

Green bonds

Mobilising the debt capital markets for a low-carbon transition

POLICY PERSPECTIVES



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“Government policies can play a central role in influencing how private capital is mobilised and shifted. It will only be green if the investment landscape is supportive. Coherent climate policies and good framework conditions for investment are essential. We need to move from a world where green bonds are a novelty to one in which the entire bond market begins to reflect the transition towards a low-carbon transformation.”

Angel Gurría, OECD Secretary-General

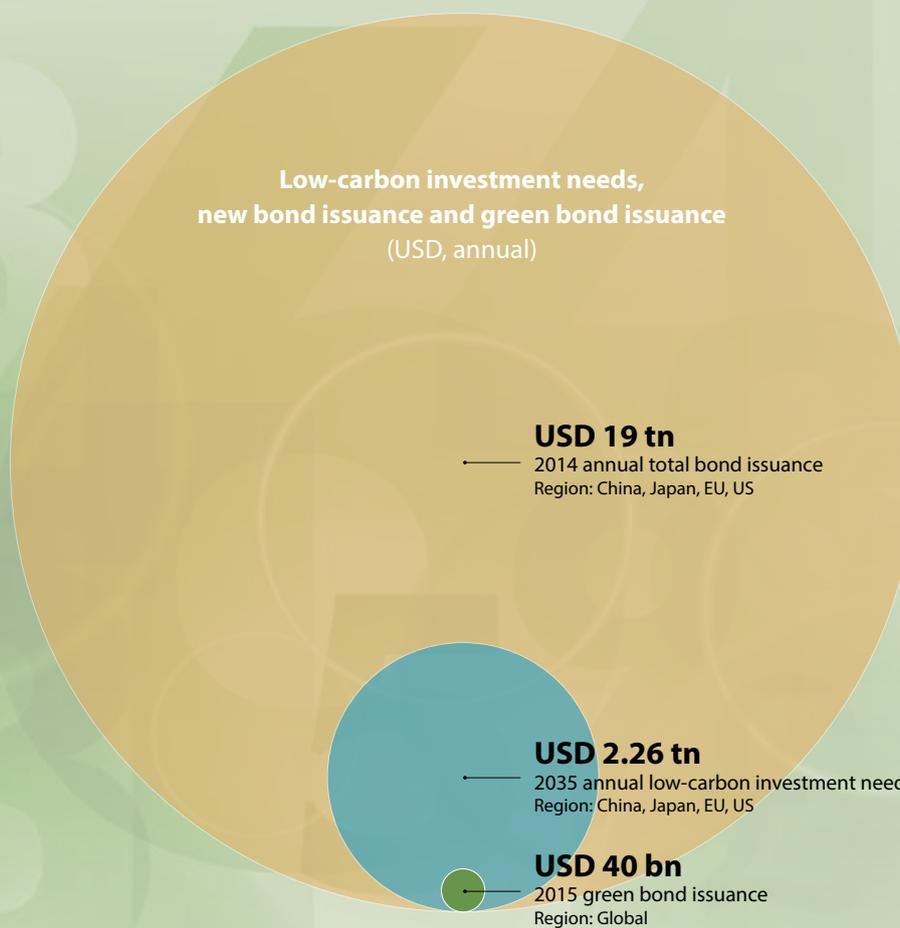
“Financial markets can help solve the climate challenge by meeting the growing demand for low-carbon projects around the world, from urban transit infrastructure to renewable energy facilities. New financial tools like green bonds are helping drive more capital to these projects, and as this report shows, clear standards and better market data will accelerate the use of green bonds by making them an even more attractive way to invest.”

Michael R. Bloomberg, United Nations Secretary-General's Special Envoy for Cities and Climate Change

Key messages

This document describes the emergence of a market for green bonds and examines how the market has evolved, previewing a forthcoming OECD report on the topic (Q1 2016).

- Investment is growing in renewable energy, energy efficiency and low-emissions vehicles, but not quickly enough to put the world on a cost-effective track to limit warming to below 2°C relative to pre-industrial levels.
- While the scale of investment needs is relatively well known, policymakers need a clearer understanding of how to mobilise sufficient debt and equity capital to finance the transition to a low-carbon and climate-resilient (LCR) economy. Debt currently finances the majority of LCR infrastructure investment but the challenge will be to shift away from emissions-intensive investments while scaling up LCR investment despite constraints on traditional sources of capital (including governments, banks and corporates).
- Governments will need to consider in particular how they can foster the transformation of the global bond markets to finance the low-carbon transition. Bonds have the potential to provide low-cost, long-term sources of debt capital; they can directly finance or re-finance investments, and can allow for “recycling” of loans, leading to increased lending. Bonds can also tap into a deep global pool of capital with a diverse base of investors. In particular, bonds connect investment needs with the latent demand for sustainability-themed investments from institutional investors, whose asset holdings are projected to increase from USD 93 trillion in 2014 to USD 120 trillion by 2019 in the OECD.
- The use of bonds to finance large scale LCR infrastructure directly or to fund lending is not new. However since 2007 a market for bonds specifically self-labelled or designated as “green” has emerged. A green bond is differentiated from a regular bond by this label, which signifies a commitment to exclusively use the funds raised to finance or re-finance “green” projects, assets or business activities.
- Annual issuance of labelled green bonds tripled in 2014 to reach USD 36.6 billion, and issuance grew further in 2015 with USD 40 billion issued by November 2015. The broader unlabelled “climate-aligned” bond market was valued at USD 600 billion in June 2015.
- The momentum of continued green bond issuance and market demand has led to growing consensus on what constitutes a green bond, and progress has been made on standards and criteria for what constitutes a green project or activity. Market and government-led efforts at standardisation and definition in the green bond market have borne fruit, with the emergence of The Green Bond Principles (a self-regulatory initiative designed to promote transparency and disclosure in the market); the Climate Bond Standards; and other principles and guidelines recognised and backed by the official sector including public financial institutions and development banks.



- An ecosystem of verifiers and assurance providers now exists to examine process and environmental integrity. China is developing country specific Green Bond Guidelines and definitions to guide the market and the European Commission continues to monitor, assess and support these developments under the EU Capital Markets Union.
- The OECD's forthcoming report 1) takes stock of these developments; 2) proposes a framework to analyse the potential contribution that bonds can make to a low-carbon transition, considering scenarios for future market evolution; and 3) provides recommendations to policy makers.
- Preliminary analysis suggests that the 2020s have the potential to be the "golden years" for bond issuance in the low-carbon sectors. As low-carbon technologies mature and become more standardised and as the costs of physical assets fall, the role played by bonds could expand rapidly. A particular opportunity to scale up safe and transparent markets for asset-backed securities is identified.
- However, bond issuance must occur at a scale, and in a format, with which institutional investors are comfortable. The analysis suggests that institutional investors have the potential to shift their asset allocations over time and absorb the increasing supply of green bonds.
- The speed at which green bond markets develop and mature hinges on many variables, including policy and regulatory factors, market conditions and financing trends. Additionally, the evolving green bond market faces a range of specific challenges and barriers to its further evolution and growth. These include underdeveloped domestic bond markets, insufficient pipelines of bankable and standardised green projects, a lack of commonly accepted green standards and definitions, issuer's views on costs vs. benefits, and a general scale mismatch between projects, bonds and institutional investors.
- Policy makers will need to focus attention on overcoming these barriers to grow a sustainable green bond market with environmental integrity. The OECD's forthcoming quantitative scenarios suggest that if there is a concerted push by policy makers and market participants to develop it, the green bond market can scale up rapidly to raise and finance the debt capital that will be needed for the transition to a low-carbon economy.

1 The problem: climate change and the need to shift to low-carbon and climate-resilient investment



At COP15 in Copenhagen in 2009, nations agreed that to “stabilise greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system,” we must reduce global emissions so as to hold the increase in global average temperature below 2 degrees Celsius (2°C) above pre-industrial levels and co-operate in achieving the peaking of global and national emissions as soon as possible. Even if this objective is achieved, significant risks and costs will be borne by citizens, businesses, investors and governments around the world.

The good news is that clean, low-carbon energy sources are becoming more cost-competitive every month.¹ The IEA’s 2015 World Energy Outlook (WEO) shows that renewables² contributed almost half of the world’s new power generation capacity in 2014 and have already become the second-largest source of electricity after coal globally. The coverage of mandatory energy efficiency regulation has expanded to more than one-quarter of global energy consumption. The climate pledges submitted by COP21 include 157 commitments from 185 Parties (including the EU member states) on renewables or energy efficiency or both, and this is reflected in the IEA’s finding that renewables are set to become the leading source of new energy supply from now to 2040 (IEA, 2015a).

Investment needs are immense, but incremental costs of “going low-carbon” are much more modest

Global energy infrastructure needs and the increasingly pressing challenges and risks associated with climate change present the world with an unprecedented investment opportunity related to the transition to a low-carbon climate resilient economy. An estimated USD 93 trillion in infrastructure investment across transport, energy and water systems will be needed in the next 15 years (New Climate Economy, 2014). Making these infrastructure investments “low-carbon” will impose estimated incremental costs of only 4.5% relative to business-as-usual, while yielding benefits (including better health, improved energy security and less traffic congestion) that far outweigh these incremental costs. The IEA also estimates that the incremental costs of investing in a low-carbon energy system are relatively modest. To have an

around 50% chance to limit the global long-term temperature increase to less than 2°C, cumulative energy investment will need to reach USD 53 trillion by 2035, which is just 10% higher than under current policies (and those under discussion) and would result in significant energy savings (IEA, 2014).

The challenge is to ensure that investment capital is reallocated from high-carbon to low-carbon and climate-resilient (LCR) options. It is only through such a re-allocation that the infrastructural foundations of the global economy can be rewired to be consistent with keeping the global temperature increase below 2°C. To promote this re-allocation and scale-up investment in LCR infrastructure, governments can make efficient use of available public capital to mobilise much larger pools of private capital.

Bonds and the need to mobilise the debt capital markets

While the scale of investment needs is relatively well known, policymakers need a clearer understanding of whether this could feasibly be financed from private sources of debt and equity capital, and if so, how it might be done. Debt currently finances the majority of LCR infrastructure investment but the challenge will be to shift away from emissions-intensive investments while scaling up investment in LCR infrastructure. The typical debt to equity ratio in overall infrastructure project finance is 70:30 (McKinsey Global Institute, 2013), with a somewhat higher proportion of debt in renewable energy financing (75:25) and equal shares in financing for energy efficiency and low-emissions vehicles (OECD 2016, forthcoming). Governments will need

to consider in particular how they can foster the transformation of the global bond market to finance the low-carbon transition.

Bond finance is a natural fit for LCR infrastructure assets. The case is especially clear for renewable energy infrastructure, which is characterised by high up-front capital costs and long-dated and frequently inflation-linked income streams. Cities and municipalities also rely on bonds to raise the financing for their low-carbon development plans.

It bears noting, however, that bond financing is not a means to an end; while it can facilitate the flow of capital to LCR infrastructure investments, the demand for such investment is driven by other factors, most notably low-carbon policy mandates, such as clean energy standards or deployment targets. An enabling policy context can therefore be a vital catalyst for actual use of the debt capital available through bond markets.

While banks and corporates will continue to be an important source of direct LCR infrastructure finance, especially at earlier stages of project finance, the scale of investment needs along with the “maturity mismatch” (short-term funding of long-term assets) in asset financing significantly exceeds the capabilities of a post-financial crisis banking sector and an electric utility sector with increasingly constrained

balance sheets (McKinsey, 2013a; b; c). Bond markets, which provide both an alternative and a complement to bank and corporate financing of debt, will need to play a pivotal role.

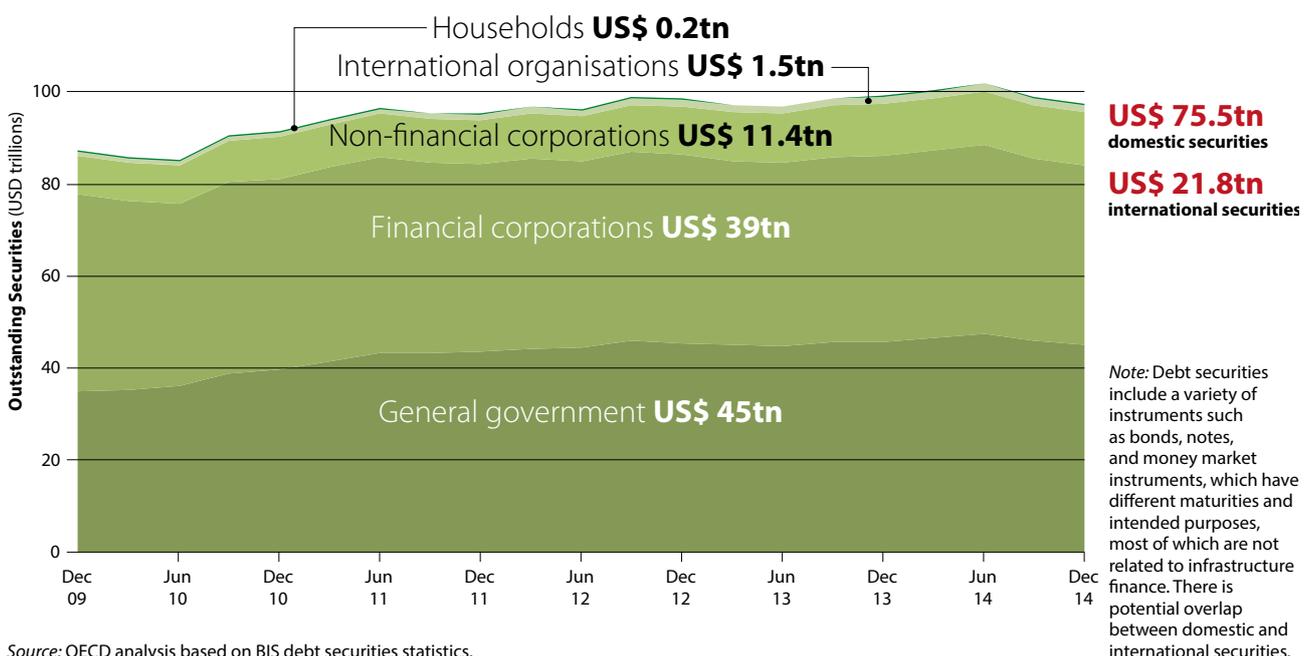
Bonds have the potential to provide the long-term sources of debt capital needed by LCR infrastructure projects. Given that the cost of project finance debt arranged by banks is higher than the yield for investment-grade project bonds in most jurisdictions⁴, it may be possible to achieve a reduction in the weighted average cost of capital (WACC) for LCR infrastructure financed or re-financed with bonds (WEF, 2013), although the cost of capital is usually an inherent feature of the project and its risk, not the financing method. Bonds can raise capital directly for LCR projects, or they can re-finance existing shorter-term loans potentially at a lower cost. Lowering the cost of capital for renewable energy is important because an estimated 50-70% of the costs of electricity generation are in the financial cost of capital, with only the balance being the physical or operational costs of the installation (OECD, 2015b). Thus, even small changes in the WACC can have substantial impact on the long-term levelised cost of

USD 97.2 trillion

In 2014 the total amount of capital held in global debt securities (i.e. bonds, notes and money market instruments) markets issued by all types of entities (banks, governments, corporations, etc.) was estimated at USD 97.2 trillion. Source: OECD analysis based on BIS data.

Source: OECD analysis based on BIS data.

Figure 1: **USD 97.2tn in total debt securities in 2014**



Source: OECD analysis based on BIS debt securities statistics.

capital-intensive renewable energy projects and their competitiveness with alternatives.

A liquid bond market provides greater flexibility and more options for early project phase capital to be freed up after it has been deployed (an “exit”), as well as for the longer-term project finance debt held by banks constrained by deleveraging and regulations. In this way, bonds can help to increase the speed at which capital can be “recycled” back into development, construction and early stage risk and also help to attract additional early stage finance. Investors are more likely to invest their capital in construction if there is a credible and predictable low cost exit once assets become operational (Caldecott, 2012).

Bonds fit within the investment portfolios of mainstream institutional investors (who managed USD 93 trillion of assets in the OECD in 2014) and can reconcile the emerging demand (Box 4) from institutional investors for sustainability-themed and Environment, Social and Governance (ESG)-screened investments with infrastructure investment needs. Bonds with long tenors are potentially a good fit with institutional investors’ long-term liabilities, allowing for asset-liability matching. Traditionally, bonds have been the asset class favoured by OECD pension funds and insurance companies, which in 2013 invested on average 53% and 64% respectively of their portfolio in bonds (simple average).⁵

2 What is a green bond?



The use of bonds to finance large scale LCR infrastructure directly or to fund lending is not new. However, since 2007 a market for bonds specifically “self-labelled” or designated as “green” (hereafter “green bonds”) has emerged.

“Going forward, we call on our Ministers to promote long-term financing, foster institutional investors’ involvement, support the development of alternative capital market instruments, and asset-based financing models.”

– G20 Leaders’
Communiqué, Antalya
Summit, 15-16
November 2015

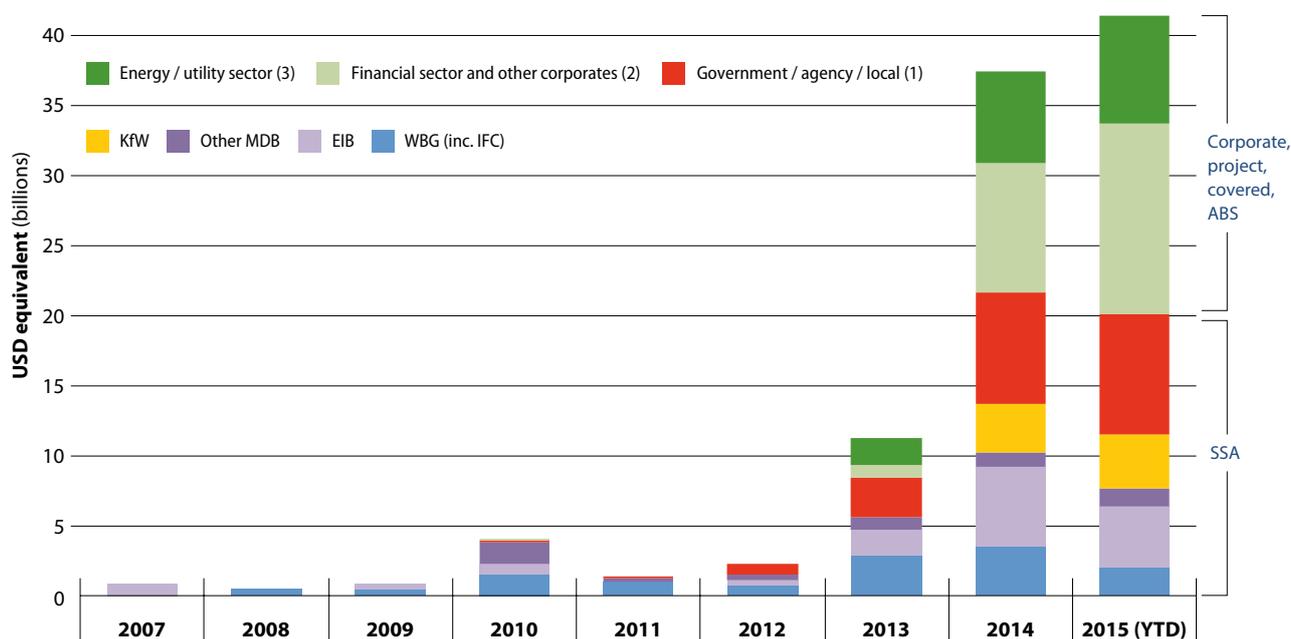
Annual issuance of green bonds tripled from USD 11 billion in 2013 to reach USD 36.6 billion in 2014. Issuance is expected to grow further in 2015, but less than some observers had expected, with USD 40 billion issued by November 2015 (Figure 2).

These green bonds are issued into a broader market of around USD 600 billion in outstanding securities,⁶ comprising USD 532 billion of “unlabelled climate-aligned” bonds as designated by the NGO Climate Bonds Initiative (CBI), and USD 66 billion of labelled green bonds, as reported in June 2015 (CBI/HSBC, 2015).

Unlabelled climate-aligned bonds are bonds whose proceeds are used to finance LCR industries, sectors and solutions but do not yet carry the green label yet (CBI/HSBC, 2015).⁷

The momentum of continued issuance and market demand has led to growing consensus on what constitutes a green bond (Ceres, 2015), and progress has been made on standards and criteria for what constitutes a green project or activity. As previously examined by the OECD (OECD, 2015b; Inderst et al., 2012), the lack of systematic rules and standardisation of green definitions, reporting and impact assessment is a shared and enduring source of concern cited by participants in the market. According to KPMG (2015), issuers face reputational risk and potential accusations of so-called “greenwashing” if proceeds are not used for their intended purposes or if issuers are unable to prove that proceeds have funded projects with positive and additional impact.

While the green bond market’s integrity so far remains robust (Ceres, 2015), the risks are legitimate and have necessitated focused attention from market participants and stakeholders. At the same time, there are also concerns among market participants that

Figure 2: **Composition of the green bond market** (as of November 2015, USD Bn, gross issuance)

Note: SSA: Sub-sovereign, Supranational and Agency, Muni: Municipal; ABS: Asset Backed Securities. (1) includes national development banks, sub-sovereign jurisdictions including municipalities, agencies, and local funding authorities. (2) includes financial sector bonds and all other corporates that are not energy/utility sector, as well as covered, project and ABS not energy/utility related. (3) includes corporate bonds issued by energy/utility companies as well as covered, project and ABS related to energy/utility companies

Source: OECD analysis based on Bloomberg and World Bank data

BOX 1: WHAT IS A GREEN BOND?

A “green bond” is differentiated from a regular bond by its label, which signifies a commitment to exclusively use the funds raised to finance or re-finance “green” projects, assets or business activities (ICMA, 2015). While the OECD has not defined what constitutes a green investment or green bond, it has discussed in its work definitions for “green infrastructure” and for “green investments” (OECD, 2013; Inderst et al., 2012) and has provided a general quantitative basis for assessing to what extent infrastructure systems can be considered “low-carbon and

climate-resilient (LCR)” (Kennedy and Corfee-Morlot, 2012). The OECD’s forthcoming bond modelling scenarios and annual investment needs in this analysis are limited to the renewable energy, energy efficiency and low-emissions vehicle sectors as estimated by the IEA (2014) to be consistent with a 2°C emissions path.



BOX 2: FINANCIAL CHARACTERISTICS OF GREEN BONDS

Like any other bond, a green bond is a fixed-income financial instrument for raising capital from investors through the debt capital market. Typically, the bond issuer raises a fixed amount of capital from investors over a set period of time (the “maturity”), repaying the capital (the “principal”) when the bond matures and paying an agreed amount of interest (“coupons”) along the way. A green bond is differentiated from a regular bond by being “labelled”, i.e. designated as “green” by the issuer or another entity, whereby a commitment is made to use the

proceeds of green bonds (i.e. the principal) in a transparent manner, and exclusively to finance or re-finance “green” projects, assets or business activities with an environmental benefit. A green label can also be applied to a bond by another entity via its inclusion in a green bond index (Box 3) or via a “tag” on analytical tools widely used in financial markets such as the Bloomberg Terminal.⁸



attempts to establish stringent requirements and standards for bonds to qualify as “green” could slow, inhibit or de-rail the growth of a potentially critical source of capital for LCR infrastructure at an early stage of development (Deutsche Bank, 2015; Global Capital, 2015; Institutional Investor, 2015).

In response to these tensions, a significant amount of market-led effort has gone into shaping and cultivating a better-defined market with assurances for the environmental integrity and impact of green bonds while keeping “green transaction costs” low or seeking to drive them lower. Much of this initial work has involved determining what investments count as

“green”; enhancing the transparency of the process by which a green bond is issued and how the proceeds are used and managed; and also on improving data and impact reporting.

Market and government-led efforts at standardisation and definition in the green bond market have borne fruit, with the emergence of The Green Bond Principles (GBP - a self-regulatory initiative designed to promote transparency and disclosure in the market), the Climate Bond Standards; and other principles and guidelines recognised and backed by the official sector including public financial institutions and development banks.

BOX 3: THE EMERGENCE OF GREEN BOND BENCHMARK INDICES AND EXCHANGE LISTINGS

As the green bond market has expanded and investor appetite increased, so too has the need for comparable performance data and the need to create benchmarks or reference points for performance. Market indices are broadly defined as metrics, often statistical, that track the performance of a specific group of securities or investment vehicles. In 2014 a range of banks, ratings agencies and service providers launched green bonds indices. These indices are aimed at lowering information barriers facing investors by providing clear risk-return data.

Many institutional investors are required to invest exclusively in “benchmark-eligible” securities, so having a green bond included in a benchmark index can be an important attribute for attracting these mainstream investors. As of November 2015, four “families” of green bond indices were available to investors, each with different methodologies for calculation and with eligibility thresholds for green bonds (including currency, size, rating, and extra-financial characteristics like second-party opinions).

The four indices are:

- Bank of America Merrill Lynch Green Bond Index
- Barclays MSCI Green Bond Index
- S&P Green Bond Index and Green Project Bond Index
- Solactive Green Bond Index

Indices also take a view on what projects and activities are eligible. For instance, to qualify for the Barclays MSCI Index, at least 90% of proceeds must be used for either new or existing environmental projects in five broad categories: alternative energy, energy efficiency,

green building, pollution prevention and control, and sustainable water. Stock Exchanges have built on these efforts and have launched dedicated Green Bond Listings or Segments which provide added capabilities for market participants, including different market modes, data quoting and secondary market trading. As of 2015, green bonds were listed on the London, Oslo and Stockholm Stock Exchanges and Mexico’s stock exchange plans to launch the first green bond segment outside Europe.



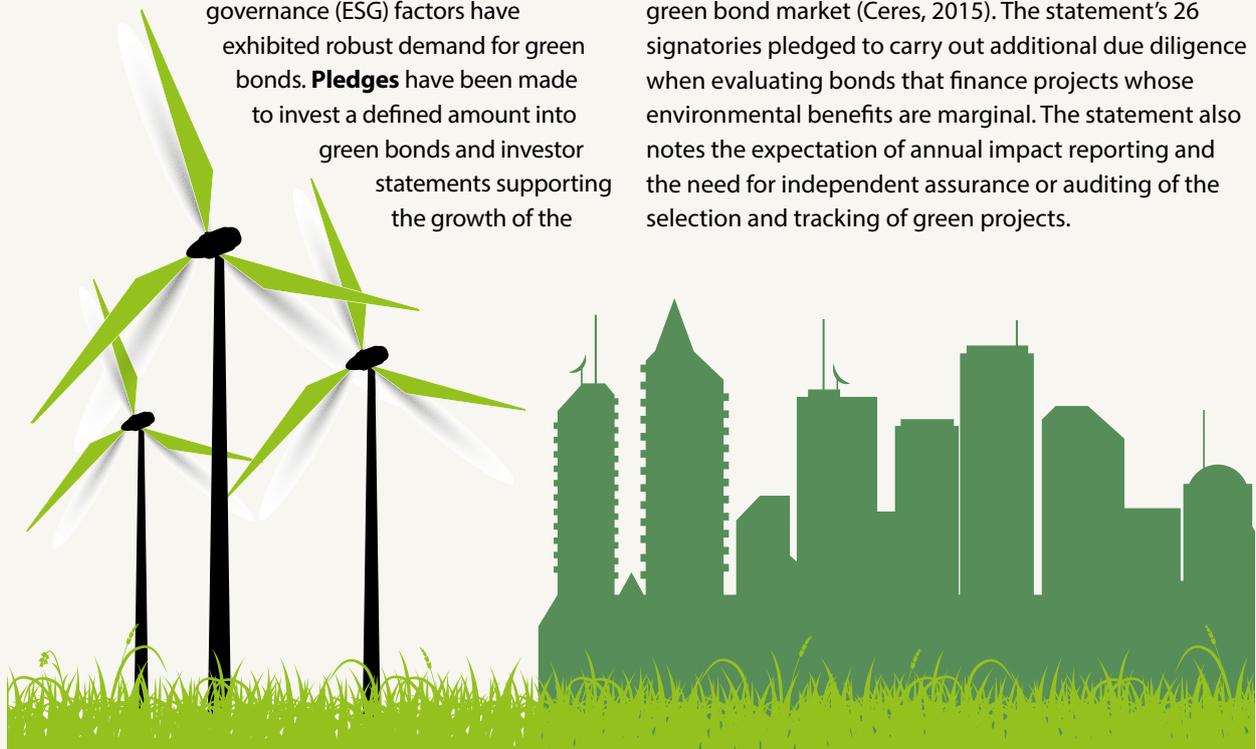
BOX 4: INVESTOR DEMAND FOR SUSTAINABILITY AND FOR GREEN BONDS RISES

Assets under management by signatories to the UN-supported Principles for Responsible Investment (PRI) now stand at more than USD 60 trillion (according to the PRI), up from USD 4 trillion at the PRI's launch in 2006. So-called sustainable-investment assets increased 61% globally in two years to USD 21.4 trillion at the start of 2014, with half of the assets allocated to bonds (Global Sustainable Investment Alliance, 2014).

Socially Responsible Investors (SRI) as well as mainstream investors that screen for environment, social and governance (ESG) factors have exhibited robust demand for green bonds. **Pledges** have been made to invest a defined amount into green bonds and investor statements supporting the growth of the

green bonds market have been released. Over the last two years, 17 institutional investors and financial institutions have publicly pledged to increase green bond holdings including from Zurich Insurance, Deutsche Bank, Barclays, HSBC, KfW and ACTIAM. In addition, there are increasing numbers of specialised **green bond funds**.¹²

A 2014 investor statement on green bonds signed by investors with USD 2.6 trillion of assets under management was followed in 2015 with another investor statement setting out expectations for the green bond market (Ceres, 2015). The statement's 26 signatories pledged to carry out additional due diligence when evaluating bonds that finance projects whose environmental benefits are marginal. The statement also notes the expectation of annual impact reporting and the need for independent assurance or auditing of the selection and tracking of green projects.



An ecosystem of assurance providers has developed, resulting in the production of guidelines specific to municipal issuances, e.g. the Green Muni Bonds Playbook (Green City Bonds Coalition, 2015), as well as a framework developed by 11 international financial institutions active in the green bond market to harmonise impact indicators and reporting.⁹ Several green bond benchmark indices have been launched to track performance and help formalise what qualifies as green by specifying specific attributes as requirements for inclusion in the index (Box 3).

Green bond market participants and observers are reported to be coalescing (BNEF, 2015) around the GBP, an initiative to develop voluntary guidelines which

clarify the approach for issuance of a green bond and recommend transparency and disclosure to promote integrity in the development of the green bond market. The GBP initiative comprises issuers, investors and intermediaries in the green bond market as well as observers, and is administered by the International Capital Market Association (ICMA), which acts as secretary to the GBP.¹⁰

The GBP define green bonds as “any type of bond instruments where the [issuance] proceeds will be exclusively applied to finance or re-finance in part or in full new and/or existing eligible Green Projects and which follows the four Green Bond Principles” (ICMA, 2015).¹¹

3 Transparency in the “use of proceeds” as a key to integrity



The foundation of the green bond market lies in the utilisation of the proceeds of the bond which, according to the GBP, should be “appropriately described in the legal documentation for the security”. The GBP recommend that “designated green project categories should provide clear environmentally sustainable benefits, which, where feasible, will be quantified or assessed by the issuer”.

The GBP explicitly recognise several “broad categories” of potentially eligible green projects aiming to address key areas of concern such as climate change, natural resources depletion, biodiversity conservation and pollution.¹³ The GBP do not currently define the type of projects under the general categories that qualify as “green”, but point issuers and other stakeholders to existing, independently developed sets of criteria and standards for defining eligible green projects that can be used as a guide.

For instance, the Climate Bond Initiative’s taxonomy (Figure 3) specifies the green definitions for the Climate Bond Standards and Certification Scheme and is guided by a panel of climate and energy experts. It is the only current industry effort to address the challenge of green standards within each of the broader asset categories provided by the GBP. CICERO, a second-party reviewer of green bonds, offers a “Shades of Green” methodology whereby green bonds are graded “dark, medium or light” green depending on the underlying project’s contribution to “implementing a 2050 climate solution” (Clapp and Torvanger, 2015).

A key element in the development of standards involves working out exactly how to verify the proper use of proceeds. While shortcomings in the disclosure of information about the use of proceeds may, for instance, be alleviated by the guidelines set out in the GBP, these are voluntary guidelines only, and do not currently spell out material requirements for the type and nature of activities, nor do they mandate a certain threshold of environmental benefits.

Investors need to be assured that the proceeds of the green bonds in which they invest are being allocated

to appropriate qualifying projects that generate the desired “green” impacts. To secure this assurance in the absence of market-wide standardisation, the “majority of issuers” (CBI/HSBC, 2015) choose to retain specialist service providers and undergo independent review through assurance processes that include second-party reviews and consultation, audits and third-party certifications (Box 5). These different processes have been used on their own, or in combination, and serve to elucidate and validate the environmental criteria the issuer will use to select projects for funding, check compliance of the bonds against criteria specified by standards and provide independent assurance about whether the bond’s proceeds have been applied and managed as intended.

As of October 2015, according to CBI/ HSBC (2015), 60% of total green bond issuance to date has officially incorporated a second-party review, and this percentage has remained stable over the past three years. “Most” of the remaining 40% of green bonds use a type of proxy for second-party review, including audited assurance reports or benchmark measures related to use of proceeds and impact (e.g. LEED) (CBI/ HSBC, 2015). For instance, the EIB, currently the largest green bond issuer, reports in detail on the allocations of its Climate Awareness Bond proceeds in annual audited sustainability reports and in a dedicated newsletter. According to Barclays (2015), these bespoke reviews help investors understand green credentials to the extent that the quality of independent reviews and impact reporting has become a significant differentiator for the investor base, with greater investor demand for the bonds of issuers that provide high-quality information about the environmental benefits of the underwritten projects.

Figure 3: A taxonomy provides "green definitions" for Climate Bond Standards & Certification Scheme

CLIMATE BONDS TAXONOMY							
Energy	Low carbon buildings	Industry & Energy – intensive commercial	Waste & pollution control	Transport	Information technology & communications	Agriculture, forestry & land use	Adaptation
Solar	New residential	Manufacturing	Recycling facilities	Low carbon transport (land)	Power management	AFOLU mitigation	Water
Wind	New commercial	Energy efficiency processes	Recycles products & circular economy	Vehicles	Tele-conferencing	AFOLU adaptation	Energy
Bioenergy	Retrofit	Energy efficiency products	Waste to energy	Public transport	Resource efficiency	Agricultural products	Industry & waste
Geothermal	Products for building carbon efficiency	Retail & wholesale	Geo-sequestration	Bus rapid transport			Transport
Marine		Data centres		Alternative fuel infrastructure			ICT
Dedicated transmission		Process & fugitive emissions		Water-borne			Buildings
Energy distribution & management		Energy efficient appliance					Food supply
		Combined heat & power					Coastal

Source: Climate Bonds Initiative

The trajectory of green bond governance

Securities and markets serve to link investors to investments, and in many ways a green bond can be seen as a *process* as well as a financing instrument. The development of standardised definitions and transparent procedures for assessing the greenness of bonds should help investors and businesses with aligned objectives find each other through the green label (as a "discovery tool"). Better securities and market design could lower the cost of linking investors to investments. Efficient instruments and markets do this at the lowest cost, which, in turn maximizes the flow of capital. All of the work that goes into defining what is to count as a green bond can be understood as important "spadework" in facilitating buyers and sellers to find each other.

For instance, in 2015 the EIB established a direct link between its green bonds and the projects they finance. This improved level of information flow was achieved through better design and the upgrading of its internal procedures and IT-infrastructure following extensive due diligence. The linkage enables improved impact reporting and is also a strategic response to investor demand for funds that enable enhanced reporting on the carbon impact of their portfolios, in anticipation of regulatory requirements such as a French law (Article 173 of the Energy Transition Bill) that will oblige institutional investors to disclose this information (Bloomberg, 2015).¹⁴ The World Bank Group, some municipal issuers (e.g. Massachusetts) and others also report details on a project-by-project basis..

Governments have engaged in supporting the development of standards and definitions for green bonds. For instance, in 2015 Switzerland became the first national government member of the Climate Bond Partners to support the development of the Climate Bonds Standard (Kidney, 2015). China is developing country-specific Green Bond Guidelines and definitions to guide the market as part of broader green financial reforms (UNEP and PBoC, 2015) and the European Commission continues to monitor, assess and support these

developments under the EU Capital Markets Union. (EC, 2015).

Convergence towards commonly-accepted definitions and reporting procedures will be essential to maximise the effectiveness, efficiency and integrity of the market. Striking the right balance will be critical to avoid overloading issuers with administrative hurdles and transaction costs. Efforts aimed at harmonising and streamlining of definitions can serve to reduce these barriers and bureaucratic burdens.

BOX 5: REVIEW AND ASSURANCE IN THE GREEN BOND MARKET

The Green Bond Principles (ICMA, 2015) describe a variety of ways for issuers to obtain outside input to the formulation of their green bond process and recommend several levels and types of independent assurance¹⁵. Such guidance and assure might include:

Second party reviews and consultation: for example, an issuer can seek advice from consultants and/or institutions (“second party”) with recognised expertise in environmental sustainability to review or to help in the establishment of its process for project evaluation and selection including project categories eligible for green bond financing. The reviews and reports of the second party are private, and may be made publicly available only at the discretion of the issuer.

Audits: Issuers are encouraged to have independently verified or audited certain aspects of their green bond process, such as the internal tracking method and the allocation of funds from proceeds. The verification can be provided by qualified third parties, or by internal and/or external auditors. These independent reports and audits may be put in the public domain at the discretion of the issuer.

Third-party certifications: Second-party standards intended for use by qualified third parties to certify green bonds are in use or in development. The GBP are supportive of the development of and use of such standards for the certification of green bonds, as defined by the GBP.



Table 1: Advantages and disadvantages of green bonds as cited by investors and issuers

FOR INVESTORS	
Advantages	Disadvantages
<i>Commonly cited</i>	
<ul style="list-style-type: none"> ● Investors can balance risk-adjusted financial returns with environmental benefits ● Satisfies Environment, Social and Governance (ESG) requirements and green investment mandates ● Improved risk assessment in an otherwise opaque fixed income market through use of proceeds reporting ● Potential use pure-play, project and ABS to actively hedge against climate policy risks in a portfolio that includes emissions-intensive assets ● Recognised by UNFCCC as non-state actor "climate action" 	<ul style="list-style-type: none"> ● Small and nascent (and potentially less liquid) market, small bond sizes ● Lack of unified standards can raise confusion and possibility for reputational risk if green integrity of bond questioned ● Limited scope for legal enforcement of green integrity ● Lack of standardisation can lead to complexities in research and a need for extra due diligence that may not always be fulfilled
<i>Infrequently cited</i>	
<ul style="list-style-type: none"> ● Engagement and private dialogue with issuers on ESG topics related to green bond issuance results in information that enhances credit analysis, through more comprehensive credit profiles of borrowers (BlackRock, 2015) ● Added transparency of proceeds use and reporting requirements provides informational advantage otherwise unavailable (on spending efficiency, project details and updates, impact performance) which gives green bond investors a significant information advantage (Nikko, 2014) ● Tracking of proceeds use and reporting leads to improved internal governance structures and a positive feedback loop which improves the overall credit quality of the issuer (Nikko, 2014) 	
FOR ISSUERS	
Advantages	Disadvantages
<i>Commonly cited</i>	
<ul style="list-style-type: none"> ● Demonstrating and implementing issuer's approach to ESG issues ● Strong investor demand can lead to oversubscription and potential to increase issuance size ● Improving diversification of bond issuer investor base, potentially reducing exposure to bond demand fluctuations ● Evidence of more "buy and hold" investors for green bonds which can lead to lower bond volatility in secondary market ● Reputational benefits (e.g. marketing can highlight issuer's green credentials and support for green investment) ● Articulation and enhanced credibility of sustainability strategy ("money where your mouth is") ● Access to "economies of scale" as majority of issuance costs are in setting up the processes 	<ul style="list-style-type: none"> ● Up front and ongoing transaction costs from labelling and associated administrative, certification, reporting, verification and monitoring requirements (cost estimates vary) ● Reputational risk if a bond's green credentials are challenged
<i>Infrequently cited</i>	
<ul style="list-style-type: none"> ● Tracking of proceeds use and reporting leads to improved internal governance structures, communication and knowledge sharing between project side and treasury side of business (Nikko, 2014) 	<ul style="list-style-type: none"> ● Investors may seek penalties for a "green default" whereby a bond is paid in full but issuer breaks agreed green clauses (KPMG, 2014)

4 The growing green bond market



The green bond market has materialised out of a variety of institutional actions. In 2007, the European Investment Bank (EIB) marketed a EUR 600 million Climate Awareness Bond, the first of a series. In 2008, the World Bank (IBRD) began its marketing of green bonds with a USD 300 million issuance.

The identical financial characteristics of green bonds compared to conventional bonds and the relatively simple principle of green labelling and the ring-fencing, ear-marking or “use of proceeds” implied by the label have been catalytic elements in the market’s growth. Combined, they have allowed for a wide range

of issuers and investors to join the market attracted by the advantages offered by green bonds (Table 1). For the purposes of this analysis, green bonds are categorised into six distinct forms that can be issued by different entities and as different structures or “types” (Box 6).

BOX 6: GREEN BONDS COME IN SIX FORMS

- 1. Corporate bond:** A “use of proceeds” bond issued by a corporate entity with recourse to the issuer in the case of default on interest payments or on return of principal. This category includes bonds issued by “YieldCo” vehicles to finance asset acquisitions.
- 2. Project bond:** A bond backed by single or multiple projects for which the investor has direct exposure to the risk of the project, with or without recourse to the bond issuer.
- 3. Asset-backed security (ABS):** A bond collateralised by one or more specific projects, usually providing recourse only to the assets, except in the case of covered bonds (included in this category). For covered bonds, the primary recourse is to the issuing entity, with secondary recourse to an underlying cover pool of assets, in the event of default of the issuer.
- 4. Supranational, sub-sovereign and agency (SSA) bond:** Bonds issued by international financial institutions (IFIs) such as the World Bank and the European Investment Bank (i.e. “supranational issuers”). SSA bonds have features similar to a corporate bond relating to “use of proceeds” and recourse to the issuer. Agency bonds are included in this category (e.g. issuance by export-import banks), as are sub-sovereign national development banks (e.g. the German KfW).
- 5. Municipal bond:** Bonds issued by a municipal government, region or city. A national government entity could theoretically also issue a “sovereign” bond; no green sovereign bonds have been issued to date.
- 6. Financial sector bond:** A type of corporate bond issued by a financial institution to specifically raise capital to finance “on-balance sheet lending” (i.e. to provide loans) to green activities (e.g. ABN AMRO or Agricultural Bank of China). This type of bond is considered separately for the purposes of OECD scenario modelling to retain a distinction between financial sector bond issuances which finance lending and those which directly finance green investments.



BOX 7: GREEN BONDS CURRENTLY HAVE FINANCIAL FEATURES THAT ARE IDENTICAL TO CONVENTIONAL BONDS

With the exception of the ring-fencing or ear-marking of proceeds required by the green label, green bonds have financial characteristics that are identical to conventional bonds from the same issuer, including the credit quality, yield and price at which they are issued.

The concept of “flat-pricing” has been central to the rapid expansion of the market driven by investor demand. Prices are said to be flat at issuance because the credit profile of a green bond is the same as any other of the most regular, simple and standardised (“plain vanilla”) bonds from the same issuer, so no difference in pricing is warranted.¹⁶ This means that issuers have not been able or willing to realise pricing advantages (and a correspondingly lower cost of capital for green projects) through green labelling as investors are unwilling to take lower than expected returns at the primary issuance stage simply for the ability to “go green” (BNEF, 2014). At the same time, investors have not been able to realise demand for higher yields to justify supposed additional risk-taking to finance green activities as in general (with exception for project, covered and ABS bonds) they are financing the balance sheet of the issuing entity itself (so the credit risk is the same to any other regular bond from the same entity).



Yet, one report has indicated that green bonds trade on the secondary market at a slight premium during certain periods studied (Barclays, 2015).

Barclays partly attributes this phenomenon to “opportunistic pricing based on strong demand from environmentally focused funds faced with comparatively limited green bond supply” along with other factors that are difficult to substantiate empirically at present (Barclays, 2015).

A mix of views exist on the likely development in the market pricing for green bonds. Debate is ongoing, characterised by a tension between issuers who see strong demand to the point of oversubscription and argue for a pricing advantage to compensate for issuance costs, and investors, who are unwilling

to take a pricing “haircut” (i.e. a lower price) that cannot be sufficiently justified on a risk-adjusted return basis. The green bond market is evolving under pressure from issuers looking to drive the costs of issuance down and investors calling for more supply to meet their demand.

The market evolved beyond SSA issuers in 2013 when corporate issuers joined the market, first with Bank of America’s “financial sector” bond, followed by EDF, Vasakronan and others. Corporates have also extended the green bond label to asset backed securities, starting with Toyota’s 2014 sale of securities with proceeds used for investment in electric vehicles and hybrids. The deal was backed by leases and loans to non-green vehicles, as the pool of leases and loans to EVs and hybrids was too small. Municipalities have joined the market, with the issuance by Ile de France (the Paris region) in 2012 followed by Gothenburg (Sweden) in 2013. The year 2014 also saw the first emerging market municipal issuance, by Johannesburg (South Africa). Export Credit Agencies and Export-Import Banks have issued green bonds including in India (India ExIM). The first covered bond issuance (Berlin HYP) occurred in 2015 along with further growth in ABS and project bonds.

Green bond issuing entities can make use of a variety of structures related to the “use of proceeds” (according to the GBP, four “types” of green bond at present, although additional types may emerge). The

most common structures used have been standard “recourse-to-the-issuer” debt obligations (i.e. if the principal is not returned to the investor in full for whatever reason, the investor can recoup unreturned principal from the issuer). While the use of funds is targeted, the repayment obligation is backed by all of the issuer’s assets. Most SSA and corporate green bonds are characterised by this “plain vanilla” issuance. Green bonds can also involve pledging specific cash flows as the basis for repayment (such as the revenue of a project), may be issued by a special purpose entity responsible for a specific project and without recourse to the issuer, or can be a securitisation with collateral from a collection of many assets. This structure is generally associated with project bonds, asset-backed securities (ABS) and municipal debt issuance.

Within the unlabelled market, there is a small but growing pocket of bonds whose cash flows depend on the underlying projects, unlike corporate and SSA bonds where cash flows depend on the issuer and may not necessarily be linked to projects. These

unlabelled green project bonds and ABS totalled about USD 15 billion in 2014 according to CBI/HSBC (2015). In practice less than 2 billion of the 15 billion in ABS included as climate-aligned bonds have been self-labelled as green¹⁶ and few project or covered bonds have been labelled as such.

The geography of the green bond market is expanding and diversifying (Box 8). Green bonds have been issued in 23 jurisdictions, including 20 for domestic and foreign investors, and three for foreign investors only. Green bonds have been issued in 23 currencies and in 14 markets of the G20.

BOX 8: THE GEOGRAPHY OF THE GREEN BOND MARKET

Green bonds have been issued in 23 jurisdictions, including 14 markets of the G20, and in 23 currencies.



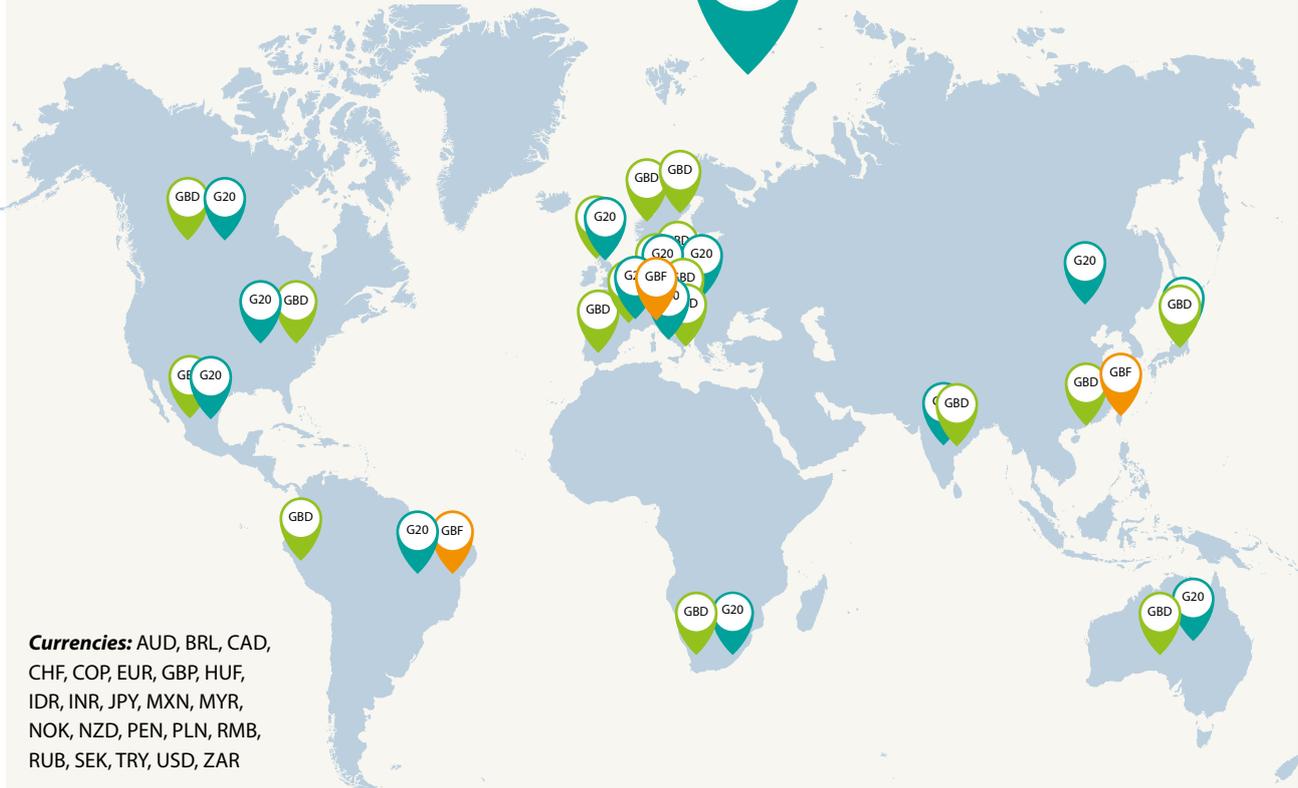
Green bonds issued for domestic and foreign investors: Australia; Austria; Canada; China; EU; France; Germany; Hong Kong, China; India; Italy; Japan; Mexico; Netherlands; Norway; Peru; South Africa; Spain; Sweden; the UK and the USA.



For foreign investors only: Brazil, Switzerland, and Chinese Taipei.



G20 markets: Australia, Brazil, Canada, China, EU, France, Germany, India, Italy, Japan, Mexico, South Africa, UK, USA.



Currencies: AUD, BRL, CAD, CHF, COP, EUR, GBP, HUF, IDR, INR, JPY, MXN, MYR, NOK, NZD, PEN, PLN, RMB, RUB, SEK, TRY, USD, ZAR

Australia – Dollar	Brazil – Real	Canada – Dollar	China – Yuan	Colombia – Peso	Eurozone – Euro	Hungary – Forint	India – Rupee
Indonesia – Rupiah	Japan – Yen	Malaysia – Ringgit	Mexico – Peso	New Zealand – Dollar	Norway – Krone	Peru – Nuevo Sol	Poland – Zloty
Russia – Dollar	South Africa – Rand	Sweden – Krona	Switzerland – Franc	Turkey – Lira	UK – Pound	USA – Dollar	

5 A quantitative framework for analysing potential bond contributions in a low-carbon transition

The preliminary results presented here are previews from a forthcoming OECD report to be released in Q1 2016.

Ongoing OECD work¹⁸ considers scenarios for the future growth of the global green bond market in a 2°C energy investment scenario, assuming that governments adopt policies supportive to market growth (OECD, 2016 forthcoming). The analysis will propose a framework for understanding scenarios and possible directions of green bond market evolution and will equip policy makers with the tools to analyse the potential contribution that the bond markets can make to a low-carbon transition. Starting with energy investment requirements at the national level estimated by the IEA for its 2°C scenarios (2DS), the analysis converts investments into their constituent equity and debt components. Focusing on debt, the analysis considers the role that the bond markets will need to play to finance this investment and connect bond supply with demand from institutional investors.

Debt financing requirements through 2035 are considered for renewable energy, the energy efficiency portion of building investments, and low-emission vehicles (LEVs)¹⁹. These three sectors accounted for 75% or USD 50 billion out of 66 USD billion in outstanding labelled green bonds as of June 2015 (CBI/HSBC, 2015).²⁰ For purposes of simplicity, the analysis refers to bonds issued in the renewable energy, energy efficiency and LEV sectors as “low-carbon bonds”, and does not speculate on what portion will be labelled green in 2035.

The ongoing analysis covers bond markets in China, the EU, Japan and the US, which represent 68% of the global annual investment needs projected for the next five

years and 52% in 2030-2035 (Table 2). These markets currently have significantly more established debt capital markets than other regions, and are the largest globally, accounting for 76% or USD 74 trillion of the global bond markets valued at 97 trillion in 2014. Bonds outstanding from all sectors (government, corporate, municipal, ABS, etc.) amounted to USD 39 trillion in the US, USD 21 trillion in the EU, USD 9.7 trillion in Japan and USD 4.3 trillion in China. Bond issuance in 2014 amounted to USD 19 trillion in these markets.²¹

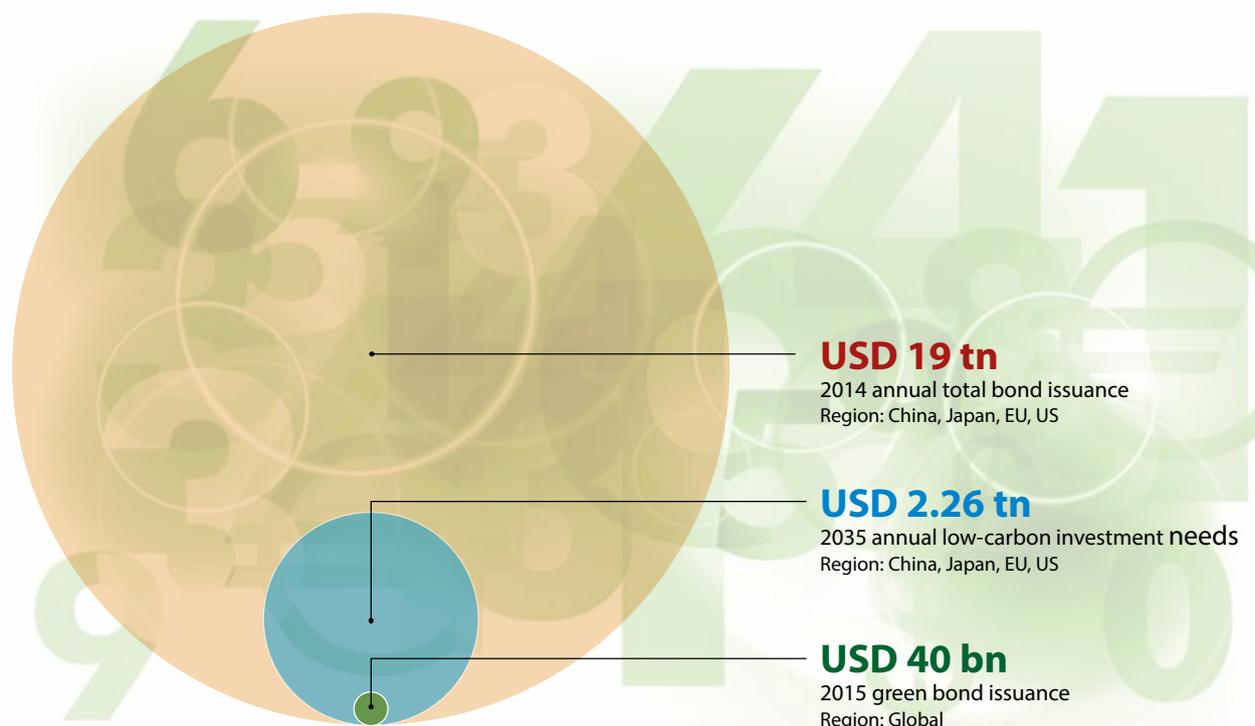
In its World Energy Investment Outlook (2014) and Energy Technology Perspectives (2012), the IEA estimated investment needs in the renewable energy, energy efficiency and LEV sectors to 2035, consistent with an expectation that countries will take policy actions leading to a 2°C emissions pathway. Building on these investment scenarios, this work applies assumptions based on current trends in regional financial markets to synthetically break down the aggregated investment needs by source of finance and type of financial instrument.

Preliminary results indicate that debt (lending) and bond financing will continue to grow. The mix of financing types will range significantly across the types of physical assets, and change over time. Current trends in financing asset and durable consumption purchases show that a significant proportion of energy efficiency and low emission vehicle investment is done through consumer finance (i.e. loans provided to consumers by commercial

Table 2: Annual investment needs for renewable energy, energy efficiency and low-emission vehicles in a 2DS (2015-2035, 2012 USD)

	2015-2020	2021-2025	2026-2030	2031-2035
4 markets (China, EU, Japan & US)	573 bn	1 315 bn	1 264 bn	2 262 bn
World	839 bn	2 230 bn	2 404 bn	4 340 bn
Share of 4 markets out of world investment	68%	59%	53%	52%

Note: Figures are annualised over the five year periods Source: OECD analysis based on IEA (2014, 2012)

Figure 4. **Low-carbon investment needs, new bond issuance and green bond issuance** (USD, annual)

Note: “Low-carbon” investment needs cover the renewable energy, energy efficiency and low-emissions vehicle sectors as estimated by the IEA (2014, 2012). The 2015 green bond issuance figure of USD 40 billion extends to all sectors covered in Climate Bonds Initiative database as of November 2015. Annual total bond issuance is provided as an illustration and just as with green bond issuance, reflects “gross issuance” figures i.e. does not account for those securities that reach maturity or are redeemed from previous years (termed “net issuance”). It includes other types of debt securities such as notes and money market instruments.

Source: OECD analysis based on IEA (2014, 2012), Climate Bonds Initiative (2015), BIS (2015), SIFMA (2015), ECB (2015), JSRI (2015), ADB (2015) and Goldman Sachs (2015).

banks) or equity (i.e. “self-finance”, such as an LEV purchase made without any financing). Assuming that this continues to be the case, and given the large size of LEV and energy efficiency investment needs relative to renewables, equity and self-finance are expected to continue to make a large contribution to financing low-carbon energy investment.

The forthcoming analysis suggests that the 2020s have the potential to be the “golden years” for bond issuance in the low-carbon sectors. As low-carbon technologies mature, they become more familiar to bond markets which will be substantial contributors to the financing and re-financing of new-build assets. As the costs of assets fall and as policy stabilises, the role played by bonds could expand rapidly. As early stage capital markets become more robust (e.g. venture capital or early project phase capital), and companies and projects become ready for bonds, issuance can scale up further. One important driver of growth in green bond markets will be actions scaling up issuance of asset-backed securities (ABS). Leases of LEVs are a particularly suitable target, as demonstrated by ABS issued in 2014 and 2015 from Toyota. Securitising residential energy efficiency loans is also seen to have

strong potential as illustrated by several recent bonds out of California (Deutsche Bank 2014).

ABS have a disproportionately large potential to scale (provided barriers to securitisation are overcome) as they are less likely to be constrained by government fiscal and budgetary constraints in the case of government (i.e. municipal) bonds, and by balance sheet constraints in the case of corporate and SSA bonds.

The preliminary results reveal the prominent role loans play in financing low-carbon investment needs to 2035. Financial institutions (including banks and non-bank intermediaries) are expected to continue to be the largest provider of loans to all three sectors given their specific expertise in the arranging of credit for the earlier stages of infrastructure development project cycle, from planning, to construction through to project operation, at which point other sources of debt capital including bond markets can be called on to re-finance the debt. While financial institutions have a major role to play in arranging the debt financing for low-carbon infrastructure through loans and underwriting and investing in bonds, they notably also can act as issuers of “financial sector” bonds.

Financial institutions rely to a large extent on bonds to raise capital for their lending activities, with US and EU commercial banks currently maintaining a debt to loan ratio of 30%. Commercial banks are among the most active and prominent users of bonds markets to raise capital for their lending activities. In the US and EU, 42% and 48% respectively of outstanding debt securities had been issued by financial institutions in 2014 (McKinsey, 2015; ECB, 2015).

Financial institutions are expected to continue to use bond markets to raise capital to finance their low-carbon related lending, which can lead to financial sector issuance of bonds that finance this on-balance sheet lending (referred to as “on-lending”). An example of this type of bond in the market today is ABN AMRO’s EUR 500 green bond issued in 2015, where the proceeds are used to finance and re-finance “Green Loans” that finance solar panels installed on residential buildings as well as commercial real estate loans for the construction and financing of energy-efficiency buildings.

Unlike ABS and Collateralised Loan Obligations (CLOs), bonds issued by bank treasuries will not be directly backed by green assets; but as is seen in the case of “use of proceeds” corporate bonds, a link can be established between raised capital and how it is put to use in financing low-carbon infrastructure investment.

When examining the individual markets, the scenarios highlight geographical variations and some similarities. For instance, financial sector issuance potential is seen as strong in all four markets accounting for the largest low-carbon bond sector in China, the EU and Japan.

 **US:** A higher share of ABS is possible than in other markets in 2035. This is due to the higher level of maturity of the financial markets in general and securitisation markets in particular. The US Mortgage Backed Securities (MBS) market currently represents 60% of all mortgage debt outstanding in the US and the US auto loan ABS market is also relatively mature with a 20% securitisation rate of total vehicle expenditure (SIFMA, 2015).

US utilities are among the highest users of bond finance, and are reflected as such in this analysis. Over time it is assumed that a portion of corporate

borrowing by US utilities will be substituted by project bonds and ABS. US municipal authorities are also prominent issuers in bond markets to finance their infrastructure-related expenditure and are expected to continue as such. SSA and development banks are seen as having a key role to play with state-sponsored “Green Investment Banks” in Connecticut and Hawaii already active in mobilising the debt capital markets.



EU: Similar to the US, ABS is seen as accumulating a large market share but ceding some of this share over time to corporate and project bonds. The expected increase in project bonds reflects the Europe 2020 Project Bond Initiative by the European Investment Bank with the European Commission, which is targeted at increasing reliance on bond financing at the project level.

Corporate bond issuance is likely to be significant given the very active role European utilities have played in the EU corporate bond market. There could also be strong involvement of governments in raising funds through the bond market to implement energy efficiency and renewable energy programmes. Many options are possible in Europe, and much will depend on the direction policy takes and the strength of corporate utility balance sheets, which have deteriorated in recent years.



Japan: Overall the assumptions used to examine the Japanese market’s potential result in a low degree of securitisation and bond issuance in Japan. Investment needs in general are lower compared to the other three markets, and bond issuance as a percentage of investment needs is also lower. The equity portion is seen as remaining large, as a high proportion of vehicle purchase is self-financed.



China: Corporate and project bonds are expected to take the greater share while ABS will expand alongside a maturing debt capital market. China has been largely successful in issuing infrastructure bonds and creating a market for these bonds, done mainly through state owned enterprises and the “quasi-public” sector. Between 2009 and 2013, an estimated

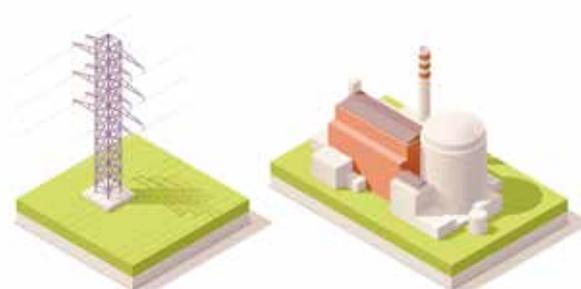
Financial institutions (including banks and non-bank intermediaries) are expected to continue to be the largest provider of loans to all three sectors, but could finance a third of these loans through the bond market.

80% of infrastructure debt was raised through infrastructure bonds. The high proportion of bond finance for infrastructure projects and low reliance on bond finance by Chinese corporates has resulted in modelling assumptions for this analysis using an average bond proportion of 47% in the capital structure of renewables project finance and 20% bond share in corporate finance by power utilities.

The current policy push to reduce reliance on the banking sector in China could hasten the development of an ABS market and bond markets

in general. The analysis also suggests that China could have much larger bond markets with greater involvement of SSA actors in the future. International Financial Institutions, and sub-sovereign development banks working in conjunction with policy banks, are seen as having the potential to play a pivotal role in the early development of a green bond market in China. Municipal bond issuance is currently low given the traditional reliance of municipalities on bank loans; this is changing rapidly, however, due to government policy aimed at swapping municipal debt for bonds.

6 Implications for institutional investors



Debt finance has the potential to play a significant role in mobilising additional institutional investors to support the low-carbon investment necessary to meet a 2DS by mid-century. However, bond issuance must occur at a scale, and in a format, that such investors are able to absorb. While other sources of potential bond demand exist, such as from retail investors, banks and corporations, as institutional investor demand has driven the growth of the market to date, it is assumed that this condition would have to endure in order for these levels of issuance to be reached.

Traditionally, bonds have been the asset class favoured by OECD pension funds and insurance companies. In 2013 they invested 53% and 64% respectively of their portfolio in bonds (by simple average)

The forthcoming OECD analysis uses data and estimates on institutional investor assets under management (AuM) to 2035 to assess the scale of green bonds outstanding, relative to total AuM and bond holdings of the three main types of institutional investors, namely pension funds, insurance companies and investment funds. The results suggest that institutional investors in the OECD, whose assets may grow to over USD 120 trillion in 2019 (OECD, 2015d), have the potential to absorb the increasing supply of low-carbon bonds, through shifting asset allocations in response to the increased percentage of low-carbon sectors issuing in to the broader bond markets.

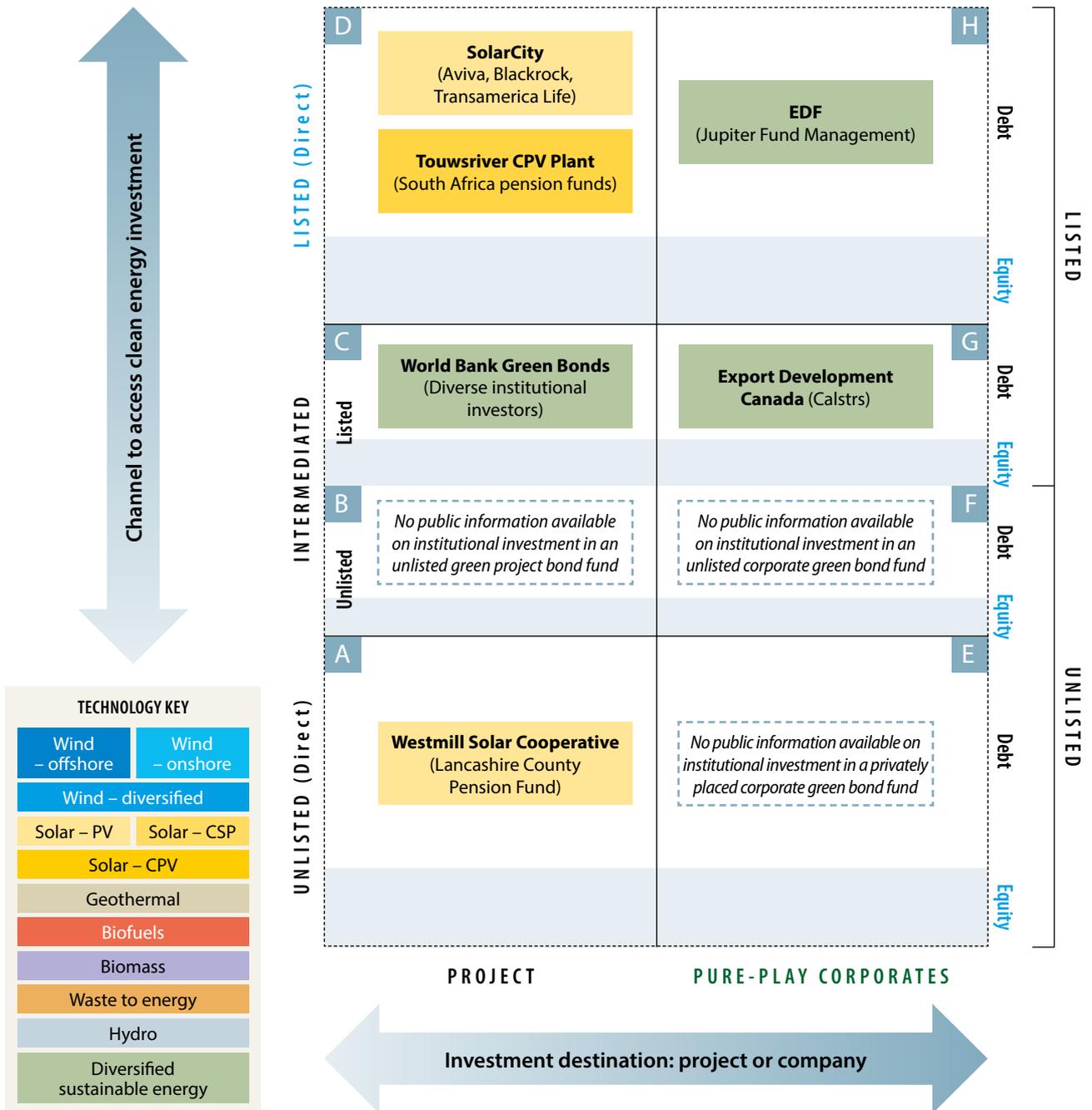
Green bonds appeal to institutional investors for a number of reasons (discussed in Table 1), but can also offer the option to access low-carbon investments across a wide variety of channels. The OECD's Mapping Channels to Mobilise Institutional Investment in Sustainable Energy report (OECD, 2015b) introduced a "matrix frame" (updated and configured to show green bonds in Figure 5), which visualises a range of channels (boxes A-H) that represent typical choices institutional investors need to make when allocating capital to low-carbon investments. Institutional investors consider equity and debt opportunities through a series of lenses (composed of basic investment characteristics).

A first choice is whether the exposure desired is to project, corporates, or both. The investment can be made directly ("in-house") if they have the

capability to do so, or it can be outsourced via an “intermediated” channel such as a fund. Investments can be made on a listed or unlisted basis. Green bonds can theoretically be classified into each of these channels (Figure 5); although in practice a lack of

publicly available information leads to certain channels appearing as currently unoccupied (e.g. while institutional investors anecdotally invest in privately placed corporate bonds, no public record is currently available).

Figure 5. A “matrix frame” to map channels for institutional investment in green bonds

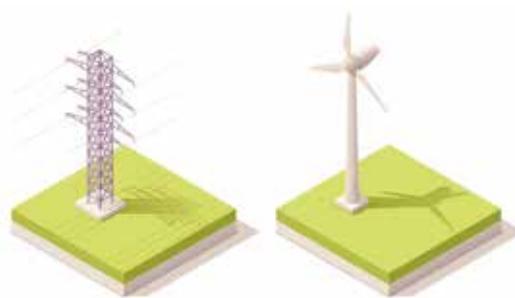


Note: Coloured boxes are examples of green bonds invested in by selected institutional investors (named in brackets where information is publicly available – bonds will have more than these listed investors). Colours represent technologies. Although not shown here, diversified corporates can also issue a green bond where the proceeds are reserved for “green projects or activities.” “Pure-play” refers to entities focused on only one industry or product e.g. a solar PV company.

Source: OECD (2015b; 2016 forthcoming)

7

Barriers to scaling up



The speed at which green bond markets develop and mature hinges on many variables, including policy and regulatory factors (e.g. policies that create the demand for green projects) and market conditions (e.g. interest rate developments and the credit cycle). These conditions will differ across the jurisdictions in which green bonds have been issued; the sub-national, national and regional markets that add up to an investor base of green bond demand with a global outlook.

Additionally, the evolving green bond market faces a range of specific challenges and barriers to its further evolution and growth. Policy makers have a suite of options available to overcome these barriers and help to grow a sustainable green bond market with integrity. The OECD modelling scenarios suggest that if there is a concerted push by policy makers and market participants to develop it, the green bond market can scale up rapidly to raise and finance the debt capital that will be needed for a transition to a low-carbon economy.

Barriers may differ in importance across jurisdictions, with challenges particular to developing and emerging economies, where more fundamental and general actions are needed by governments. For instance, the lack of a domestic debt capital market and other enabling conditions for issuance would need to be addressed in line with longer-term financial market development priorities. While this presents a barrier to green bond market growth it also represents an opportunity for synergy if addressed in tandem (CBI/UNEP Inquiry, 2015).

A common list of barriers to green bond market growth may include:

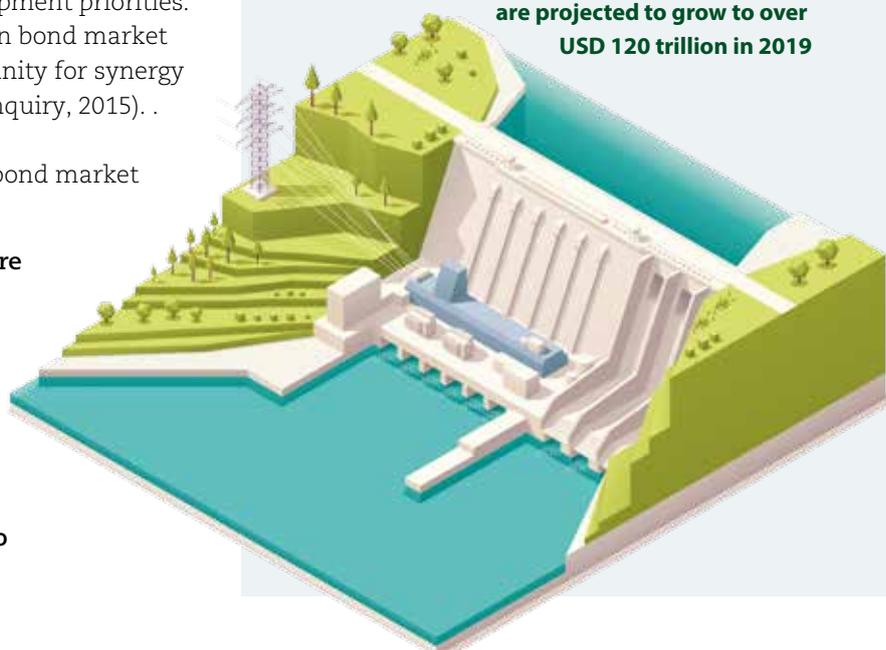
- **Lack of a pipeline of infrastructure projects corresponding to a long-term governmental commitment to low-carbon development;**
- **Lack of commonly accepted green definitions;**
- **Investors with limited capacity to analyse green investments;**

- **Scale and mismatch among projects, bonds and institutional investors;**
- **A lack of suitable aggregation mechanisms; non-standardised projects and cash flow instability;**
- **Low credit ratings for potential green bond issuers and green projects, especially in emerging economies.**

The OECD's forthcoming report will analyse these barriers and provide policy recommendations for governments to facilitate the growth of sustainable debt capital market access for low-carbon and climate-resilient infrastructure.

\$120 tn

Assets managed by institutional investors in the OECD are projected to grow to over USD 120 trillion in 2019



A

Annex A: Methodology for quantitative framework

Methodology: Models were constructed for the four geographic markets and assumption-based scenarios were run to generate the output data. Input data and assumptions for the scenarios relate to investment need and capital structure. Data from current trends in regional financial markets were used to establish benchmark levels of leverage and proportions of bond finance, by type, and for each investment class. The investment data and decomposition by sector are all provided by the IEA. When a level of disaggregation proved insufficient, it was supplemented through a set of global assumptions, e.g. the split between utility scale and rooftop photovoltaics (PV), drawn from a range of sources. Where data were unavailable, assumptions were constructed to simulate values and stress-tested, then validated through consultation with market and industry experts. Consultation and stress testing of the variables and assumptions is ongoing and the OECD welcomes expert interest and input.

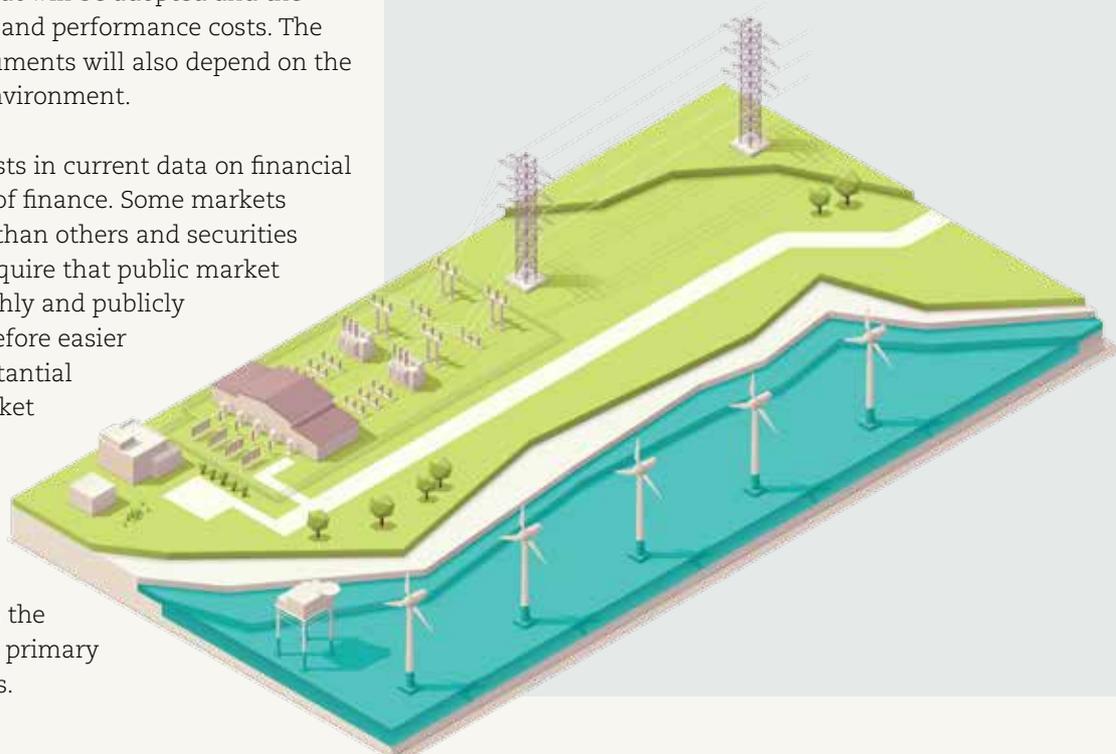
There are three areas of uncertainty in these scenario estimates. First, uncertainty lies in the strength and mix of support policy that will be adopted and the evolution of technology and performance costs. The projections for all instruments will also depend on the regulatory and policy environment.

Second, uncertainty exists in current data on financial structures and sources of finance. Some markets are better documented than others and securities regulations generally require that public market transactions be thoroughly and publicly documented – and therefore easier to analyse, while a substantial portion of financial market transactions are private or un-listed and have limited disclosure of deal specifics. In these cases, third party market analysis is the only option, rather than primary audited financial reports.

Third, financial practices may change. Although traditional financing structures may well continue, waves of financial innovation are often driven by changes in regulation, market preferences, corporate balance sheets, tax structures, financial crises and other factors. The types of financial structures and debt-equity mixes deployed may be profoundly affected by such market shifts. For instance, China's debt markets have experienced challenges and the financial system is undergoing significant change. As such, there are significant uncertainties regarding the future role of bond financing for low-carbon infrastructure. At the same time, the government has prioritised the development of green bond markets (UNEP/PBoC, 2015).

\$40 bn

Annual issuance of labelled green bonds tripled in 2014 to reach USD 36.6 billion, and issuance grew further in 2015 with USD 40 billion issued by November 2015.



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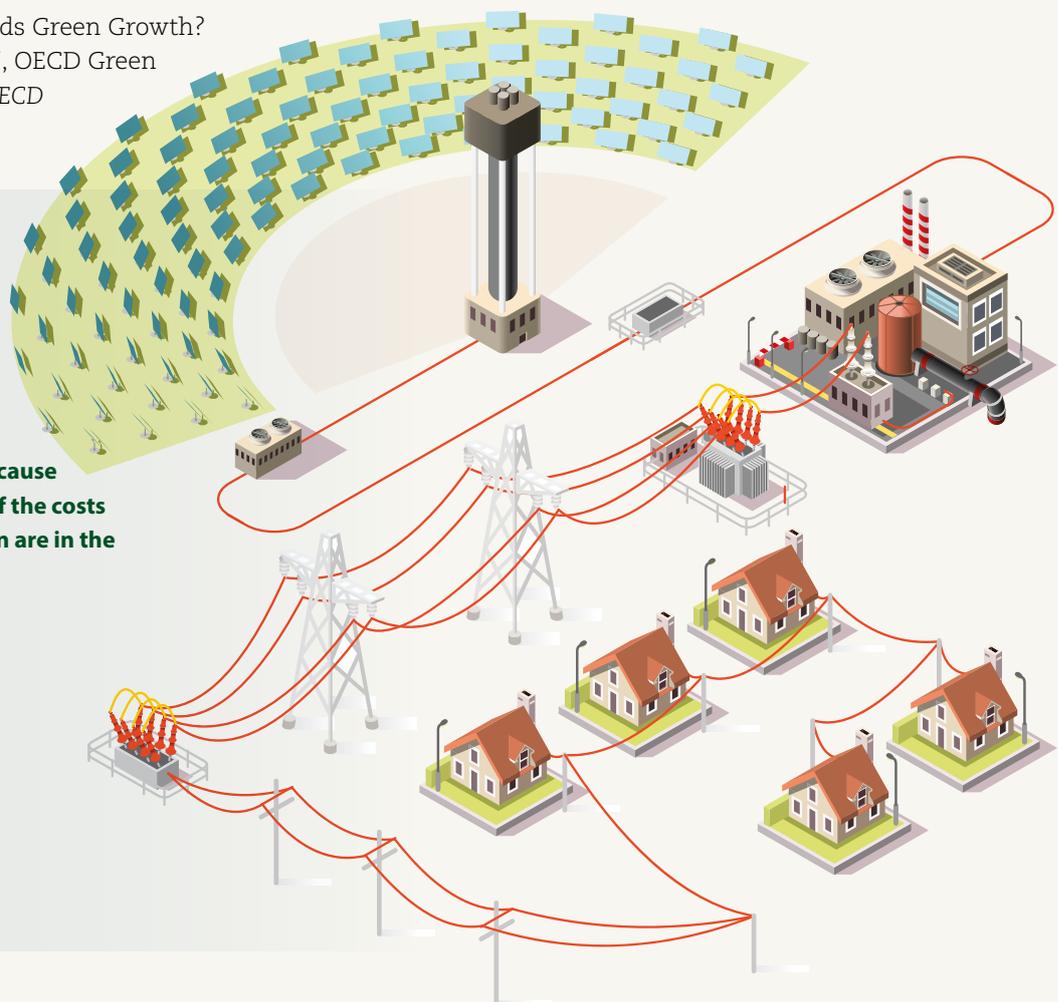
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50-70%

Lowering the cost of capital for renewable energy is important because an estimated 50-70% of the costs of electricity generation are in the financial cost of capital



Notes

1. For instance, as of October 2015, low contracted prices for electricity generated by solar PV energy include USD 58/MWh in the UAE (IEA, 2015), and USD 38.70/MWh in Nevada, United States (PVTech, 2015). Contracted prices do not always reflect the level of current generation costs due to tax advantages or other financial advantages.
2. While nuclear energy is also a low-carbon form of energy, the focus of this analysis is on renewables.
3. As context, the global project finance market for all types of infrastructure included USD 298 billion in loans and USD 55 billion in bonds in 2013 (S&P, 2014).
4. The spread varies across regions and changes due to economic and market conditions. For instance, as of 11/2015 in the UK (broadly representative of EU and OECD markets as London is the most active project finance lending market globally) the all-in cost of a 20yr project loan compared with a project bond of a similar credit quality (e.g. BBB-) may be roughly as follows: Loan: Libor (~250 basis points (bps)) + ~250 bps credit spread (~5%). Bond: "Mid-swaps" (~150 bps) + ~300bp credit spread (~4.5%). Therefore project loans are more expensive than equivalent project bonds reflecting low yields in the mid-swap market (the benchmark for bond pricing). At the same time, demand for investment-grade project debt in the bank market has been high so credit spreads have been declining, making pricing very competitive with the bond market, but only up to 20 years of loan tenor. Typically banks are not prepared to go beyond 20 years, which is where the bond market is more competitive for project financing and re-financing (Source: S&P, interviews).
5. OECD Global Pension Statistics, Global Insurance Statistics and Institutional Investors databases, and OECD estimates.
6. i.e. those bonds that have been issued and have not reached maturity or been redeemed.
7. For instance, traditional bonds of "pure-play" wind and solar energy companies qualify as unlabelled green bonds. Reasons for not labelling bonds as green may relate to concerns of a lack of standardisation in the market, political or stakeholder sensitivities and concerns over restrictions associated with the label.
8. To tag a bond as "green", Bloomberg examines bond documentation and official statements for clear indication of an issuer's intention to both label a bond as green and clearly specify that the use of proceeds advances climate change mitigation or adaptation or promotes other environmental sustainability solutions (BNEF, 2015b).
9. "Working Towards a Harmonized Framework for Impact Reporting" (December 2015), available: <http://www.icmagroup.org/assets/documents/Regulatory/Green-Bonds/20151202-0530-FINALRevised-Proposal.pdf>
10. As of November 2015, 103 institutions representing participants in the green bond market have joined the GBP initiative as members, and 53 organisations have received GBP observer status. The GPB Executive Committee was established at the end of June 2014 and includes representatives from 24 organisations, comprising a distribution of investors, issuers and underwriters.
11. "Green Projects" are defined by the GBP as "projects and activities that will promote progress on environmentally sustainable activities as defined by the issuer (Principle 1) and in line with the issuer's project process for evaluation and selection (Principle 2). The management of Green Bond proceeds should be traceable within the issuing organisation (Principle 3) and issuers should report at least annually on use of proceeds (Principle 4)" (ICMA, 2015).
12. These include green bond funds managed by AXA, SPP, SEB, Nikko, BlackRock, Calvert, Shelton and State Street.
13. According to the GBPs, these broad categories include, but are not limited to: renewable energy, energy efficiency (including efficient buildings), sustainable waste management, sustainable land use (including sustainable forestry and agriculture), biodiversity conservation, clean transportation, sustainable water management (including clean and drinking water), and climate change adaptation.
14. In the case of green bonds, assurance can be provided on the bond criteria, project selection and evaluation, internal processes for tracking proceeds, non-financial data on environmental outcomes, and processes for preparing progress reports.
15. See: http://www.eib.org/investor_relations/cab/index.htm
16. In legal and financial vernacular, green bonds are said to be on a "pari-passu" (Latin for "equal footing") basis to plain vanilla bonds.
17. e.g. Toyota, Fannie Mae, Hannon Armstrong & Renew Financial.
18. OECD is working with Vivid Economics to build scenario models for market evolution.
19. LEV includes hybrid vehicles, plug-in and electric vehicles and fuel-cell vehicles.
20. Other significant labelled green bond and unlabelled climate bond market segments relating to climate change mitigation, climate adaptation and other key areas of environmentally-related investment are beyond the scope of this analysis.
21. OECD analysis based data from BIS, SIFMA, ECB, JSRI, ADB and Goldman Sachs.

For more information:

www.oecd.org/environment/cc/financing.htm

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