and representing over US\$3 trillion of assets under management.⁴⁶
- Increasing detailed risk analysis of the implications of climate change for institutional investors. According to global investment consultant Mercer, 'the necessary reduction in carbon emissions will require a fundamental change in the energy mix that underpins, to some extent, every investment in a portfolio'. Mercer's analysis has quantified the implications of certain scenarios to tackle climate change.⁴⁷

44. Analysis by the Carbon Tracker Initiative (www.carbontracker.org); Oxford University Smith School Stranded Assets Programme (www.smithschool.ox.ac.uk/research/stranded-assets/).

45. See Portfolio Decarbonisation Coalition: <http://unepfi.org/pdc/>.

46. Divest-Invest Philanthropies and Europeans for Divest-Invest: briefing circulated 18 December 2015, www.divestinvest.org/wp-content/uploads/2015/12/12.5_Divest-Invest%20Brief_FINAL.pdf.

47. 'Investing in a time of climate change', Mercer, June 2015. Available at: www.mercer.com/insights/focus/invest-in-climate-change-study-2015.html.

CLIMATE AND CLEAN ENERGY INDICES

"The climate related risks that companies face are now widely recognised. They include the possibility of stricter carbon regulation, physical damage, technology change and modifications to consumer behaviour."

Julia Kochetygova, S&P Dow Jones Indices⁴⁸

A proliferating number of specialized indices are being launched to assist companies to channel funds into listed equities on the basis of climate, clean energy and non-fossil fuel themes. Examples include:

- FTSE Russell's launch in 2016 of a Green Revenues Index Series based on a Low Carbon Economy data model tracking 'green revenues' from public companies, providing 'the first complete picture of the scale and velocity of the structural shift to a green economy across public companies'.⁴⁹
- S&P Dow Jones family of green indices: carbon efficient (underweight or excluding the worst CO₂ emitters); Fossil Fuel Free indices that exclude companies that own fossil fuel reserves; thematic green indices including a Clean Energy Index, a Green Bonds Index (for labelled bonds) and a Green Project Bond Index;
- FTSE/Blackrock's launch of a non-fossil fuel index in 2014 (FTSE Developed ex-Fossil Fuels Index Series), enabling investors to manage exposures to coal, oil and gas companies, and 'reduce, write-off or downward revaluation risks associated with stranded assets'.⁵⁰

In terms of understanding the performance track record:

- The first benchmark Climate Change Index was launched by HSBC in 2007. This targeted companies across four investment areas: low-carbon energy production; energy efficiency; climate finance (capital deployment and financial products); mitigation and adaptation including land-use management.
- The first global clean energy index, NEX (WilderHill New Energy Global Innovation Index), was launched in January 2006 by New Energy Finance. BNEF reports regularly on its performance.⁵¹

48. Interview with Julia Kochetygova, S&P Dow Jones Indices, in 'Climate Risk: Rising Tides Raise the Stakes', Standard & Poor's Ratings Services, December 2015.

49. See http://www.ftserussell.com/sites/default/files/press_releases/ftse_russell_lce_green_revenues_final.pdf.

50. See www.ftse.com/Indices/FTSE_Developed_ex_Fossil_Fuels_Index_Series/index.jsp.

51. See www.nexindex.com/pdf/2015_09_30_NEX%20Factsheet.pdf.

CONCLUDING OBSERVATIONS

The UN Paris Climate Agreement, together with energy security and access to modern energy sources for those without, are all focusing considerable attention on mobilizing investment into renewable energy, energy efficiency, new low-carbon technologies and green infrastructure more broadly.

To attract larger volumes of investment at a lower cost of capital in any given jurisdiction, policy-makers need to understand the factors that can have an impact on the risk-and-return profile of investments in order to attract different sources of capital, in any given jurisdiction.

Providing underlying conditions are in place, the range of renewable energy risk profiles can be matched to the spectrum of financial institutions across both debt and equity from project finance and investment banking to private equity, infrastructure funds and other avenues for accessing institutional capital. However, despite technology cost reductions and the near-term competitiveness of mature technologies in several geographies, a clear and stable policy and regulatory environment remains a core component of attracting capital.

Two tiers of policy are particularly important: i) the overarching objectives, setting expectations and drivers of market growth (the pipeline of opportunities); and ii) the policy and regulatory detail that shapes the 'risk/return profile' and will enable investors to respond. This is no longer about renewable energy support mechanisms, which can be expected to be phased down, but, necessarily, about the integration with regulatory requirements for new demand and supply configurations in the design of power systems and, increasingly, broader economic development, as implied by the scale and timing of action required on climate change.

It is imperative that policy be clear, long-term and legally based in order to provide confidence and stability, and designed to secure strong project pipelines which will underpin capital flows to the sector. This is also essential to foster innovation within the financial sector itself as it responds to new demand for finance at different scales, and as new market segments rise up the agenda (including the very small-scale off-grid segment).

A broadening range of 'new low-carbon' technologies and actors has emerged, including storage, demand-side response, energy efficiency and distributed energy, as well as renewable heat and transport. These

not only offer system flexibility alongside renewable energy, but are creating a new set of investment opportunities; policy regimes need to keep pace with these developments to avoid bottlenecks and ensure a smooth transition.

Investor-led momentum in understanding and responding to climate risk will increase attention from a wider range of both policy-makers and investors on renewable energy and the transformation of energy systems to deliver low- and zero-carbon outcomes. Notable areas include the discussion on stranding of high-carbon assets; divestment; corporate and portfolio measurement and disclosure of carbon; and potential liabilities facing companies whose valuations are heavily reliant on the extraction and use of fossil fuels.

This is not only about energy markets and macroeconomic conditions; increasingly, financial regulation is being assessed for its coherence with green infrastructure investment. Moreover, an important and fundamental question is being asked, at the highest level, about the risk to financial stability itself from climate change.

As these features become more aligned, governments have an important opportunity to act more confidently to crystallize plans on the pace and scale of transition to a fully decarbonized, secure energy system and, critically, to do so at the right resolution of detail that will enable investors to respond with the capital required.

ANNEXES

ANNEX 1: A TYPICAL PROJECT TRANSACTION PROCESS

The following is a summary of the steps undertaken by a bank when looking at a project (see also [Section 2.4.1](#) on debt sizing). Equity investors undertake a very similar process, substituting investment committee for credit committee and putting greater focus on factors impacting equity returns over the expected life of the investment.

TRANSACTION PROCESS

- Opportunity arises, initial review and client discussions and interest confirmed ('origination').
- Signing of confidentiality agreements to permit exchange of relevant details, an initial review of risks vs. return and a check against internal risk appetite.
- Outline transaction terms may be set out in a high level 'term sheet' between borrower and lender(s) to ensure overall agreement on structure of transaction.
- Detailed transaction review including financial modelling of the project over its whole life; stress testing of high and low case risk scenarios and testing of debt repayment ability.
- A full proposal is prepared for the internal credit committee, which must approve bank transactions. This includes:
 - the nature of the company wishing to borrow, its management and experience, renewable energy track record and financial strength;
 - the relationship between the bank and the borrower, including other exposure that the company may have with the bank, and future opportunities;
 - a detailed outline of the project, technology, lifespan, total capex (capital expenditure), required debt amount, subsidy support, contract review;
 - a detailed assessment of all the project risks and their mitigation;
 - the financial model which assesses the proposed debt profile and repayment schedule and the impact of a series of stress tests on ability to repay the debt. Stress tests may include construction delays, mechanical breakdown, lowering of subsidy, low electricity prices, inflation etc. A series of ratios (e.g. debt service cover ratios) is calculated;

- the returns earned by bank for the loan and any ancillary products provided by the bank (e.g. interest rate hedging);
 - a detailed review of the project, the contracts and technology (relies on external legal counsel review as well as review by the internal lender team);
 - the term sheet setting out the proposed terms and conditions for the loan.
-
- Approval will mean the bank can progress to commit in a legally binding way to the outline of a transaction, and funds will be set aside to permit the bank to honour these obligations. Once approved, a submission is made to the client. This may include conditions required by the credit committee.
 - The client enters into an agreement with the bank, which will have instructed external legal counsel to prepare the loan documents and finalize project due diligence. Due diligence will be extensive and will be tailored to the renewable energy technology to be employed. (For example, wind-power transactions require analysis of an absolute minimum of 12 months' site-specific wind data for direction and speed.)
 - Documentation is finalized, reflecting any final negotiations between bank and client, or findings from due diligence.
 - Financial close: documents are signed, lenders take security over the assets, equity is contributed by the investor and the initial debt funds are drawn:
 - Following drawdown, monitoring of construction progress is carried out regularly by the lenders' technical advisor, who reports to the bank(s) and confirms that future drawdowns of debt may be made (i.e. confirming that the project is within the agreed lending parameters);
 - Commissioning of the plant will similarly be checked and confirmed by lenders' technical advisor and signed off by the lender(s);
 - Once in operation, regular reporting continues – both financial (for example, cash flow and actual prices achieved) and operational (to confirm the plant is performing in line with agreed minima).

ANNEX 2: RESOURCES

A number of reports and initiatives have focused on renewable energy, low-carbon infrastructure and mobilizing private finance, including many providing analysis of developing-country markets and energy access. Several of these organizations update their analysis regularly. This list adds to resources referred to within the guide; it is not comprehensive but these links sign-post to other information hubs, including those of public finance institutions.

2016

- BNEF, CERES, 'Mapping the Gap: The Road from Paris, Finance Paths for a 2-Degree Future', January 2016. Available at www.ceres.org/resources/reports/mapping-the-gap-the-roadfrom-paris/.
- BNEF, 'Climatescope 2015'. This is a clean energy country competitiveness index, interactive report and online tool that outlines clean energy activity and the regimes of 55 emerging markets (in Africa, Asia and Latin America and the Caribbean) and their ability and potential to attract capital. Available at <http://global-climatescope.org/en/>.
- Climate Policy Initiative, 'The role of the Climate Investment Funds in meeting investment needs', June 2016. Available at <http://climatepolicyinitiative.org/wp-content/uploads/2016/06/The-role-of-the-Climate-Investment-Funds-in-meeting-investment-needs.pdf>.
- 'The Global Innovation Lab for Climate Finance', a partnership of governments and private-sector finance, with regular 'tenders' for new ideas for ramping up climate finance provision. More information at <http://climatefinancelab.org/>. Refer also to companion initiative 'Finance for Resilience', 'FiRE', at <http://www.financeforresilience.com/>.
- IRENA, 'Unlocking Renewable Energy Investment: The role of risk mitigation and structured finance', 2016. This comprehensive report identifies the main risks and barriers limiting investment. Available at http://www.irena.org/DocumentDownloads/Publications/IRENA_Risk_Mitigation_and_Structured_Finance_2016.pdf; see also IRENA, 'REthinking Energy', 2015, available at www.irena.org/rethinking/default2015.aspx.
- McKinsey, 'Financing change: how to mobilize private sector financing for sustainable infrastructure', January 2016. Available at www.mckinsey.com/industries/infrastructure/our-insights/next-generation-of-infrastructure.

- REN21, 'Global Status Report 2016'. REN21 is the international Renewable Energy Network and this is its benchmark report on renewable energy policy developments internationally, updated annually with additional regional sub-reports. Available at <http://www.ren21.net/gsr> (direct to report); micro-site with full reference links: <http://www.ren21.net/gsr-online>.
- UNEP, BNEF, 'Global Trends in Renewable Energy Investment 2016', March 2016. Available at http://fs-unep-centre.org/sites/default/files/publications/globaltrendsinrenewableenergyinvestment2016lowres_0.pdf.

2015

- Climate Policy Initiative, 'Emerging solutions to drive private investment in climate resilience', June 2015. This report covers investment in resilience in infrastructure, available at <http://climatepolicyinitiative.org/wp-content/uploads/2015/06/Finance-for-Climate-Resilience.pdf>.
- Department of Energy and Climate Change, UK Government case studies for use of its International Climate Fund. Available at www.gov.uk/government/collections/international-climate-fund-icf-case-studies.
- Sustainable Energy for All, SE4All Advisory Board's Finance Committee Report on Scaling Up Finance for Sustainable Energy Investments, July 2015. Available at <http://www.se4all.org/sites/default/files/l/2015/09/SE4All-Advisory-Board-Finance-Committee-Report.pdf>.
- UNEP-Collaborating Centre for Climate and Sustainable Energy Finance: Summer Academy and elearning course on Climate and Renewable Energy Finance. Details available at <http://fs-unep-centre.org/>.
- World Bank, EIB et al., 'Mainstreaming Principles for Climate Action within Financial Institutions', December 2015. This is an initiative of public and private financial institutions, with several case studies. Overview available at www.worldbank.org/content/dam/Worldbank/document/Climate/5Principles.pdf; information and background reports available at EIB host site: <http://www.eib.org/projects/priorities/climate-action/road-to-paris/fi-climate-mainstreaming.htm>.

2014

- Green Growth Best Practice Initiative, 'Green Growth in Practice, Lessons from Country Experiences', June 2014. Available from: www.ggbp.org.
- Power for All, 'Clean Energy Services for All: Financing Universal Electrification', June 2014. Available at <http://www.powerforall.org/resources/>.
- UNEPFI, Demystifying Private Climate Finance, December 2014. Available at www.unepfi.org/fileadmin/documents/DemystifyingPrivateClimateFinance.pdf.
- The Climate & Development Knowledge Network (www.cdkn.org), the International Energy Agency (www.iea.org) and the OECD (www.oecd.org) are also useful information portals.

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