Chapter 11

Bond Financing for Renewable Energy in Asia

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Chapter 11

Bond Financing for Renewable Energy in Asia[41]

Thiam Hee Ng[42]

Abstract

Energy needs in Asia are huge. Meeting these needs in a sustainable way will require a shift in investment away from fossil fuels towards renewable energy sources. Significant upfront costs and long payback periods of renewable energy projects have often discouraged investors from financing these projects. With government finances already overstretched in many countries, the public sector will find it hard to meet the large financing needs of renewable energy. Improving the financing mechanisms for renewable energy projects is essential to lower the financing cost and make the transition towards renewable energy more affordable for investors, governments, and consumers. The large pool of investable funds available in Asia suggests that the private sector can play a major role in providing financing. With heightened interest in investing in renewable energy, there is a large pool of potential investors. To attract these investors however, the investment will have to be packaged in a form that they are familiar with, which has traditionally been through bonds.

Keywords: Bond financing, renewable energy, Asia

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1. Introduction

Energy needs in Asia are huge. The Asian Development Bank (ADB) (2013a) estimates that Asia's share of world energy consumption will rise from around a third in 2010 to more than half by 2035 if consumption continues on its current growth path. The use of renewable energy (RE) will increase by 50% over this period but will account for only 13% of total energy supply in 2035. To ensure that the growing energy needs of Asia can be met sustainably, energy sources have to diversify from fossil fuels towards RE. Greater use of RE can result in lower cost through improvements in the learning process and reaping benefits from greater economies of scale.

Across the globe, investment in RE is gaining momentum. The Frankfurt School–United Nations Environment Programme Centre (2015) estimates global investment in renewable power reached $270 billion in 2014. This was driven by large installations of solar energy plants in the China and Japan, which totalled $75 billion. While initially, developed countries were the investors in RE, investment in developing countries has grown at a faster pace. In 2014, investment in RE in developing countries was almost on par with that of developed countries. The country with the largest investment in RE was the PRC at $83 billion, which is more than double the $38 billion investment in the United States.

Asian countries have stepped up their investment in RE and we have also seen a substantial increase in the use of RE. India and the PRC have both expanded rapidly their wind power capacity. Data from the Global Wind Energy Council (2014) shows that as of end 2014, the PRC already had the largest installed wind power capacity at 115 gigawatts (GW) or slightly less than a third of the global total. The PRC has also been ramping up its installation of solar power capacity in the face of declining prices for solar panel.

It is clear that RE has many environmental and social benefits. These include very little carbon emission, no air pollution, stable energy costs, and a more resilient energy system. Further, the cost of RE technology has also been falling rapidly. The International Renewable Energy Agency (2015) finds that wind and hydropower are already cost competitive with conventional fossil fuel plants. The fall in solar panel costs also means that solar photovoltaic technology is getting closer to being cost competitive. As technology improves, the cost of RE is expected to fall further. Further advances in energy storage could further encourage the deployment of RE. Heal (2009) highlighted the importance of developing energy storage technology to overcome the intermittent nature of RE. Without

sufficient improvement in energy storage, it will be difficult to have a large proportion of energy generation from renewable sources such as wind and solar.

There has been a lot of attention aimed at facilitating greater adoption of RE. Some examples of existing policies include stricter environmental measures, emissions trading systems, and taxes on polluting industries. No doubt these policies have an important role to play in fostering the development of the RE sector. However, at the same time, there is also need to look at the financing aspects of RE projects.

The constraint for adopting RE now lies more in the availability and cost of financing. While the flow of financing for RE has grown, much more investment is needed. Zadek and Zhang (2014) argued that financing for RE has lagged behind what is required and argued for stronger intervention in the financial system. There is still a lack of clear strategy on how to raise the financing needed for RE investment. Most RE projects have a large initial cost and very small operating cost. This means that RE projects will require large and long-term financing. The availability and cost of financing will play an important factor in whether an RE project is viable. Improvements in financing can lower the cost of RE projects. The lack of operating costs means that increasing emphasis is on the financing costs. Improving the efficiency of investments can ensure that RE projects become more affordable and can promote its spread.

This chapter will explore briefly the various financing options available for RE. It will then examine the trends and developments in using bonds to finance RE projects. There has been some success with corporations in Asia with RE operations, particularly in the PRC, which have been able to raise large amounts of funds in the domestic bond market. This chapter will also chart the growing popularity of 'green bonds'.

2. Financing options for renewable energy

The large upfront costs and long payback period of RE projects mean that availability and cost of financing play a critical role. Without the proper financing framework, the necessary investment in RE may not take place. Funds may flow towards conventional sources of energy where risk is lower. Lack of financing can also deter the much-needed investment in the RE sector. Morgenthal et al. (2009) documented that in the aftermath of the global financial crisis, there was a large drop in investment in RE. This underlined the close link between the financing environment and investment in RE.

There are several financing channels that RE projects can avail. These include multilateral development banks, government, and private investors. Financing is crucial to ensure that RE investments are undertaken. Ekholm et al. (2013) warn that lack of financing can constrain the region's ability to meet its RE investment target.

Within Asia, multilateral development banks such as the World Bank and ADB have provided technical assistance and financing for RE projects. These institutions offer market-based financing and concessional financing at below market rates for low-income countries. They have been very active in facilitating RE investments in Asia. Currently, the multilateral development banks have a significant role in financing RE projects in developing countries. In poorer countries, Spratt and Griffith-Jones (2013) argued that support from outside such as that from multilateral banks is needed to help facilitate private sector financing of RE investments.

ADB has undertaken strong efforts to combat climate change in Asia. Promoting RE is part of this effort. ADB has been working to increase the amount of RE utilised in the region. It has focused on promoting the use of advanced technologies to increase energy efficiency. At the same time, ADB is also working to raise the share of RE in the energy mix. In 2013, ADB invested $2.3 billion in clean energy. This continues ADB's strong track record in clean energy. Its investment in clean energy has consistently exceeded the $2 billion target since 2011. Most of ADB's clean energy investments go into RE, which reached $1.4 billion in 2013. Most of ADB's support for RE went into solar and wind projects, but it also invests in hydroelectric projects. Further, it has included clean energy in its projects and has helped facilitate financing to help reduce the cost of clean energy projects. ADB launched the Asia Solar Energy Initiative which aimed to produce 3GW of solar-generated electricity in 2010. To achieve that goal, ADB planned to invest $2.25 billion and leverage an additional $6.75 billion in solar power investments. In the wind sector, it launched the Quantum Leap in Wind Initiative to produce 1GW of wind-generated energy.

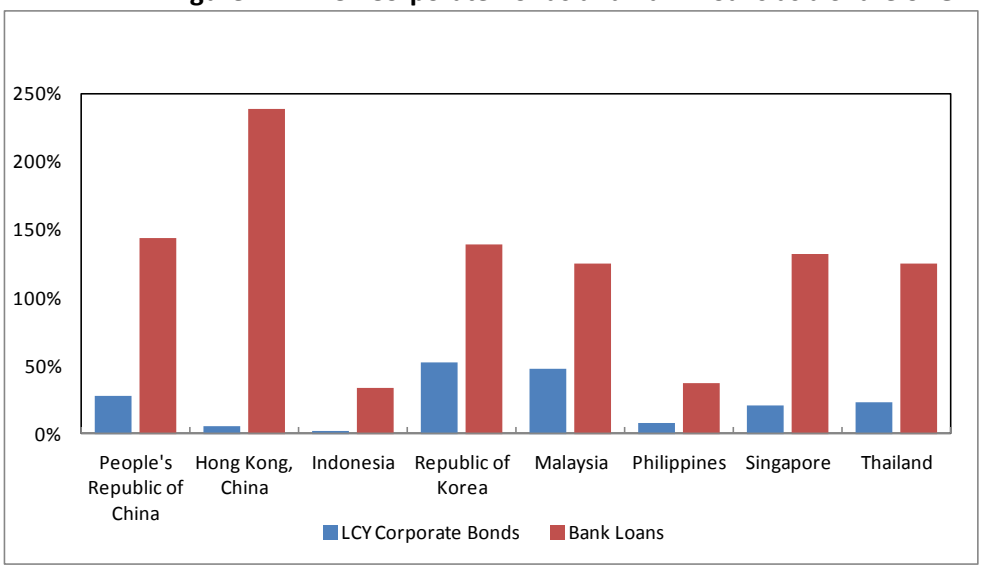
Governments can also play an important role in supporting the financing of RE by offering subsidies to cover RE projects' higher costs and putting in place a regulation that reduces the risks of RE projects. Public authorities can also provide financing for renewable projects that are cheaper than commercial terms. This can be either soft loans from public financial institutions or loan guarantees. However, given that government finances are already overstretched in many developing countries in Asia, it is unlikely that the

government can act as the direct financier. However, governments can put in place the proper policies and regulations that can attract financing from the private sector, both domestically and internationally.

As government finances are already overstretched in many countries in Asia, it is unlikely that the public sector will be able to take on the additional burden to finance the large investment needed for RE. In Africa, Gujba et al. (2012) saw international donors and governments playing a more important role in financing. But the large pool of investable funds available in Asia suggests that the private sector will play a major role. The appeal of investing in developing countries has been increasing. Their growth performances have been outpacing that of developed countries by a considerable margin after the global financial crisis. In addition, some of the Asian countries also have natural advantages in terms of RE potential. Having a relatively less developed conventional energy sector could also be an advantage as it has the potential to leap frog to a more modern technology without having to deal with the sunk cost of previous investments.

In Asia, the banking sector is the main source of financing. Banks dominate the financial sector and are usually larger than the bond market (Figure 11.1). There are several ways that banks could finance RE projects. This could be through loans, project loans, mezzanine loans, and refinancing. A typical corporate loan has no restrictions and could be put to any use. The lending would be based on the overall health of the company. Project finance is also becoming more popular. In this case, the funding is meant for a specific project. This means that the loans are only secured by the project asset and serviced by the revenues from the project. Banks can also provide mezzanine loans which are subordinated loans meant to serve as supplementary financing. This tends to be a riskier lending that lies in between secured debt and equity. As mezzanine loans are riskier, they usually have higher returns.

Figure 11.1: LCY Corporate Bonds and Bank Loans as a Share of GDP*



* GDP = gross domestic product; LCY = local currency.
Note: Data as of end of December 2014.
Sources: International Monetary Fund's International Financial Statistics; Haver Analytics, CEIC; Bloomberg L.P.

While banks are likely to continue to play an important role in financing RE, the new Basel III regulations could make banks more reluctant to lend long term. The new Basel III rules aim to ensure that banks have liquid and high-quality assets so that they can better ride out periods of stress. Hence, Basel III introduces new liquidity requirements for the first time. These liquidity requirements tend to penalise long-term loans for which there is no active secondary market. RE project loans tend to fall under this category and will likely find it harder to access bank financing. It will also likely raise the cost as well. Although banks still have some time to implement the new Basel III regulations, they may have started cutting back already on long-term lending as these loans will still likely be on their books when the Basel III regulations come into force.

Banks in Asia have relatively little experience in financing RE. Renewable technology requires higher level of technical skills to evaluate that banks do not possess. Further, the limited track record for RE projects makes it harder to evaluate. By its nature, RE projects tend to have large upfront costs and long payback period, which may make them less attractive from the perspective of bankers.

This suggests that the bond market may become the preferred source of financing for RE projects. If banks are becoming less likely to lend to projects, borrowers might turn to the bond markets. There are many similarities between RE project financing and

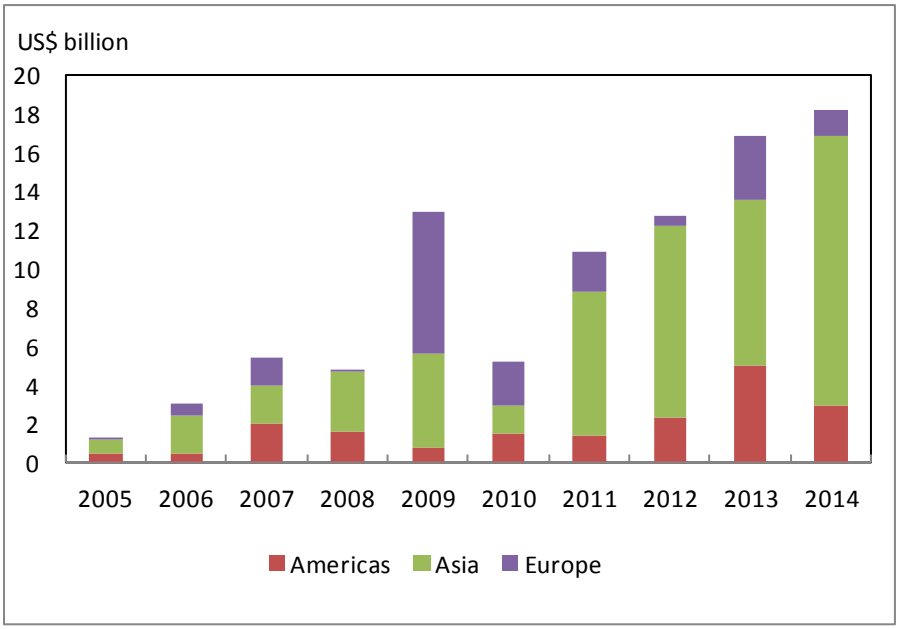
infrastructure project financing. ADB (2013b) highlighted that bonds have large potentials in financing infrastructure projects in Asia.

3. Bond financing for the renewable energy sector

Given heightened interest in investing in RE, there is a large pool for potential investors. However, to attract these investors, the investment will have to be packaged in a form that investors are familiar and comfortable with for them to invest. These large investors such as pension funds and sovereign wealth funds have traditionally allocated a large proportion of their portfolios to bonds. There is a huge pool of investment assets available. Nelson and Pierpont (2013) have estimated the pool of institutional assets globally at around $80 trillion. The development of bond markets for RE is also supported by the general trend towards increased investor interest in environmentally friendly 'green' projects.

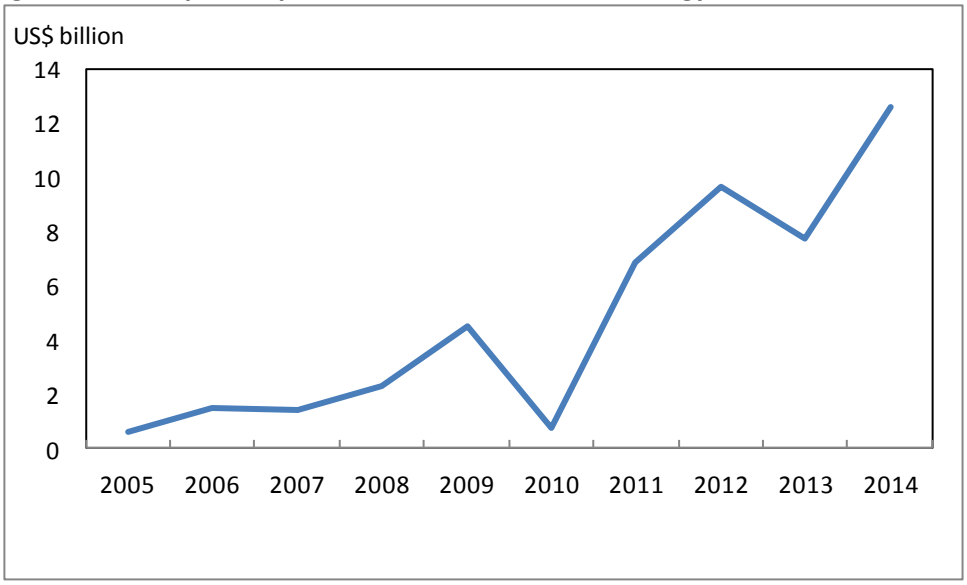
Globally, renewable sector bonds have been increasing rapidly. Since 2010, total bonds issued by RE corporations have increased from $5.2 billion to $18.3 billion (Figure 11.2). Asia has been leading the way in using bonds. However, almost all of the renewable sector bonds in Asia have come from the PRC (Figure 11.3). In 2014, 90% of Asia's renewable sector bonds came from the PRC. This is consistent with the overall trend of increasing investments in the RE sector in developing countries. Zadek and Flynn (2013) found that about half of global RE infrastructure investment in 2012 came from developing countries, with the PRC accounting for the bulk of it. Strong government support and a large financial sector facilitated the rapid expansion of RE in the PRC.

Figure 11.2: Renewable Energy Sector Bonds by Region



Source: Bloomberg L.P.

Figure 11.3: People's Republic of China's Renewable Energy Sector Bond Issuance



Source: Bloomberg L.P.

One reason why Asia has been leading in RE bonds is that Asia has a large pool of funds available for investment. Overall, Asia remains a capital surplus region. In particular, the PRC has a high savings rate and a large current account surplus. At the moment, much of the surplus capital from Asia is invested in low-yielding assets in the developed world. There is great potential to invest some of those funds in the RE sector.

Being more familiar with the region might lead to Asian investors assessing the risks and returns on RE projects in the region differently from investors from advanced economies. As domestic and regional investors have greater knowledge and experience of the situation on the ground, they may be able view risk differently from international investors. Another point in favour is that domestic investors do not face exchange rate risk, which could be an important factor for international investors.

Better knowledge of local conditions may make domestic investors more willing to finance RE projects. Local investors are usually better able to assess the complicated risks of building and delivering RE projects. Better understanding of domestic regulations could also be an advantage to domestic investors. This is especially true in Asia where environmental regulations and incentives for investment in RE are evolving quickly. Being closer to the regulators may also provide domestic investors better opportunity to take advantage of investment opportunities opening up.

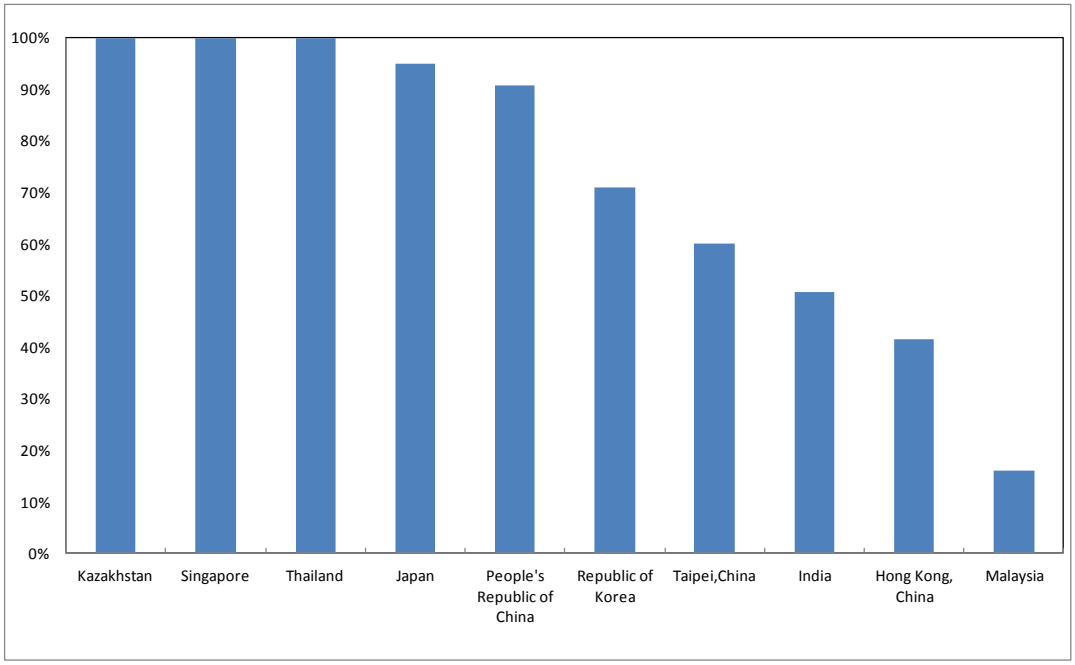
In many developing countries in Asia, bringing down the financing cost for RE is important. Having underdeveloped financial markets, the cost of financing tends to be higher in many Asian countries. The higher upfront costs for RE projects also have a greater competitive disadvantage when compared to conventional projects.

Accessing foreign debt could be seen as a way to bypass the inefficiency of local financial markets. But this comes at a price as international debt tends to be priced in foreign currency, usually in US dollars. So, taking on foreign debt would usually mean taking on exchange rate risks as the revenue from the RE projects would be in domestic currency. The foreign exchange rate risk could be hedged but it would then probably offset most of the benefits in terms of lower yields.

The good news is that there are growing local currency bond markets that can help finance large infrastructure projects in Asia. Having a well-functioning and liquid local currency bond market can help these investors finance their activities. In Asia, economies with well-developed bond markets have been able to mobilise large amounts of funds. So

far, most of the RE sector bonds in Asia are being issued in local currencies (Figure 11.4).

Figure 11.4: LCY-denominated Renewable Energy Bonds as Share of Total



LCY = local currency.
Note: As of end 2014.
Source: Bloomberg L.P.

One example of a recent RE company issuing bonds is Trina Solar Limited from the PRC. Trina Solar Limited is a large-scale integrated solar power products manufacturer, including crystalline silicon photovoltaic modules and solar system developer. In October 2014, Trina Solar Limited issued a total of $115 million convertible senior notes due in 2019. The proceeds will be used for developing new solar projects.

Another RE company that has tapped the bond market is GS Yuasa Corporation. Its business includes the manufacture and supply of batteries, power supply systems, lighting equipment, and other electrical equipment. In March 2014, GS Yuasa Corporation issued a ¥25 billion zero coupon convertible bond maturing in 2019.

While concerns about climate change are driving policymakers' attention, businesses also have good reason to be interested in RE. There are increasing expectations that carbon will likely be taxed or charged in the future. Partnership for Market Readiness (2015) documents Royal Dutch Shell, Rio Tinto, and Pacific Gas and Electric Company – companies with large carbon intensive operations – to have been preparing for the time that carbon will be taxed. Companies are also under growing scrutiny about their environmental track record. With government fiscal conditions under growing stress, they

have been encouraged to cut back on fuel subsidies (ADB, 2013). These policies can strengthen the government's balance sheets while at the same time promote growth in the RE sector.

4. Rising interest in green bonds

While RE companies have been active in issuing bonds, the proceeds from the issuance need not necessarily be used for green projects. A recent innovation is the development of green bonds where there is a commitment by the issuer for the proceeds to be used for projects with environmental benefits. Most green bonds issued so far have been used to finance climate change mitigation or adaptation, including clean energy, energy efficiency, mass transit, and water technology. Green bonds can be either plain vanilla treasury-style retail bonds (with a fixed rate of interest and redeemable in full on maturity), or asset-backed securities comprising several green projects. Most green bonds issued are 'use of proceeds' bonds where the funds raised from the bond issuance are earmarked for green projects. While the proceeds can be used only for green projects, the bond is backed by the entire assets of the company issuing the bonds.

The growing interest in investing in green bonds is due to the growing interest of investors in investing according to environmental, social, and governance (ESG) criteria. The United Nations' Principles for Responsible Investing Initiative lists more than 1,000 investors as signatories, representing about $45 trillion in assets under management. In January 2014, a group of financial institutions launched the Green Bond Principles, which sets out the voluntary process guidelines and clarifies the approach for the issuance of green bonds. Private sector interest was high after seeing strong demand for multilaterals' green bond issuance. Citigroup, Bank of America Merrill Lynch, JP Morgan, and Crédit Agricole were the original backers of the Green Bond Principles. The support has since swelled to 55 underwriters, issuers, and investors as signatories.

The Global Sustainable Investment Alliance (2014) found that assets invested based on sustainable principles have grown from $13.3 trillion at the beginning of 2012 to $21.4 trillion 2 years later. As a proportion of professionally managed assets, the share of sustainable-related investment has risen to 30.2% in 2014 from 21.5% in 2012. However, while the share of assets managed according to sustainable criteria have increased in all regions, it is important to highlight that the share in Asia is very low at only 0.8%, way below

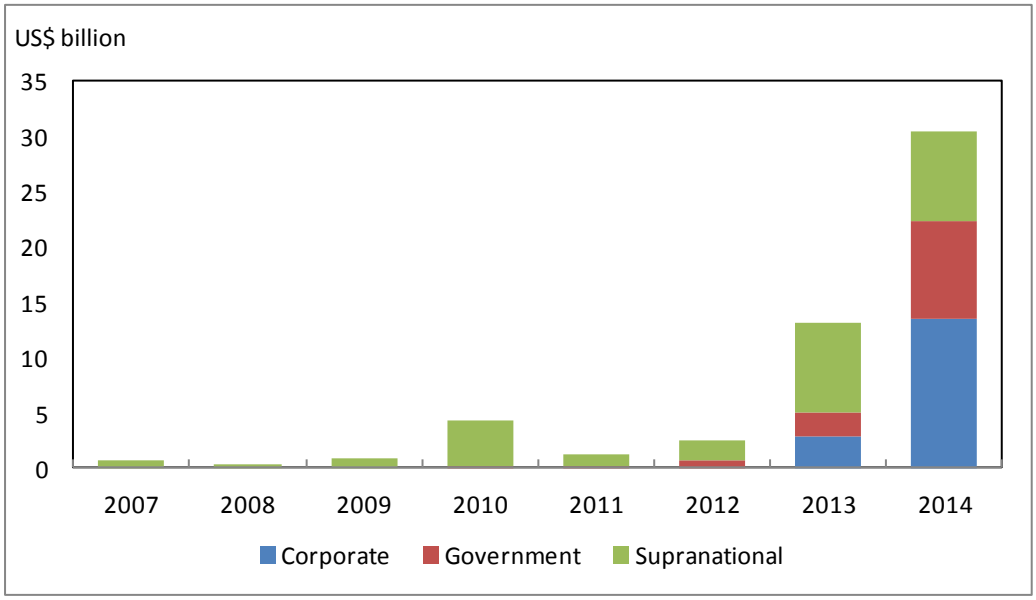
the global average and far behind the almost 60% share in Europe.

While the amount of sustainable investment assets is still low in the region, it has been increasing. Between 2012 and 2014, it has grown by 32% to reach $53 billion. Malaysia; South Korea; and Hong Kong, China are the largest markets for sustainable investment. The leading role of Malaysia is due to the large size of the Islamic fund markets there where investment will have to go through screening based on shariah principles.

As awareness in sustainable investing continues to grow, it is expected that the share of sustainable investment assets will rise substantially. There have been strong moves to urge institutional investors to divest their investments in companies involved in fossil fuels. The Association for Sustainable and Responsible Investing in Asia (2014) documented that several new national policies and regulations are facilitating the process. India and Viet Nam have strengthened their corporate reporting requirements for sustainable business practices. Stock markets in the PRC; Singapore; and Hong Kong, China have introduced guidelines on sustainability reporting. Importantly, some public pension funds have taken steps to integrate sustainability principles into their investment decision-making process. As of August 2014, 160 large institutional investors in Japan, including the giant Government Pension Investment Fund with ¥130 trillion under management, have endorsed the 'Principles for Responsible Institutional Investors'. Given the large pool of assets that these funds manage, this initiative could have a significant impact on facilitating greater investment in RE.

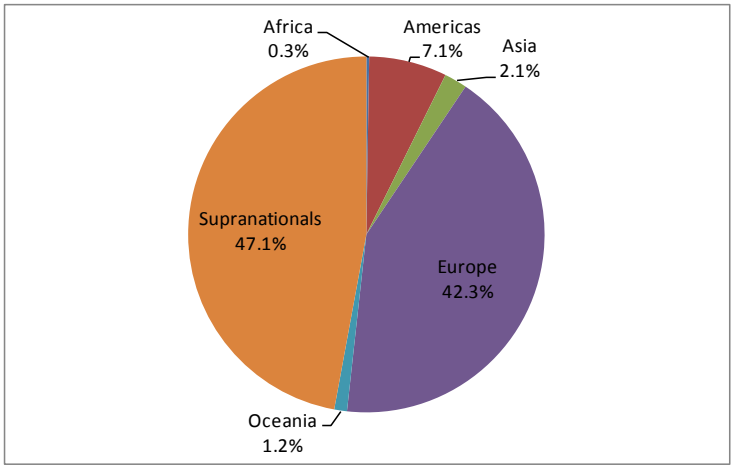
Given the growing demand by investors, it is not surprising that the green bond issuance is surging. In 2014, the total issuance of global green bonds reached US$30.5 billion, more than double the amount in 2013 (Figure 11.5). Most of the green bond issuance has been by 'supranationals', which include the multilateral banks. European government entities and corporations are a close second (Figure 11.6). In Asia, green bonds have been slower to take off. Part of the reason is that there is a smaller pool of assets in Asia that is targeted at sustainable investing. However, it is important to point out that there have been plenty of RE firms that have successfully raised funds in Asia but did not choose to label their bonds as green bonds.

Figure 11.5: Green Bond Issuance by Issuer



Note: As of end 2014.
Source: Bloomberg L.P.

Figure 11.6: Green Bond Issuance by Region, 2007–2014



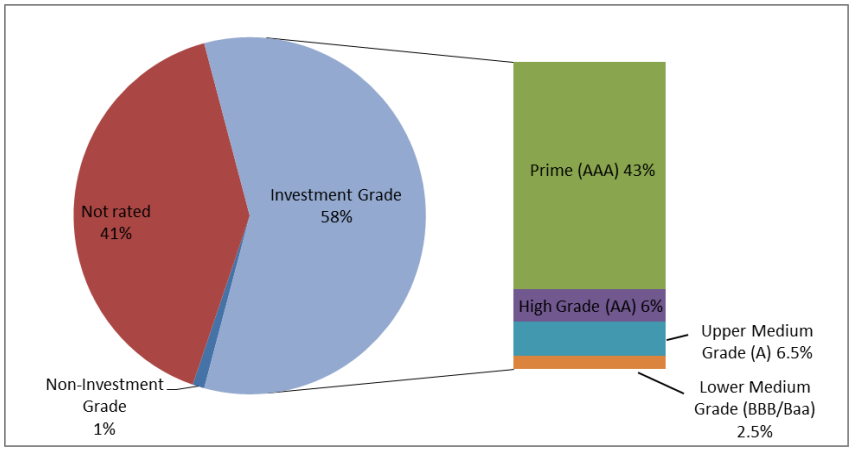
Source: Bloomberg L.P.

Green bonds were first issued by multilateral banks as part of their efforts to combat climate change. They have been well-received and highly rated. The European Investment Bank (EIB) pioneered the first green bond issuance in 2007. To date, EIB is the largest issuer of green bonds with €7.4 billion raised across 10 currencies, of which €4.3 billion were raised in 2014 alone. Most of the funds raised from the issuance of bonds were invested in energy efficiency and RE projects. The World Bank followed soon after, issuing its first green bond in 2008 to support climate change mitigation and adaptation projects. Since then, the World Bank has issued over $7 billion worth of green bonds.

In Asia, ADB sold its first Clean Energy Bonds in September 2010, raising $232 million to support its RE and energy efficiency projects in Asia and the Pacific. This was followed in May 2012 with the second sale of Clean Energy Bonds raising $339 million. More recently, in March 2015, ADB raised $500 million from its inaugural green bond issue, aimed at channelling more investor funds to ADB projects that promote low-carbon and climate-resilient economic growth and development in developing Asia.

The attraction of the multilateral bonds is that they rank equal to the other obligations of the multilateral banks so they have the same AAA credit rating. Institutional investors who are traditional buyers of the multilateral bank bonds are also attracted to them because it gives them the opportunity to invest in environmental projects at little risk. Reflecting the importance of the multilateral issuers, most green bonds have been investment graded, with the bulk rated AAA (Figure 11.7).

Figure 11.7: Green Bond Ratings, 2007–2014

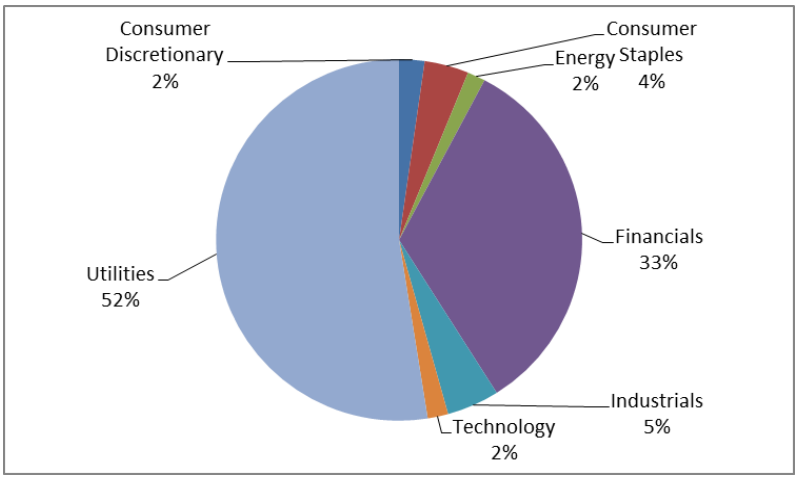


Note: As of end 2014.
Source: Bloomberg L.P.

For corporate green bonds, utilities have been raising more than half of the funds in the green bonds market. However, financial firms are also big issuers (Figure 11.8). Financial firms issuing bonds would earmark the funds raised for lending to environmental projects. Corporate issuance of green bonds is concentrated in the European markets (Figure 11.9). At the moment, Asia has only a very small slice of the corporate green bonds market. There has been limited issuance of green bonds in Asia. Part of the reason is that it is still a relatively new trend in Asia. The benefit of labelling bonds as green is the ability to access a broader range of investors. In particular, this would be able to access investors that have environment and sustainable goals as part of their investment criteria. The

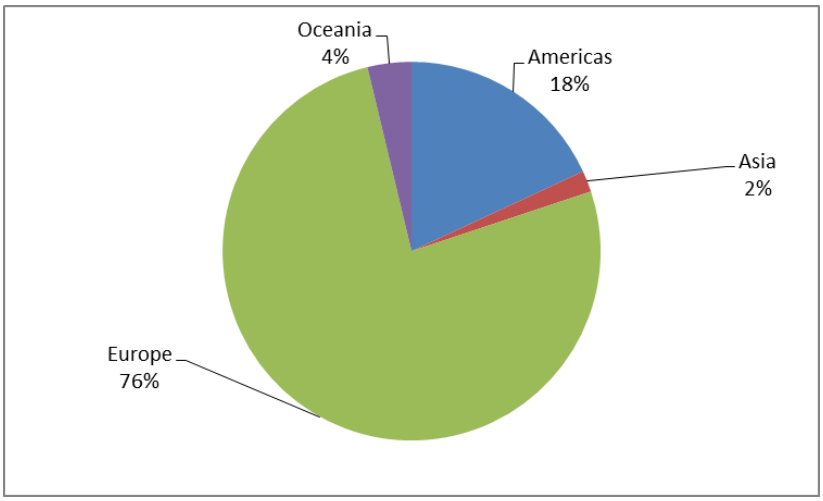
growing pool of such investors (Environmental and Social Impact Assessment, 2014) suggests that there is potential for lower costs and increased liquidity in the green bonds market.

Figure 11.8: Corporate Green Bond Issuance by Industry, 2007–2014



Note: As of end 2014.
Source: Bloomberg L.P.

Figure 11.9: Corporate Green Bond Issuance by Region, 2007–2014



Note: As of end 2014.
Source: Bloomberg L.P.

However, it should be emphasised that the pool of investors in Asia is still very small. Issuers will therefore have to target investors in developed countries. Another important benefit of issuing labelled green bonds is its benefit to the firm's reputation. It is a visible way to signal firm's commitment to environmental goals. However, Lyon et al. (2013) found that Chinese firms that have been lauded for their environmental achievements had not

seen any positive impact on their valuation. This suggests that the halo effect of an environmental firm seems to be limited in the PRC for now.

Against these benefits, there are also additional costs associated with issuing labelled green bonds. For example, there are additional costs for certifying and monitoring the bonds. There is also the risk that investors may seek penalties if the funds are not used for their stated environmental purposes. The lack of a universal standard on what is considered a green bond could make it unclear. And without a proper legal framework, issuers and investors will have to decide among themselves what qualifies as a green bond.

The corporate green bond market is still nascent. So far, there have been only two issuances. The first one was by Advanced Semiconductor Engineering, a provider of semiconductor packaging and testing services based in Taipei,China. In July 2014, it issued a $300 million three-year green bond via its subsidiary, Anstock II Limited. The bond yielded 125 basis points above US Treasuries, which is roughly comparable with that of the company's bonds. The bond issue was met with strong investor interest, with most of the bonds taken up by Asian investors.

In 2015, Asia's second corporate bond was issued by YES Bank from India, which is India's fifth largest private sector bank. In February 2015, YES Bank raised 1,000 crores ($156 million) through a 10-year green bond, with the proceeds to be used to finance infrastructure projects in RE. KPMG India will be providing the assurance services annually on the use of proceeds in accordance with the Green Bond Principles.

Green bonds are still a sliver of the overall bond universe at just 0.06% as of end December 2014. But with the right support and policy, there is tremendous potential for green bonds. It is important to ensure that the corporate green bond market develops to ensure that there is a liquid market that can attract new investors to participate. To further facilitate green bond investment, Barclays worked with Morgan Stanley Capital International to introduce a new green bond index that will track the global market for green bonds in 2014. Bank of America Merrill Lynch has also launched a Green Bond Index. These indices will make it easier to track the performance of green bonds in the market. It could also lead to the introduction of passively managed green bond funds that can open up the green bonds market to a larger group of investors.

5. Project bonds for financing renewable energy projects

In addition to 'general use' bonds, there is a growing trend towards using project bonds. With project finance, funds are raised to finance a specific project. The cash flows from that project will be used to cover the servicing cost of the loan. In a project bond, the creditworthiness of the bond is based on the ability of the project to generate the necessary cash flows to cover the servicing cost of the bond and provide a return to the investors. This is contrast to conventional bonds where the issuing firm's entire balance sheet is available for servicing the loan. Therefore, when investing in project finance bonds, investors would have to scrutinise the project's construction costs, operating costs, and revenue to evaluate the payouts.

Project finance can be used to finance large infrastructure projects that might otherwise be too risky or burdensome for a company's balance sheet. With project finance, the lenders provide funding for the project based only the risk and return profile of the project alone. Therefore, the company that develops the project is not liable in case the project fails.

RE investments are similar to long-term infrastructure investments. This means that they would tend to appeal to investors with long investment horizon such as pension funds, which need long-term investment assets to match their liabilities. As in infrastructure projects, most of the risks in RE projects are in the construction phase. Once the project is up and running, the risks are relatively minimal. RE projects have very low operating costs and well-defined stream of revenues if there is a long-term contract or feed-in-tariff.

Tighter prudential regulations for banks brought in after the global financial crisis have made project financing from banks more expensive and difficult to obtain. Long-term loans are riskier and now attract a higher risk weight under the new Basel III regulations. This hurts projects with long-term paybacks such as RE projects. With the payback period from RE projects very similar to that of bonds, it may make sense to package and structure it as a project finance bond. This could be more cost effective than going through a bank.

Another concern that investors may have with RE project bonds is that they may lack liquidity. To get around this problem, we have seen the 'Yield Co' structure gaining popularity in the United States. The Yield Co investment structure is targeted at long-term investors looking for higher yields in the current low-interest rates environment. In the United States where it was first introduced, Yield Co is structured as a public company that

puts together a portfolio of RE assets that is already operating and generating revenue to generate a predictable stream of dividends for the investors. It is also typically structured to avoid double taxation. As the Yield Co invests in RE projects that are already up and running, most of the construction and operating risks are eliminated. It also allows the original project developers to recoup their investments, allowing them to invest in other projects. Yield Cos are usually structured by securitising several different RE assets to make them more liquid. A portfolio of assets is also more diversified and less risky. Structures like this could help attract additional investors to the RE market by lowering the risk and increasing the liquidity. Lowering the cost of capital is essential for RE projects given the higher upfront cost. The first 'Yield Co' was NRG Yield, which raised $500 million in 2014 to finance a wind farm. In January 2015, TerraForm Power issued $800 million green bonds to finance its acquisition of a wind farm.

The success of the Yield Co model suggests that there could be great potential for the securitisation model to help improve liquidity and diversify the risk of RE project bonds. Alafita and Pearce (2014) found that securitisation on solar asset backed securities can help reduce project financing costs significantly. However, for the securitisation model to succeed, it is important to ensure that the securitised security is liquid and easily traded. This means there will need to be a well-developed bond market and some standardisation of the assets. It would also involve having a regulatory framework that allows for the securitisation of revenue streams. Greater transparency and availability of data could also make it easier to attract investors.

6. Policy recommendations for promoting greater bond financing

While the case for financing RE is compelling, there are several key challenges that would need to be overcome to ensure that the financing needs for RE can be met. Bond financing can help attract a new class of investors to finance RE projects. Several economies in the region with large developed bond markets have successfully raised funds for large infrastructure projects. Deep capital markets are important to ensure sufficient liquidity to facilitate the issuance of bonds. In addition, it will be important to develop a pool of long-term investors that can invest in these long-term bonds. One way to encourage broader participation in the bond market is to issue retail bonds to target retail investors who usually do not have the large minimum sum needed to invest in regular bonds. Retail bonds are

typically issued in smaller volumes, which could be attractive to small- and medium-sized companies. This can enable smaller RE companies to also tap the bond market for financing.

Although the government's financing capacity for RE projects may be limited, they still have an important role to play. Regulatory policies can have a strong influence on the financing environment. Lo (2014) found that in the PRC, the government has taken strong actions to promote the development of RE since 2005. While substantial progress has been made, he argued that more needs to be done such as increasing the rate for solar feed-in-tariff and creating more incentives for local governments to pursue energy conservation.

A stable regulatory regime can also work to reduce the risk of investing in RE. Polzin et al. (2015) find that a long-term supportive policy framework for RE goes a long way towards promoting investment in RE capacity. Given the long-term nature of many RE investments, the stability of the policy framework is very important. Fabrizio (2013) found that the US states that have backtracked in their regulations to promote RE attracted less investments. This suggests that policy uncertainty can deter new investments. Abolhosseini and Heshmati (2014) argued that feed-in-tariff could be useful to reduce the risks to investors for RE projects. Supportive policies that are long-term and do not depend on annual budget allocations tend to be favoured by investors.

While bonds offer a promising avenue for financing RE projects, governments may also need to provide incentives to increase the return on RE investment to attract investors. These can be justified by the positive environmental externalities that RE offers. RE projects tend to be at a disadvantage as they have shorter track records and higher upfront costs than conventional energy projects. Further, RE projects may also face higher transaction costs than conventional energy projects. This is because RE projects tend to be of smaller scale than conventional energy projects.

One way to level the playing field for RE projects is to provide guarantees that can reduce the cost of financing. Traditionally, this guarantee has been provided by governments, but it carries a fiscal risk. Hence, the cost of providing the guarantee has to be carefully weighed. Another way would be to set up a dedicated fund to provide low-cost financing for renewable projects. This can help narrow the cost disadvantage. As more RE projects are completed and running, investors may become more comfortable with investing in them and the need for guarantees or low-cost financing will diminish. Tax incentives or exemptions for RE projects can also help reduce the cost differentials.

At the same time, polluting industries with negative environmental externalities should also bear the burden of their pollution. Traditionally, fossil fuel energy sources have not faced the full costs of the pollution they generate. To level the playing field between fossil fuel and RE sources, fossil fuel energy sources should face higher costs. Higher taxes could be imposed on fossil fuel sources to reflect more accurately the cost of the pollution that they cause. This would reduce the return on investing in fossil fuel, thus making RE more competitive.

There is a perception investing in that RE firms is risky. But generally, RE firms are not necessarily riskier. Donovan and Nunez (2012) found that from the perspective of an international investor, the risks of RE firms in India, Brazil, and the PRC are comparable with that of the overall market. The risks from the perspective of a domestic investor are more varied. Indian RE firms have higher-than-average market risk while Brazilian firms have lower-than-average market risk. Meanwhile, Chinese firms have average market risk. To a certain extent, investors may have been underestimating the risk of conventional energy firms. The threat of tighter environmental regulations in the future could severely affect their profitability.

Therefore, an important priority now is to help narrow the information gap for lenders who are contemplating investing in RE. Making data on RE project costs and performance more transparent will facilitate the participation of institutional investors and reduce the cost of financing. Before investing in infrastructure projects, investors typically would like to examine the track record of similar projects. Without historical data on past financial performance, investors may be reluctant to invest because they lack the information to make the necessary estimate of future returns. Making historical data publicly available would improve transparency in the investment process. Governments can also provide more information about the availability of RE from their assessment and mapping of RE resources. This will help investment into the RE sector.

7. Conclusions

There has been tremendous growth in both the labelled and unlabelled RE bonds. So far, most of the labelled RE bonds have come from AAA rated supranationals. The market has to develop beyond those highly rated issuers to embrace other corporations. A wider variety of issuers offering different risks and return trade-offs will help broaden the market.

The use of project bonds and asset-backed securities is also helping to develop the markets.

Asia, as yet, has lagged behind. The PRC has been a big issuer of unlabelled RE bonds. Its success has been due to corporations tapping into a large pool of liquidity. The rise of RE bonds coincides with the strong government support for RE, which resulted in many state-owned corporations investing in the sector. Investors in the Chinese bond markets are less worried about risk because of the perception that bonds in RE have an implicit guarantee from the government.

Going ahead, we expect more RE companies in Asia to tap the bond markets to finance their investments. So far, only a few investors in the region have ESG investment criteria, but the momentum is growing. Large international investors are also keen to invest here given the low yields in the advanced economies. Innovative public private partnerships can help increase the leverage of public funds and make corporate green bonds more attractive to large investors.

References

Abolhosseini, S. and A. Heshmati (2014), 'The Main Support Mechanisms to Finance Renewable Energy Development,' *Renewable and Sustainable Energy Reviews*, 40, pp.876–885.

Alafita, T. and J.M. Pearce (2014), 'Securitization of Residential Solar Photovoltaic Assets: Costs, Risks and Uncertainty', *Energy Policy*, 67, pp.488–498.

Asian Development Bank (ADB) (2013a), *Asian Development Outlook.* Manila: ADB.

Asian Development Bank (ADB) (2013b), *Asia Bond Monitor,* September.

Association for Sustainable and Responsible Investment in Asia (2014), *Asia Sustainable Investment Review 2014:* Hong Kong, China: Association for Sustainable and Responsible Investment in Asia.

Donovan, C. and L. Nunez (2012), 'Figuring What's Fair: The Cost of Equity Capital for Renewable Energy in Emerging Markets', *Energy Policy*, 40, pp.49–58.

Ekholm, T., H. Ghoddusi, V. Krey and K. Riahi (2013), 'The Effect of Financial Constraints on Energy Climate Scenarios', *Energy Policy*, 59, pp.562–572.

Fabrizio, K.R. (2013), 'The Effect of Regulatory Uncertainty on Investment: Evidence from Renewable Energy Generation', *Journal of Law, Economics, and Organization*, 29, pp.765–98.

Frankfurt School–United Nations Environment Programme Centre (2015), Global Trends in Renewable Energy Investment 2015, Frankfurt am Main, Germany: Frankfurt School–United Nations Environment Programme.

Fritz-Morgenthal, S., C. Greenwood, C. Menzel, M. Mironjuk, and V. Sonntag-O, Chal, ironm, *The Global Financial Crisis and its Impact on Renewable Energy Finance*. Nairobi: United Nations Environment Programme.

Global Sustainable Investment Alliance (2014), *Global Sustainable Investment Review 2014.* Global Sustainable Investment Alliance.

Global Wind Energy Council (2014), *Global Wind Report 2014*, Brussels: Global Wind Energy Council.

Gujba, H., S. Thorne, Y. Mulugetta, K. Rai, and Y. Sokona (2012), 'Financing Low Carbon Energy Access in Africa', *Energy Policy*, 47, Supp. 1, pp.71–78.

Heal, G. (2009), 'The Economics of Renewable Energy', NBER Working Paper No. 15081.

International Renewable Energy Agency (2015), *Renewable Power Generation Costs in 2014,* Abu Dhabi: IRENA.

Lo, K. (2014), 'A Critical Review of China's Rapidly Developing Renewable Energy and Energy Efficiency Policies', *Renewable and Sustainable Energy Reviews*, 29, 508–516.

Lyon, T., Y. Lu, X. Shi, and Q. Yin (2013), 'How do Investors Respond to Green Company Awards in China?', *Ecological Economics*, 94, pp.1–8.

Nelson, D. and B. Pierpont (2013), *The Challenge of Institutional Investment in Renewable Energy.* San Francisco: Climate Policy Initiative.

Polzin, F., M. Migendt, F. A. Taube, and P. von Flotow (2015), 'Public Policy Influence on Renewable Energy Investments — A Panel Data Study across OECD countries', *Energy Policy*, 80, pp.98–111.

Partnership for Market Readiness (2015), 'Preparing for Carbon Pricing: Case Studies from Company Experience — Royal Dutch Shell, Rio Tinto, and Pacific Gas and Electric Company'. Washington, DC: World Bank.

Spratt, S. and S. Griffith-Jones (2013), 'Mobilising Investment for Inclusive Green Growth in Low-Income Countries', Bonn: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

Zadek, S. and C. Flynn (2013), 'South-originating Green Finance: Exploring the Potential', Geneva: Geneva International Finance Dialogues.

Zadek, S. and Z. Chenghui (2014), 'Greening China's Financial System: An Initial Exploration', Winnipeg: International Institute for Sustainable Development.