

FREE Policy Brief Series

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Foundation for
Renewable Energy & Environment

The FREE Policy Brief series offers a topic-by-topic discussion of issues relevant to the overall mission statement of FREE.

This Policy Brief explores the development and characteristics of the green bond market – a new financing mechanism intended to support investment in sustainable activities.

The Policy Brief:

- Analyzes publically available databases on the green bond market.
- Identifies green bond market macro-trends.
- Characterizes the rapid market diversification.
- Calls attention to municipalities and cities as key players in the green bonds market in the future.

Realizing Infrastructure-scale Finance in the Green Bond Market: Scoping Trends

The 'green bond' market has experienced rapid growth since its 2007 inception by international and multilateral institutions and now represents an \$80+ billion global market. The green bond finance landscape is not only accelerating in terms of issuances but is also undergoing compositional changes such as the entering of municipal and corporate bond issuers in the market. This Policy Brief takes a closer look at the green bond market and analyzes some of its key characteristics. As a scoping study, the Policy Brief is intended to provide insight into the dynamics of the market and uncover possible avenues for future research. Using publically available datasets, an early effort to benchmark the various components of the green bond market is included as well.

Exploring the Green Bond Market

Green bonds steer capital investment towards uses of proceeds that enable a sustained and consistent transition to a low carbon economy (Kidney & Boulle, 2015). Starting in 2007, the European Investment Bank, the World Bank, and the International Finance Corporation pioneered the issuance of labeled green or climate bonds and, since then, the market has experienced rapid expansion and diversification. The direct necessity of capital markets is now increasingly included in discussions to address existing energy and climate change challenges (Croce, Kaminker, & Stewart, 2011; van Renssen, 2014).

The green bond financial instrument offers an additional tool in the toolbox to fund, update, or maintain new or existing infrastructure components. For example, all modern infrastructure, including for instance roads, railways, energy generation facilities and sewer systems, has depended on (a combination) of policy tools and regulation to establish an appropriate investment environment. Similarly, the large-

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scale and centralized energy infrastructure that currently is a key character trait of the modern energy architecture relied on, among others, guaranteed rates of return, interconnection standards, and the overall notion that electricity is a public good to attract and maintain adequate levels of investment (Sovacool, 2011). Various forms of capital steering, including strategies such as credit enhancement, guarantees, tax credits, and real estate concessions are available to policy- and decision-makers to drive and direct investment into areas of urgent policy priority. In particular, a common approach to raise capital for long-term, infrastructure-scale investment is to attract low-cost capital from the capital markets through the issuance of debt.

Overall, green bonds are largely similar to traditional corporate bonds or asset-backed securities. In general terms, to be classified as a green bond, a security's use of proceeds falls within at least one of five eligible sectors: alternative energy, energy efficiency, pollution prevention and control, sustainable water, and green buildings (Kochetygova, Arora, & Juahari, 2014). Simply put, green bonds operate as ordinary bonds, only their proceeds are "earmarked for green assets or projects" (Clapp, Alfsen, Lund, & Pillay, 2016). As such, entities with the authority to issue standard bonds are also able to issue 'green bonds'. This includes issuers such as commercial banks, municipalities, private corporations, and multilateral development finance institutions such as the World Bank and regional and national development banks.

Since its inception, the concept of a 'green bond' has proliferated rather widely. The Climate Bonds Initiative (CBI) notes that 2016 year-to-date issuance (as of November 10, 2016) stands at \$65.4 billion globally with an estimated \$649 billion of climate-aligned bonds outstanding (Climate Bonds Initiative, 2016). Using a dataset from Bloomberg New Energy Finance (BNEF), Figure 1 illustrates the rapid growth pattern of the green bond market.

In addition to its rapid growth, it is also clear that the green bond market has experienced a rapid diversification in terms of both issuers and use of

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proceeds. In particular, corporate and municipal bond issuance now make up a significant portion of the annual issuance of green bonds (Climate Bonds Initiative, 2016). U.S. municipal issuance of green bonds is especially interesting as this section of the market exhibits a particularly high rate of retail investment: up to 50% of U.S. municipal green bonds are purchased by individual investors, largely due to favorable tax conditions for municipal bondholders (Climate Bonds Initiative, 2016).

Green bonds risk profiles often mirror the low-risk, tax efficient yields typically associated with the municipal bond offerings which offer low-cost capital to local government. FREE's PennSEF and the Delaware SEU bond offerings are examples of the use of green bonds in this way. Similarly, a previous FREE Policy Note highlighted a proposal to have retail investors help fund solar energy development. Green bond market observations highlight that strong appetite across the retail investment sector for 'green' projects is present.¹ FREE researchers have, in addition, evaluated the potential of the capital market to drive sustainable energy investment. For instance, Byrne et al. (Byrne, Taminiau, Kim, Lee, & Seo, 2017; Byrne, Taminiau, Kim, Seo, & Lee, 2016; Byrne, Taminiau, Kurdgelashvili, & Kim, 2015) have estimated a \$10 billion investment opportunity for municipal bonds driving urban solar energy deployment. Additional research findings show how such 'solar city' installation (i.e. the widespread application of solar PV in the urban fabric) represents a financially viable strategy in each of the six cities under different financing conditions (Byrne, Taminiau, Kim, Lee, & Seo, 2017).

¹ The FREE Policy Brief Series is available for free at: <http://freefutures.org/policybriefs/>

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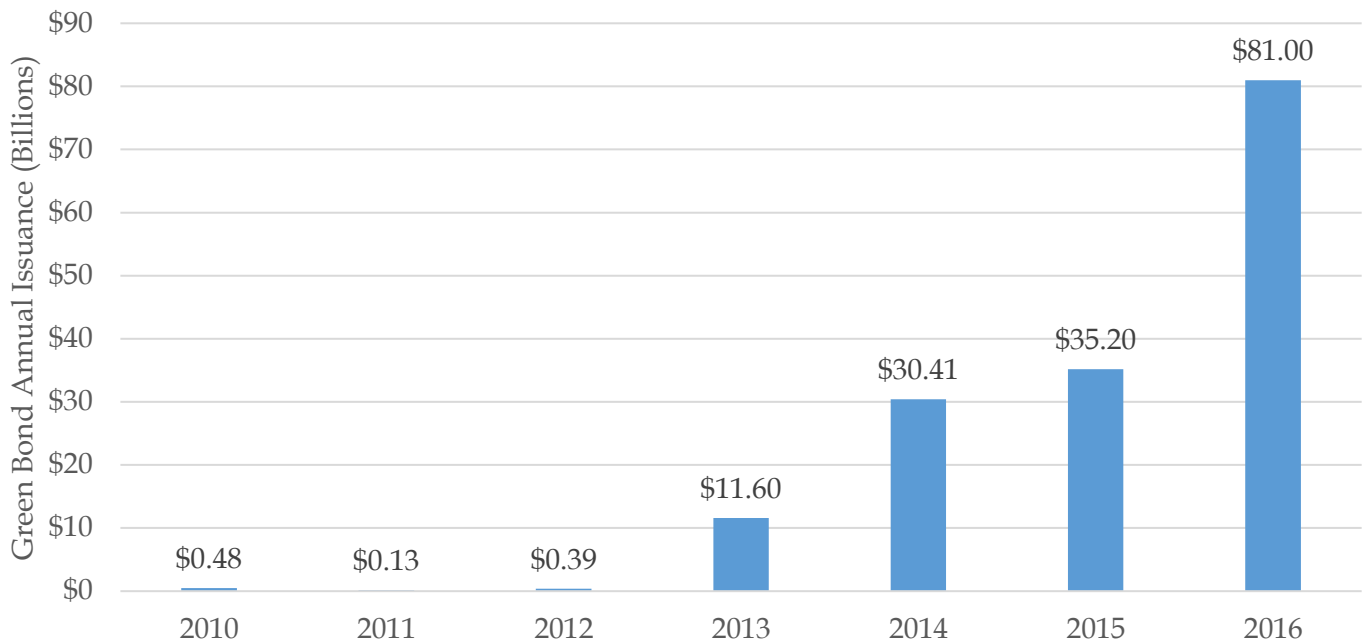


Figure 1. Overview of the growth of the green bond market (*Climate Bonds Initiative, 2016*)..

Green bonds fund long-term capital investments: the CBI found that about 70% of the green and climate bonds in their database have tenors of 10 years or more (*Climate Bonds Initiative, 2016*). Most bonds range from \$100 to \$500 million in issue size (*Climate Bonds Initiative, 2016*) but there is evidence to suggest the issue size is increasing over time (*Kidney & Boulle, 2015*).

As illustrated in Figure 2 using the BNEF database the diversity of the green bond market is such that, out of a total of 542 issuances, most green bonds can be characterized as relying on assets in 'energy' (27% of total number), 'financials' (18%), or 'government' (47%). While this is true by count, the largest bond issuances are characterized by relying on assets in 'technology' and 'utilities'. The average issue size in the 'technology' category, for instance, stands at \$900 million while 'utilities' average a bond issuance of \$637 million.

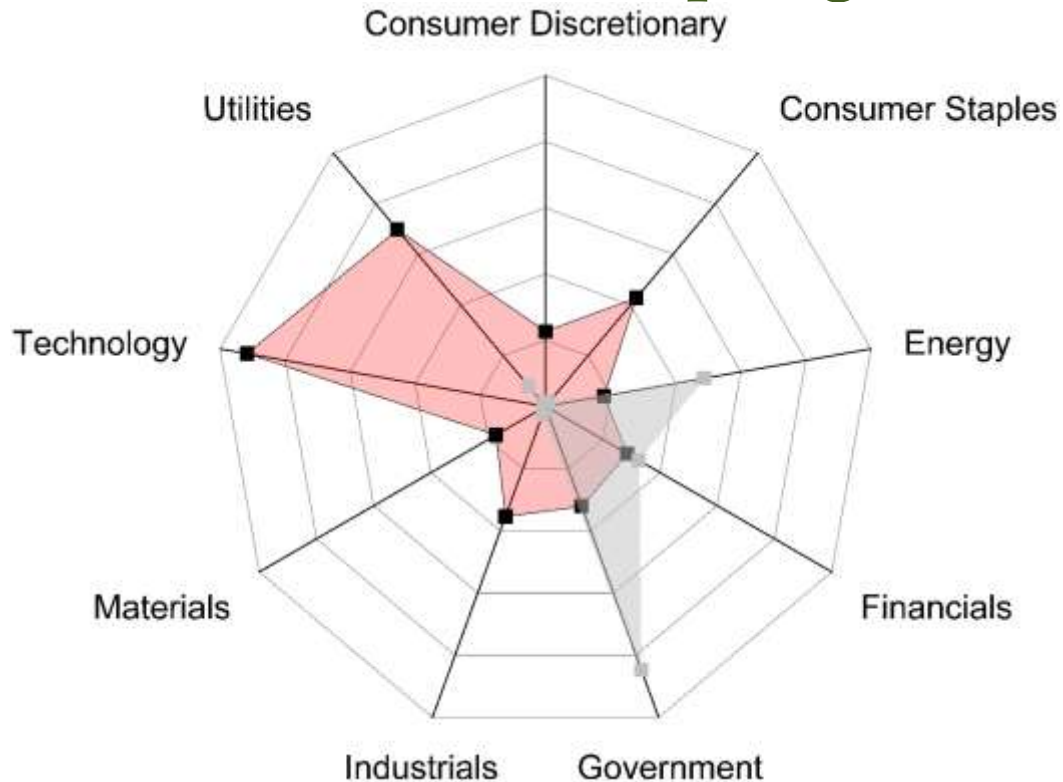


Figure 2. Characterization of green bonds by count (light gray) and by average issue size (light pink).

A similar characterization effort can be done for the average and maximum length of the bond financing (the maturity of the bond). As illustrated in Figure 3, average maturity is longest in consumer discretionary (10.5 years), government (7.4 years), utilities (7.3 years), and energy (7.2 years). In contrast, the longest maturities are found in financials (32 years), government (30 years), and consumer discretionary (24 years). This provides the insight that while technology bonds on average are the largest, they are relatively short-term compared to some of the bonds in the other sectors (Figure 3).

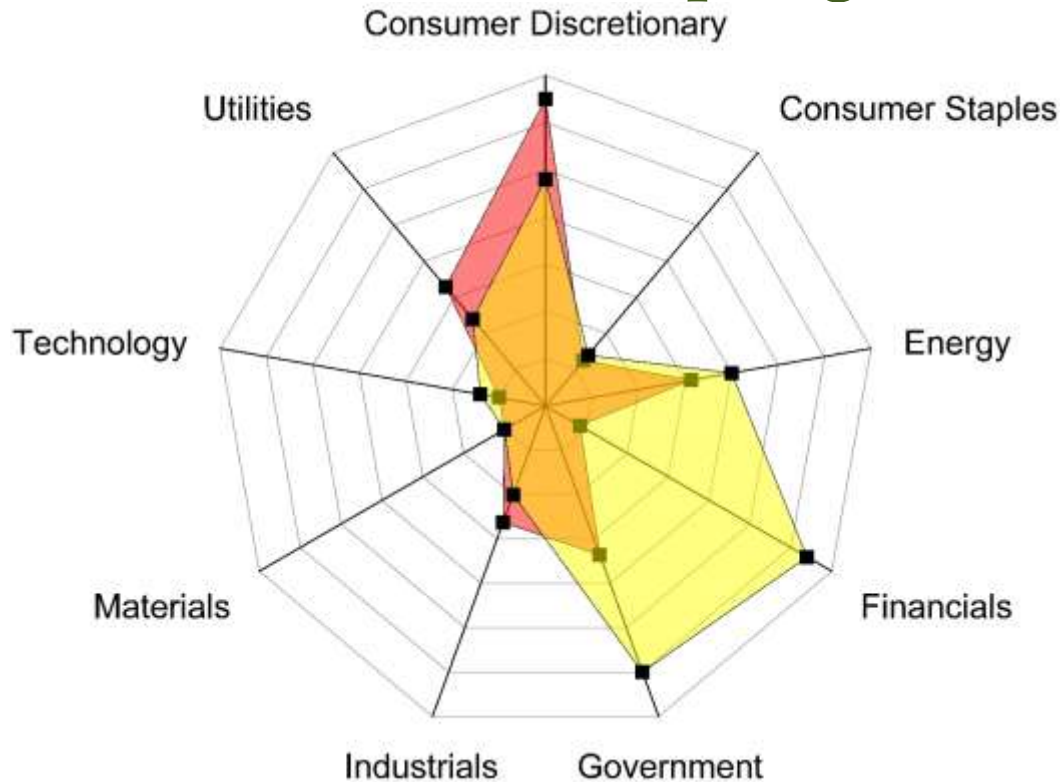


Figure 3. Characterization of green bonds by average maturity (light red) and by maximum maturity (light yellow).

Finally, to get a sense of the use of the green bonds, it is useful to look at the use of proceeds. The CBI notes that the transport sector is a principal target of climate funds (Climate Bonds Initiative, 2016), while the Barclays MSCI Green Bond Index suggests that green bonds primarily support energy efficiency and renewable energy (which can include transport) (Figure 4). However, it is important to note that the use-of-proceeds categories are not mutually exclusive and that a single issuance of green bonds may often fund multiple projects across multiple categories.

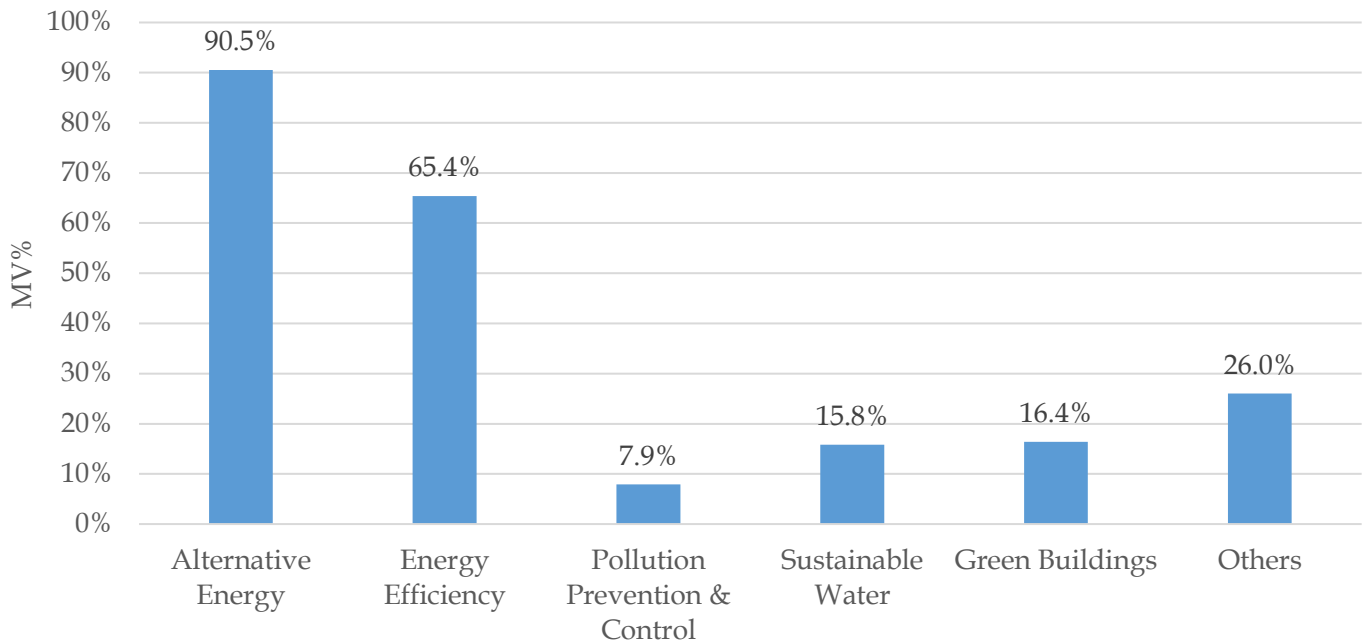


Figure 4. Green bond index use by proceeds. Source: the Barclays MSCI Green Bond Index 2015.

Concerns Related to the Green Bond Market

Several key concerns have been voiced regarding the green bond market. Early concerns pointed to aspects common to a fledgling market: the small size of the market, low liquidity and short maturities. However, as outlined above, the continuing growth of the market likely has reduced some of these concerns.

The most prominent concerns are whether a 'green bond' can justifiably be called 'green' (Wood & Grace, 2011) and whether this nomenclature is significant to investors (Clapp et al., 2016; Institutional Investors Group on Climate Change, 2011). While the debate to pin down a definitional expression of what constitutes, exactly, a 'green bond' continues, some argue that this effort is less productive compared to an open and dynamic approach where definitions and standards are in a continuous process of adjustment (Inderst, Kaminker, & Stewart, 2012). Standards and definitions have been put forth by market players and independent observers and second-opinion frameworks have been established to judge the quality and green character of green bond investments (Clapp et al.,

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2016; Ehlers & Packer, 2016). External review of the principles of the green bond issuance is done by second-opinion providers such as CICERO, Deloitte, EY, KPMG, Oekom, Sustainalytics, and Vigeo, but a potential limitation of this approach is that this review only takes place at the time of issuance (Ehlers & Packer, 2016). Monitoring of ex-post changes could be a useful way to further confidence in the green bond market (Ehlers & Packer, 2016).

It is also, perhaps, not a sufficiently distinguishing feature – green bonds are functionally the same as regular bonds. As such, the expectation is that investors are unwilling to pay a premium for the ‘green’ label or expose themselves to additional risk (Institutional Investors Group on Climate Change, 2011). Some evidence exists, however, that points to the potential of the green bond market to be a more attractive choice compared to regular bonds. For instance, Ehlers and Packer (2016) note that “using hedged returns, green bond indices have so far exhibited a financial performance that is in general superior to a broad bond market index”. On top of that, Mercer (2011) highlights how investors’ asset allocations will need to come to grips with the prospect of climate change: traditional processes of strategic asset allocation in portfolio management currently fail to take climate change into account and will need to be revamped. Also, considering repayment is tied to the issuer, as opposed to the success of the project, comparative non-repayment risk should be equivalent to when the issuer would issue a regular bond (KPMG, 2015).

In addition, the green bond market has been postulated to be particularly attractive to institutional investors because risk-return profiles of bonds are in line with their appetite, transaction volume size is sufficiently large to accommodate their investments, and bonds are highly standardized financial instruments and as such come with low transaction and processing costs (Croce et al., 2011; Inderst et al., 2012). Considering the significant share of assets under management by institutional investors – a 2009 estimate puts it at over \$65 trillion (Croce et al., 2011) – green bonds might represent a sufficiently attractive pull to further the market.

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Future Analysis of the Green Bond Market to Strengthen the Operation of FREE's Programs

As the green bond market continues its growth pattern – showing an annual compound growth rate of 50% annually since its inception in 2007 (Pham, 2016) – it will remain an attractive avenue for potential FREE project development and implementation. As mentioned, the FREE sustainable energy finance (SEF) model is an iteration of the green bond concept and future deployment of this model in Pennsylvania and elsewhere can benefit from lessons learned in the green bond market overall. As such, this brief scoping study can be seen as a starting point for further analysis of the green bond market and extraction of lessons learned and best practices. These lessons learned will be incorporated in the research expertise of FREE as well as in the project design and execution of future FREE projects.

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The Policy Brief Series is drafted by the FREE research team (<http://freefutures.org/about/free-team/free-research-team/>). For more information, contact FREE Research Principal Dr. Job Taminiau (jt@freefutures.org).

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