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A comparative study on the role of public-private partnerships and green investment banks in boosting low-carbon investments

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ADB Working Paper Series

A COMPARATIVE STUDY ON THE ROLE OF PUBLIC–PRIVATE PARTNERSHIPS AND GREEN INVESTMENT BANKS IN BOOSTING LOW-CARBON INVESTMENTS

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Abstract

Following the successful climate agreement in Paris, global attention shifted quickly to how countries will achieve their nationally determined contributions. To achieve the goals, governments need to make full use of the private sector capacity to unlock much larger flows of private investment in low-carbon green infrastructure. This paper focuses on two different types of mechanism, public–private partnerships (PPPs) and green investment banks (GIBs). PPPs are more practical for countries that have robust demand, and are complemented by strong institutions and governance, protection of investments, and dispute resolution mechanisms. In contrast, the other options for green investments should use innovative transactions, risk-reduction structures, and market expertise. Although their common objective is to upscale low-carbon investment, both PPPs and GIBs have been established in a variety of national contexts to achieve a range of goals, including access to concessional capital at lower interest rates and longer tenures for green investments. This paper examines the rationale, mandates, and financing activities of these two categories of financial architecture within the context of India and Japan. It provides stocktaking of the actual and potential use of these two approaches, and for strengthening bilateral cooperation between India and Japan.

Keywords: climate change, clean energy, green infrastructure, green investment bank, public–private partnership

JEL Classification: F21, F34, G29, Q28

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1. INTRODUCTION

Following the successful climate agreement in Paris at the end of COP 21, global attention shifted quickly to how countries will achieve their nationally determined contributions (NDCs). Achieving NDC targets requires investments in a range of technologies, projects, and businesses in a variety of sectors, including energy supply and distribution. These investments, often termed “green,” are needed throughout the cycle of innovation and market transformation, from research and development, through demonstration, deployment, and diffusion, to the commercial maturity of technologies and infrastructure projects. Addressing the specific sectoral investment needs and financing the transition are challenging (Anbumozhi, Kalirajan, and Kimua 2018) as it involves several interrelated risks.

According to the Climate Policy Initiative (2017), climate finance reached a peak at \$437 billion dollars in 2015 and then dropped to \$383 billion in 2016, a 12% drop, but the real issue is that demand for finance remains far below estimates of what is required. Furthermore, Treco et al. (2018) estimated that for the energy sector, including energy efficiency improvement in power, transportation, and buildings will require a total over \$1 trillion per year through to 2030 in the emerging economies of Asia. It is encouraging to see increased private sector activity in the maturing markets for renewable energy, and steady public financial support has been key, but funding remains a daunting task. The expected financing needs are large: A review of NDCs and other policies in the Association of Southeast Asian Nations (ASEAN), the People's Republic of China, and India, which represent 37% of global greenhouse gas (GHG) emissions, finds an initial investment opportunity of \$22.6 trillion during 2016–2030 in key energy sectors (Kumar, Anizuzzaman, and Das 2017). Although these estimates refer to levels of investment, most of these resources are intended to flow through the financial sector as bank lending, project financing, institutional investing, or equity investing (United Nations Environment Programme [UNEP] and the World Bank Group 2017).

The largest climate mitigation sector, energy supply, is actually expected to see an overall increase of \$67 billion in investment at the global level. In total, about \$200 billion in additional investment needs to be mobilized annually. This does not include the underlying investment requirements that various sectors would normally need to mobilize for development regardless of Paris agreement commitments. For instance, in the power sector, when the underlying investment requirements are added to additional decarbonization costs, about \$148 billion out of \$432 billion is projected to be green or low carbon, such as for renewables, and carbon capture and storage. In all, 70% of these green infrastructure needs will be in emerging markets and developing economies (Meltzer 2016).

Public finance and international official development assistance can and will play a critical role to jump start, leverage, and guide green investments, but transformational change will inevitably require large-scale private financing. This is because most developing countries have a low tax base, with limited ability of their citizens to pay for the services provided to them, and the government cannot raise the necessary funds through taxation.

However, traditional sources of private financing for green energy infrastructure also face significant financial, regulatory, and structural constraints. Green markets are unable to garner their full potential due to issues such as the creditworthiness and bankability of such projects. Moreover, many banks are reluctant to lend to the green energy sector because many technologies in this sector are new and hence financiers

consider them risky (Anbumozhi and Rakhmah 2018). Especially in Asia, where banks dominate the financial markets and capital markets are tiny, this is a major challenge. Thus, there is a critical need to develop new financing instruments (Yoshino and Taghizadeh-Hesary 2018). In such cases, governments, although risky partners, will benefit from private sector participation through public–private partnerships (PPPs) and green investment banks (GIBs). Whether private capital can be mobilized to support green infrastructure development will depend on the risk return profile of the investments and the regulatory environment in which these investments operate.

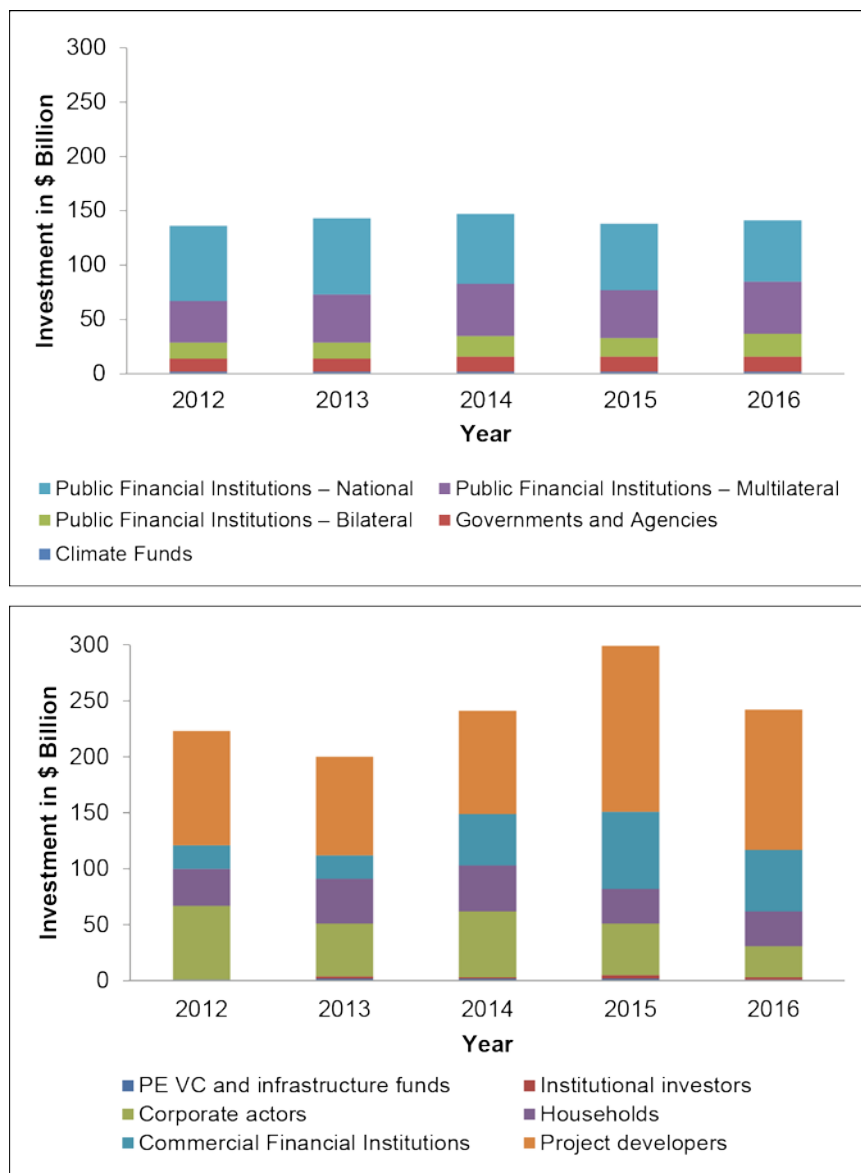
PPPs and GIBs can be understood as the intersection and alliance between public and private financial institutions to supply green finance jointly in a cost-effective way. While PPPs aim to provide public infrastructure service delivery through a mutually beneficial partnership, GIBs seek to leverage private finance for green investments. Therefore, they provide frameworks to ensure private leadership and accountability in tackling public good challenges, such as climate, while leveraging and enabling the ownership to be transferred to private hands. Moreover, PPPs and GIBs provide countries with limited public finance to crowd in private finance to supply investment needs. In this situation, efficient and effective risk allocation is crucial to increase investment, and international cooperation can play a further constructive role, providing a variety of funding, technical assistance, and guarantee measures for green infrastructure projects (Gardiner 2015). PPPs in effect allow for the transfer of investment risks to the private sector concerning projects that are traditionally executed or financed by the public sector.

The objective of this paper is to provide policy makers with a comparative review of PPPs and GIBs, and the associated interventions that can enable risk mitigation or lower transaction costs. Based on the analysis, it proposes a framework that can be used to identify where advanced economies like Japan can support emerging economies like India in providing public–private investments, and in the establishment and funding of GIBs when investments are not flowing at the pace and on the scale required. This paper builds on the review of general trends in PPP investments, the rise of numerous GIBs, and detailed analysis of case studies that help contribute to a better understanding of these institutional mechanisms.

2. USING PUBLIC–PRIVATE PARTNERSHIPS TO SCALE UP GREEN INVESTMENT

According to the Climate Policy Initiative (2017), private sector investment has taken the largest share in climate finance over recent years and project developers have consistently been driving the largest volume of private finance, as exemplified in Figure 1. While the share of more traditional lenders in the green climate financing mix signals a maturing technology market, more commercial finance institutions are taking a larger role, with institutional investment growing rapidly. In terms of public sector investments, in 2015 development finance institutions accounted for the majority of public flows, contributing 89% of the total public finance (Climate Policy Initiative 2017). The general trend suggests the need for dedicated green finance institutions to leverage private finance that can help close the funding gap for many low-carbon investments, especially in developing countries like India.

Figure 1: Global Investment to Address Climate Change by Public and Private Sector Investors 2012–2016



Source: Climate Policy Initiative 2017.

As green energy projects require high upfront investment, private sector capital, technology and innovation have often been routed through PPPs to supplement limited public sector funding in providing such services.

The real challenge for green technology and infrastructure projects is that they are very similar to other infrastructure projects, and therefore should rely on proven project financing approaches. Infrastructure projects generally face significant financing barriers due to high upfront capital costs and long-term payoffs, which increase the cost of capital and reduce its availability. High transaction costs, a lack of viable funding models, and exposure to political risk are other barriers that increase the risk of investing in green infrastructure (Meltzer 2016).

With the private sector alone being unable to mitigate externalities and monetize, many green investments often require the support of the public through PPPs and GIBs. However, these two forms of arrangement still need to exist in an overarching policy environment that provides green technologies with subsidy support, which is no different from many other infrastructure projects. Such hybrid financing schemes are increasingly common as projects become more complex and are not viable purely based on private financing structures. Green technologies must develop an equitable risk allocation framework that can provide a compelling argument for different stakeholders to support these investments through subsidized financing to the extent that this financing is justifiable from a public good perspective.

Moreover, the successful financial closure of green energy projects will improve their contribution to climate change by locking new investments into clean technology over their lifetime, while displacing low-cost polluting alternatives. This is significant as carbon mitigation initiatives often deal with emissions of pre-existing assets rather than introducing new clean investments (Baietti 2013).

Concessional PPP schemes have a particularly key role to play as a low-cost source of finance, which, when blended with other sources of public finance, can de-risk green infrastructure projects and crowd in private finance. Concessional PPPs are especially needed in the early project preparation and construction phases of PPP infrastructure projects, when the risks are highest and capital most costly and scarce. Once green energy projects commence operations and generate returns, the risks are reduced, and these projects can be securitized and sold to institutional investors looking for low-risk and stable returns. The higher the risk, the more early-stage concessional green PPPs can then be recycled into other green infrastructure projects.

Moreover, the development of financial instruments such as green bonds can be linked to PPP projects that can attract institutional investments (Meltzer 2016). With PPPs, the spillover effects originally created for energy supplies need to be used, and tax revenues refunded to the investors in energy projects (Yoshino and Taghizadeh-Hesary 2017). Thus, a well-designed PPP can be an opportunity to scale up funding for clean energy internationally and in effect contribute to the battle against climate change. Although the potential benefits of PPPs are many, there remain challenges for host governments and various partners (including the private sector, bilateral donors, and multilateral institutions) in the allocation of risks, as well as the sharing of rewards. When disputes occur between the private sector and host governments, international financial institutions (IFIs) can play an important role in resolving these, and help ensure the fair sharing of the risks and the rewards of the PPP for all the parties involved.

3. ROLE OF GREEN INVESTMENT BANKS IN BOOSTING LOW-CARBON INVESTMENTS

GIBs, as public or semi-public entities, are increasingly being used to facilitate the attraction of private capital into domestic investments, mainly in low-carbon energy infrastructure, which can help to meet NDC targets. These new institutions are publicly funded and offer preferential rate lending to finance renewable energy, energy efficiency, and other clean energy infrastructure projects in partnership with private lenders. Using innovative transaction structures, and risk-reduction and transaction-enabling techniques, with local market expertise, GIBs are well positioned to channel private investments into green projects. GIBs primarily leverage the impact of relatively limited public resources. As of 2015, 13 national and sub-national governments have

created public GIBs or similar entities (Table 1). GIBs and similar entities have been established at the national level (Australia, Japan, Malaysia, Switzerland, the United Kingdom [UK]), the state level (California, Connecticut, Hawaii, New Jersey, New York, and Rhode Island in the United States [US]), the county level (Montgomery County and Maryland in the US), and the city level (Masdar in the United Arab Emirates [UAE]) (OECD and Bloomberg Philanthropies 2015).

Table 1: Selected Examples of GIBs and GIB-like Entities and their Funding

Operational GIBs and GIB-like Entities	Location	Year Instituted	Funding Sources
Connecticut Green Bank	Connecticut, US	2011	Revenue from loans and emissions trading schemes, and utility bill surcharges, renewable portfolio standards, energy efficiency resource standards
Clean Energy Finance Corporation (CEFC)	Australia	2012	Appropriations
UK Green Investment Bank	UK	2012	National government funding
Green Fund	Japan	2013	Carbon tax revenue
Green Energy Market Securitization (GEMS) (Hawaii Green Infrastructure Authority)	Hawaii, US	2014	Bond issuance
New Jersey Energy Resilience Bank (ERB)	New Jersey, US	2014	National government funding
NY Green Bank	New York, US	2014	Revenue from emissions trading schemes, utility bill surcharges, renewable portfolio standards, energy efficiency resource and utility bill surcharges, renewable portfolio standards, energy efficiency resource standards, and reallocation of funds from existing programs

Source: Adopted from OECD 2017.

GIBs are, by virtue of their design, created to address local market and policy failures, aiming to increase private sector investment in domestic low-carbon infrastructure, leveraging the limited public capital. They are especially important for countries that do not have national development banks or similar entities actively promoting private investment in domestic infrastructures that are deemed to be green. Even if dedicated infrastructure and development banks do exist, governments can consider establishing GIBs as a means of “mainstreaming” green investment objectives in existing national development banks to mobilize more investment in support of clean energy and technology projects.

GIBs are created not only to meet ambitious emissions targets, but also to support local community development, lower energy costs, develop green technology markets, create jobs, and lower the cost of capital for green infrastructure projects (OECD and Bloomberg Philanthropies 2015). It is important to use a range of metrics to measure and track the performance of these projects to keep them accountable for public money. These metrics generally focus on emissions saved, job creation, leverage ratios (i.e., private investment mobilized per unit of public spending), and when these banks are required to be profitable, the rate of return is also included. GIBs adopt a different approach from that of many grant-making public institutions and follow strict mandates to mobilize investment using limited public capital (Geddes et al. 2018). They catalyze private financing for low-carbon technologies by using financial tools such as

long-term and low-interest loans, revolving loan funds, insurance products (loan guarantees or loan loss reserves), green bonds, and low-cost public investment. When a GIB uses public funds for financing, rather than grants or subsidies, the public funds are preserved through loan repayment.

GIBs are essentially mandated to provide the following services: (i) attractive and flexible low-cost financing terms, (ii) credit support, (iii) co-investment, (iv) standards, (v) increased supply of capital (NRDC and CEEW 2016). It is important to ensure that GIBs do not replace or “crowd out” commercial banks and private investors, but actually “crowd in” private capital. They can play a transformative role as they are neither a traditional government program with limited engagement with markets, nor private entities weighed down by competitive pressures and fiduciary constraints, and therefore are able to achieve their goals.

There are promising examples, wherein governments, cognizant of technical and regulatory barriers and opportunities for mobilizing private capital, have sometimes appointed state investment banks as GIBs to close financing gaps, such as the case of Germany’s Kreditanstalt fuer Wiederaufbau (KfW).

The UK GIB was founded in 2012 in the same way, with public funding and the goal to assist the nation in transitioning toward a more sustainable economy by mobilizing the use of private sector capital in low-carbon energy projects (UK Green Investment Bank 2017). It was set up as an independent government-owned entity, capitalized with £3 billion (\$4.6 billion). It invests on terms similar to those of commercial banks and is required to meet a minimum 3.5% annual return on investments before tax (OECD and Bloomberg Philanthropies 2015). To comply with European Union (EU) rules, approval for creation of the GIB was given provided it only lent to projects and sectors not considered investable by private or commercial funding. This provided the GIB an additional focus of crowding in private finance to such projects; essentially the private sector could leverage these public funds and risk mitigation instruments.

Today, the GIB provides a wide range of financial instruments, including long-term fixed market rate debt, mezzanine and subordinated debt, and equity and bridging equity loans, to target sectors such as offshore wind, waste-to-energy, bioenergy, energy efficiency, and more recently, onshore wind. The bank disburses loans through direct financing, co-financing partnership programs, and own managed funds, as well as contributing to third-party managed funds, financing 69 projects between 2012 and 2016 (GIB 2017). The financial performance and other performance indicators of the GIB are presented in Table 2 for the years 2013–2017. By 2016, the GIB had committed £2.1 billion (\$3.2 billion) cumulative investments toward a total of £8.5 billion (\$13 billion) worth of project value, leveraging £3 from the private sector for every £1 invested by the bank (GIB 2017). Interestingly, there is a positive correlation between the capital committed and profit before tax and renewable energy produced, indicating a successful lending portfolio.

Table 2: UK Green Investment Bank Limited (GIB) Performance Highlights

Performance Indicator	2013–2014	2014–2015	2015–2016	2016–2017
Capital committed (£ million)	617	723	770	839
Profit before tax (£ million)	(5.7)	0.1	9.9	24
Total transaction value (£ billion)	2.3	2.5	3.7	1.4
Projected portfolio return (%)	8	9	10	10
Projects financed	17	22	30	24
Renewable energy produced (TWh)	12.8	16.3	20.3	21.5

Source: GIB Annual Report. <http://greeninvestmentgroup.com/media/185901/gib-annual-report-2016-17-final.pdf>

Germany's KfW is another exemplary effort. While originally established as the country's development bank, it has also been very active in low-carbon energy financing (KfW 2017). The KfW was founded in 1948 as Germany's reconstruction and development bank to support the country's development. It was set up with Marshall Funds and is an AAA-rated institution that currently raises over 90% of its funds in capital markets through government-guaranteed bonds. Its shareholders include the Federal Government (80% share) and German states (20% share); together, these hold €3.75 billion (\$4.6 billion) of equity capital (KfW 2016). Although the KfW is not exclusively a "green" investment bank, it is mandated to support Germany's energy transition and it has been one of the largest development bank investors in clean energy projects globally (Table 3).

Table 3: KfW Key Figures of the Statement of Financial Position

	31 December 2016 € billion	31 December 2015 € billion
Total assets	507.0	503.0
Volume of lending	472.4	447.0
Volume of business	609.2	587.2
Equity	27.1	25.2
Equity ratio	5.3%	5.0%

Source: KfW Annual Report 2016.

During 2012–2016, the KfW issued commitments with a total volume of €103 billion for projects in connection with the energy transition, contributing to achieving the German Federal Government's Energy Turnaround Action Plan, and attaining the nation's environmental and climate goals (KfW 2017). The KfW's low-carbon focus areas are energy efficiency, renewable energy (solar photovoltaics [PV], wind, waste-to-energy, and bioenergy), and energy-related innovation projects. The KfW mostly provides standardized, fixed-rate concessional debt through its domestic programs, which are then distributed through its extensive network of local banks via on-lending. The bank also provides guarantees, grants, up-front repayment-free periods, and a limited amount of equity and long-term market rate debt for large corporate projects. Domestically, the KfW IPEX18 focuses on large-scale offshore and onshore wind, and specializes in project finance offering dedicated fixed market rate, long-term debt products.

4. TYPES OF PUBLIC–PRIVATE PARTNERSHIPS AND GREEN INVESTMENT BANK INTERVENTIONS IN JAPAN

4.1 Green Public–Private Partnerships Investments

PPPs have recently been promoted more aggressively by the Japanese government as part of its economic growth and stimulus strategy. The high costs of retrofitting aging public infrastructures, which were built during a high-growth period, in combination with falling fees and populations, have pushed local governments to look for alternative ways of financing and maintaining public assets. Renewable energy, public sewage facilities, and waste treatment plants and projects form the largest class of public infrastructure, with more than 3,600 public enterprises operating in the country. In March 2016, the total number of PPP projects, also known as the private finance initiative (PFI), totaled 527. These arrangements cover the operation and management of public facilities in the energy, water, and waste sectors, as well as cultural centers and medical facilities. Waste-to-energy projects have attracted considerable financing through the PFI.

Although many cities have introduced power generation at waste incineration plants, they are not financially viable in terms of making the necessary large-scale investments. The case of Yokote is interesting as the city is located in an agricultural area with a population of only 100,000. After evaluating the costs of different business models, including the conventional engineering, procurement, and construction (EPC) model, and the design, build, and operate (DBO) model, the city chose the latter. The city offered a tender and concluded contracts with a private consortium for construction, operation, and management amounting to ¥8,267 million and ¥7,070 million, respectively, over 20 years. The city prepared the funding for the construction of the plant using the Special Bond for Municipality Amalgamation, with about 70% of the principal and interest payment shouldered by the national government and a government subsidy program for promoting investments that contribute to the circular economy. More than three-quarters of capital expenditure was directly or indirectly paid by the national government. The DBO model is now a standardized approach in Japan for such projects (Hongo 2016).

In 2013 there were amendments to the PFI Act, allowing for a public–private infrastructure fund to be established with public funds of ¥10 billion to assist in certain market risk-bearing PFI/PPP projects, such as stand-alone-type PFI projects and concession-type projects. In the 2017 update to the PPP/PFI Action Plan for the 10-year period beginning in 2013, the government set a target amount of ¥21 trillion for PPP/PFIs for concession-style projects (i.e., projects in which the operating rights of government-owned facilities are assigned to a private company, and the private company recoups its investment through service fees and tolls charged). This was a significant increase on the initial PPP/PFI Action Plan targets of ¥12 trillion (\$110 billion). The PPP/PFI Action Plan focuses on addressing the issues of aging infrastructure, disaster prevention, and climate mitigation, and leveraging of stand-alone-type PFI/PPP projects not reliant on tax as a source of funding (Getting the Deal Through [GTDT] 2018a).

On the low-carbon sector front, the feed-in tariff (FIT) scheme introduced in 2012 made investments in renewable energy power generation projects more bankable, and as a result the number of PPP projects, particularly in PV power generation projects, increased dramatically. However, the government reduced the pricing under the FIT scheme, and is reviewing the related framework to address over-concentration in the PV power generation market and to promote other sources, such as offshore wind power, biomass energy, and geothermal energy. While the FIT price is being modified annually, “greenfield projects” in renewable power production are expected to continue to increase. The major challenge though for many renewable energy projects is that the majority of them are small to medium in scale, and concession and stand-alone type projects are usually suited to and target large-scale projects, which are actually limited in number.

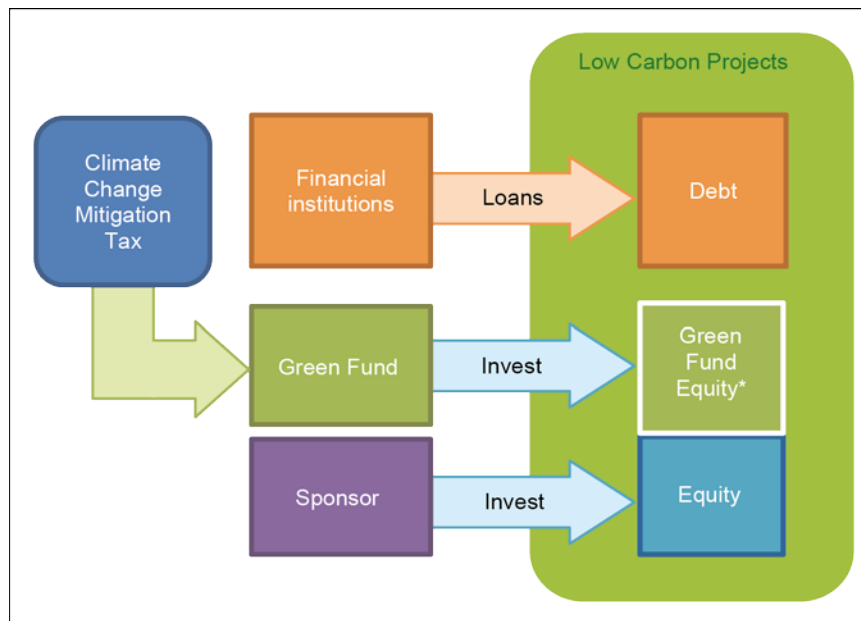
One reason PPPs have not taken off in Japan is the public facility-type PFI projects, which have relatively low project risks and therefore are also not attractive in terms of profitability. Other reasons include regional projects that constitute the vast majority of domestic PFI projects and many municipalities being inexperienced in PFI. Moreover, PPPs are not incentivized to finance public projects; on the contrary, municipal bonds are preferred as they are less expensive and have a less complicated structure (GTDT 2018b).

The interesting development in the Tokyo Stock Exchange has been the opening up of the market for listed infrastructure funds investing in renewable energy projects and concession projects. This is expected to boost the number PPPs in infrastructure projects, further aided by the development of a secondary market for domestic infrastructure. Growth in this sector is also attracting alternative investors such as institutional investors, including insurance companies and the Government Pension Investment Fund, which manages over ¥140 trillion (\$1.2 trillion) in public assets (GTDT 2018b).

4.2 The Green Finance Organization

In Japan, the Green Fund commenced its operations in 2013. The Green Finance Organization (GFO), which controls the fund, aims to support local community development to address the impacts of slow economic growth and an aging society. The Green Fund is capitalized by the proceeds from the national Climate Change Countermeasure Tax, a carbon tax established in 2012 on petroleum and coal consumption. The Green Fund was established in response to the challenges associated with financing clean energy projects, including high upfront costs for development and construction, as well as long operation and income phases that increase project risks for project owners as well as developers.

The Green Fund's objective has been to enhance the business case of small- to large-scale clean energy projects by making equity and mezzanine investments that attract further capital from private sources. Equity investments are limited to less than 50% of the total equity amount (Figure 2), and in some cases a sub-fund is created that aggregates equity investments from the GFO and other sponsors prior to funding the project vehicle (Green Bank Network 2018).

Figure 2: Funding Structure of the Japan Green Fund

*Green Fund investment capped at half of the total equity amount.

Source: Sueyoshi 2016.

Since its inception in 2013 through to March 2017, the GFO, through the Green Fund, made investment commitments of \$110 million into projects with a total value of over \$900 million, achieving a private source leverage ratio of over 10:1. Table 4 provides details of the projects invested in by the Green Fund during 2013–2015. Projects in which the GFO has invested are expected to avoid nearly 1 million tons of CO₂ every year (Green Bank Network 2018)

Table 4: Transactions by the Japan Green Fund by Project Type 2013–2015
(amount in \$1,000)

Project Type	2013		2014		2015		Total	
	Amount	Number	Amount	Number	Amount	Number	Amount	Number
Solar	500	1	4,400	3	6,700	2	11,600	6
Wind	6,000	2	0	0	13,900	2	19,900	4
Hydro	0	0	6,350	2	0	0	6,350	2
Biomass	2,000	2	15,000	3	0	0	17,000	5
Binary	3,000	1	0	0	0	0	3,000	1
Mixture	0	0	5,000	1	7,000	1	12,000	2
Total	11,500	6	30,750	9	35,600	8	77,850	23

Source: Sueyoshi 2016.

4.3 International Green Lending

Japan has also established a number of international programs with significant funding to support clean infrastructure investments. This includes, most notably, the Clean Technology Fund (CTF), the Global Environment Facility (GEF), and the Clean Development Mechanism (CDM) created by the Kyoto Protocol. Japan's climate finance is composed of the publicly financed Official Development Assistance (ODA), other official flows (OOF), and private investments. Besides these, public–private finance (PPF) is assuming an ever greater importance. Public institutions such as the Japan Bank for International Cooperation (JBIC) and Nippon Export and Investment Insurance (NEXI), provide support to Japanese companies in their investments overseas, thus promoting private climate finance (PCF). In this regard, PPPs are key components in the promotion of PCF. The ODA programs are coordinated by the Japan International Cooperation Agency (JICA) (Konrad-Adenauer-Stiftung e.V. 2017).

Furthermore, in 2010 and 2011, Japan mobilized an amount of \$3.8 billion in private climate finance support (PCFS) to mitigate climate change in developing countries as the primary or secondary goal. PCFS is often linked to programs that are either co-financed by Japanese financial institutions, or use Japanese technology or expertise. It is also tailored to the market conditions of recipient countries and has an overwhelming focus on climate change mitigation, rather than adaptation (Anbumozhi and Xiao 2016).

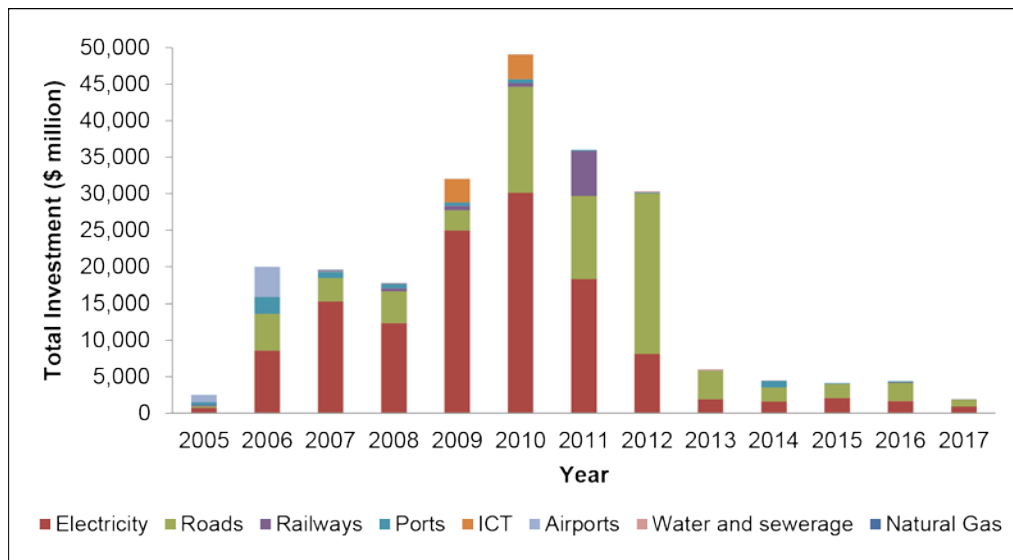
Given the situation of the domestic project finance market outlined earlier, many Japanese banks are also actively participating in offshore project finance transactions. In particular, the Japanese government has adopted a policy to enhance assistance through ODA loans and export credit agency financing, aiming to achieve infrastructure exports to the tune of approximately ¥30 trillion (\$275.2 billion) in 2020 (GTDT 2018b). According to the Japanese government, Japanese infrastructure exports hit ¥20 trillion (\$183.4 billion) in 2015. This initiative continues to be one of the most important government policies in the infrastructure space, and it is anticipated that there will be a corresponding increase in project finance transactions related to renewable infrastructure projects in developing countries like India.

5. TYPES OF PUBLIC–PRIVATE PARTNERSHIPS AND GREEN INVESTMENT BANK INTERVENTIONS IN INDIA

5.1 Green Public–Private Partnerships Investments

India has seen a rapid increase in private investment in infrastructure since 2000. Its PPP programs grew rapidly during 2006 and 2012, and then gradually declined (Figures 3 and 4), both in terms of value and number of projects. In an assessment of 19 economies in Asia and the Pacific by the Economist Intelligence Unit (EIU and ADB 2015), India was considered a country with a “developed” overall policy, regulatory, and institutional environment to attract private agents to public projects, along with the Republic of Korea, Japan, and the Philippines.

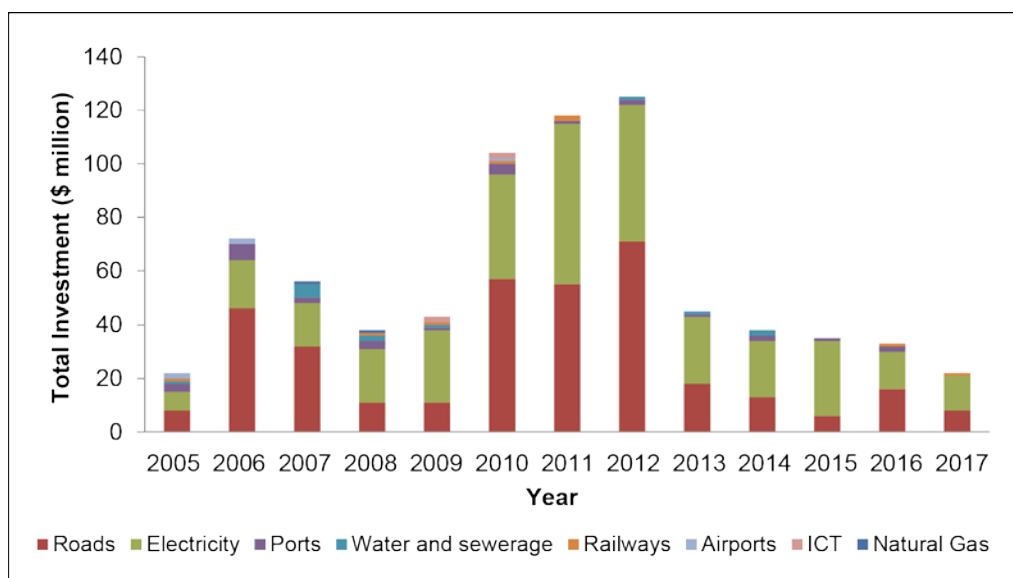
Figure 3 Annual Investments in PPPs in Infrastructure in India by Sector (2005–2017*)



*Data for 2017 only for the first half of the year.

Source: Authors' calculation using data from the World Bank Group (2017) Private Participation in Infrastructure Database.

Figure 4: Annual Project Count of PPPs in Infrastructure in India by Sector (2005–2017*)



*Data for 2017 only for the first half of the year.

Source: Authors' calculation using data from the World Bank Group (2017) Private Participation in Infrastructure Database.

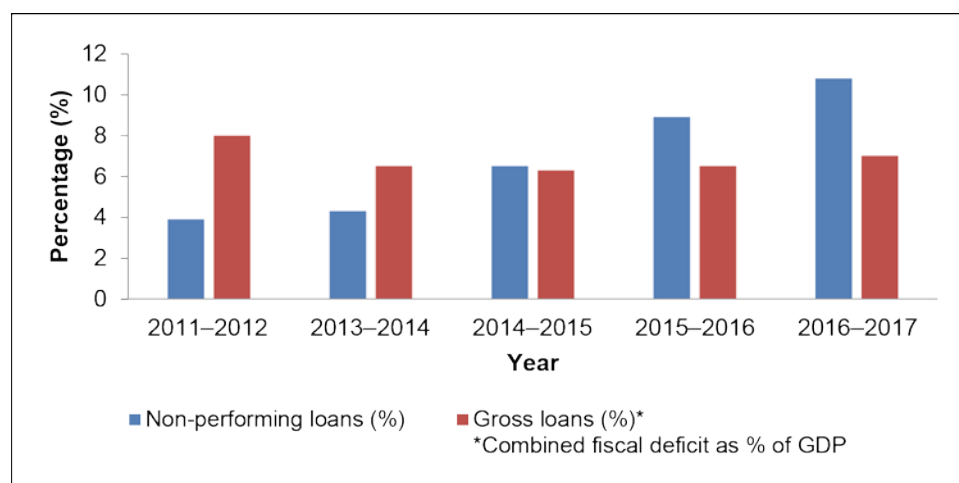
India was the top recipient of private participation in infrastructure (PPI) activity during 2008–2012. India alone accounted for almost half of the investment in new PPI projects in developing countries in 2011. This was the result of rapid opening up of the sector and policies aimed at rapidly developing infrastructure, as well as regulatory and institutional initiatives undertaken by the relevant governmental

institutions. The establishment of the apex committee—the Public Private Partnership Appraisal Committee—with the adoption of standardized bidding documents helped in dramatically streamlining the appraisal and approval of infrastructure projects.

According to the PPI database, in 2015 PPI investment in India fell for the fifth consecutive year, hitting a 10-year low at \$3.9 billion. While the global economic slowdown played a role in the slowdown of infrastructure investment through PPPs in India, other major issues also contributed to the decline. On the domestic side, PPPs were adversely affected by delays in land acquisition and clearances, shifting of utilities, and right of way issues, leading to time and cost overruns. In addition, the private sector faced inadequate due diligence by project developers, as well as project finance banks, resulting in many bank loans being rendered nonperforming (Figure 4). Moreover, Indian companies are currently saddled with debt and stretched balance sheets, and are sitting on under-utilized capacity. Therefore, in the immediate future they are unlikely to increase capital expenditure on risky low-carbon projects (GTDT 2018c).

PPP transactions in India have primarily been funded through commercial bank debt, with public sector undertaking (PSU) banks leading the way. Infrastructure loans were a major contributor to the rising non-performing assets (NPAs) approved by the state-owned (PSU) banks. Further capital markets were inadequately developed and dominated by a safe asset class of quasi-government entities, leaving virtually no appetite for infrastructure projects that were perceived as risky assets, while the government debts were increasing rapidly, reducing the fiscal space available to finance green infrastructure (Saha 2017).

**Figure 5: Non-Performing Loans and Gross Loans
(as combined fiscal deficit as % GDP) in India**



Source: National Accounts Statistics, MOSPI Government of India 2018.

Although the government has been keen on resuscitating investments in infrastructure over 2018, there has only been some interest in project financing in the renewable energy and transportation sectors, and most of this has been from the government or PSU banks (Figure 5).

Nevertheless, the energy sector is taking in most of the foreign direct investment (FDI), particularly in the solar sector, with the country overtaking the US to become the world's second most attractive renewable energy market. As of March 2017, India had a combined renewable energy capacity of 57 GW, and it hopes to grow that to 175 GW by 2022. Most of this is expected in solar, which also saw a significant drop in tariffs in 2017. Table 5 showcases a snapshot of the numerous greenfield PPP projects that are being implemented in the renewable energy sector for just the first quarters of 2017, the latest available data.

Table 5: Solar and Wind Power Greenfield PPIs in India for H1 2017*

Project	Total Investment (\$ million)	Sponsors
Rising Bhadla 2 Solar Farm	66.2	Rising Sun Energy (100%)
Telangana Solar PV Plant	52.1	Renew Power Limited (100%)
Suryoday Solar Plant	41.85	Shapoorji Pallonji Group (100%)
Divine Solren Solar park	59.56	Mahindra & Mahindra (100%)
Bhadla Solar park	149.7	Solairedirect S.A. (100%)
Bhagwanpur & Bindookhadar & Haridwar Solar Projects	28.66	EDF Energies Nouvelles SA (25%), Others (51%), Eren Holding (25%)
FRV Solar India	141	Fotowatio Renewable Ventures (FRV) (100%)
Karnataka Wind Farm	80.62	Renew Power Limited (100%)
Janardan Wind Energy	19.3	Others (100%)
Vayu Urja Bharat Wind Farm	164.9	Hero Group (100%)

*Projects that reached financial closure and are operated under build, own, operate (BOO) contracts.

Source: World Bank Private Participation in Infrastructure Database 2018.

The trends in PPP financing in India highlight several issues with implications for financing large-scale concessional PPPs program as envisaged by India government, including PPPs for green projects. PPPs have relied heavily on commercial banks for debt financing. Long-term financing exposes the banks to the risk of asset/liability mismatch; the main source of funds for Indian banks is savings deposits and term deposits, with maturity profile ranging from less than 6 months to 5 years. Over much of the period, PPP project developers were comfortable with shorter rest periods. However, as the interest rate began to increase, concerns arose regarding the impact on PPPs because the concessions contracts have no provisions for passing on higher interest rates. Continued increases in rates, as well as tightening of credit, could have adverse effects on some green energy PPP projects. Key challenges include overcoming the mismatch between long-term assets and short-term credit provision, as well as the imperative for attracting additional flows of foreign public and private capital (United Nations Environment Programme [UNEP] 2016).

On the equity side, participation by foreign players, particularly strategic institutional investors, has been low, even though PPP projects in the sectors studied are allowed to have 100% FDI. Indeed, FDI accounted only for only 11% of total investment. Encouraging pure equity providers and institutional investors to invest will require more liberal norms in allowing them to participate at the time of bidding or enabling the latter to enter with a majority stake, as well as implementing projects that are highly profitable and allow for more risk sharing with the public counterpart.

Further, governments, both central and state, need to develop mechanisms through which non-banking financial institutes could also provide financing for low-carbon projects. Unlike in Japan, the manufacturing of low-carbon energy and waste-to-energy equipment are not included in the concessional PPP guidelines in India. Manufacturing in low carbon or the Make in India campaign could play an important role in the transformation of the energy sector to achieve NDC targets. Hence, in addition to direct lending by banks, lending by intermediate financial institutes and specialized banks could benefit low-carbon projects.

5.2 Green Investment Bank Interventions and Co-Investments

To generate 175 GW of renewable energy by 2022, and to reduce GHG emissions intensity by 33%–35% from 2005 levels by 2030 as part of India's NDC commitments, India has set ambitious goals for five key sectors: i) ground-mounted, large-scale solar, ii) rooftop solar, iii) off-grid solar, iv) wind energy, and v) energy efficiency. India is part of a green infrastructure coalition launched in December 2015 to bring together investors with strategic interests in scaling up green energy infrastructure. In this context, GIBs as special purpose vehicles (SPVs) attain prominence. This is because GIBs are designed to address local market and policy failures. Based on international models, GIBs can provide financing solutions to grow India's clean energy market. Not all will be appropriate to the Indian context and actual opportunities will be determined through detailed market research.

In India, both a GIB and green bonds could support renewable energy projects by providing broader access to domestic and foreign capital, as well as better financing terms, including lower interest rates with longer lending terms. GIBs, as financial institutions, typically issue bonds to raise additional capital beyond government grants, and to sell loans and recapitalize the balance sheet. The bonds issued by a GIB would, by definition, be green bonds, because all bank capital goes toward low-carbon projects.

With a pledge to have cleaner energy sources accounting for 40% of total energy generation capacity by 2030, India will need to make tremendous efforts to achieve these targets through competitive auctions. Indian banks have begun to rise to the challenge in issuing green bonds overseas, which now include the Exim Bank, Yes Bank, and IDBI Bank. However, to boost more investments, more incentives for the issuance of such bonds in the domestic market also have to be developed by the Securities and Exchange Bureau of India (SEBI). With the Reserve Bank of India (RBI) announcing renewables as a priority lending sector, many Indian banks will be obliged to discover ways of making green bonds work, especially in the context of developing low-carbon infrastructure and allocating more investments to their loan portfolios. According to the RBI, total corporate bond issuances increased by 155% from Rs2.7 trillion in 2010–11 to Rs4.8 trillion in 2014–15, and the number of issuances increased by 77% (RBI 2015). Yet the bond market in India is small compared to that of Japan, both in terms of volume and issuances. In Japan, bond markets accounted for 16.2% of gross domestic product (GDP) in 2016 (Hongo 2018).

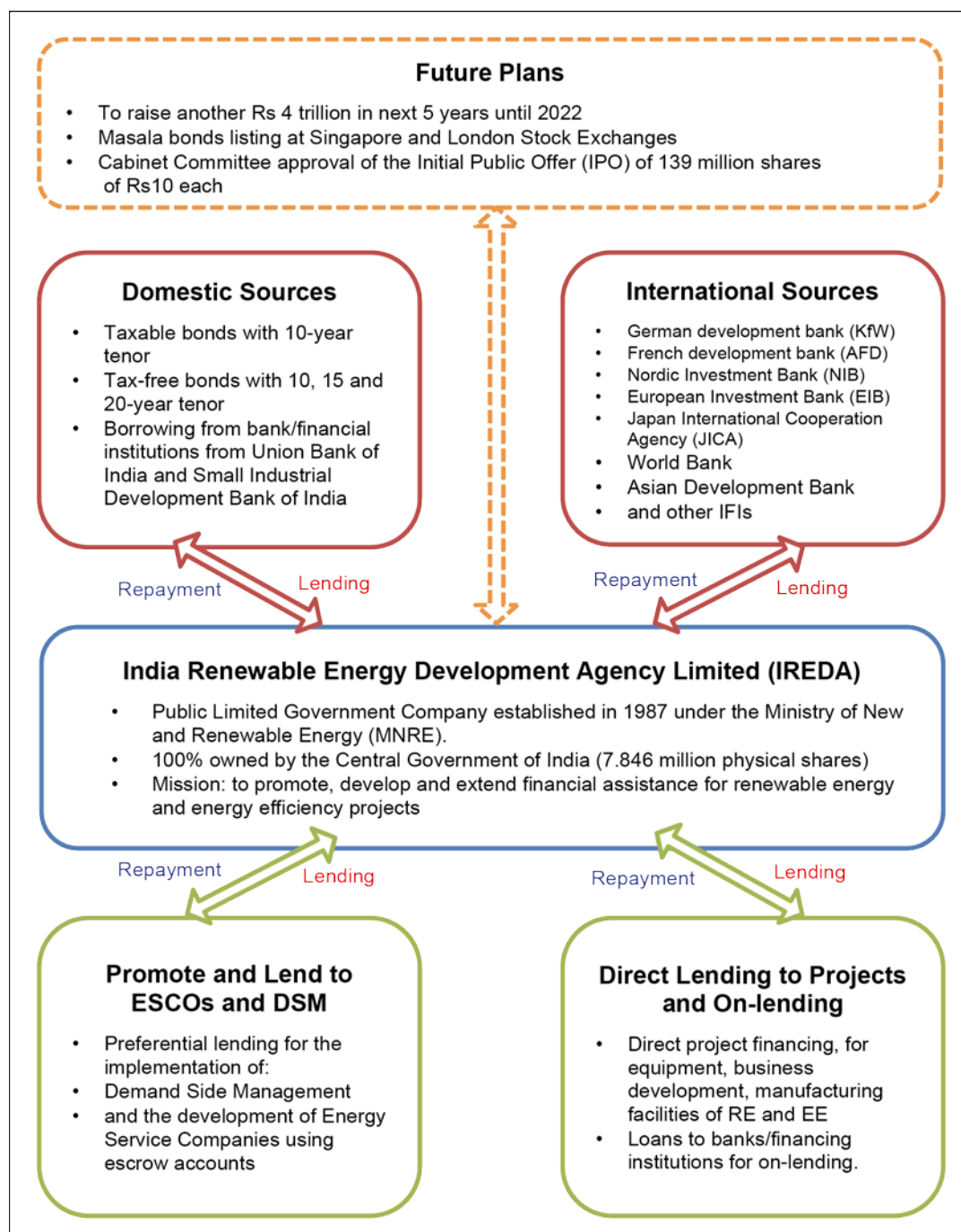
To help meet the financing requirements of \$2.5 trillion for the Paris target by 2030, SEBI proposed new norms for the issuance and listing of green bonds in 2016. The challenge is the lack of a credit governance structure that would enable important project developers such as local governments to be considered creditworthy and capable of raising funds domestically and internationally to finance low-carbon infrastructure projects. GIBs have the potential to link these new stakeholders to projects, and attract and channel international capital and accelerate domestic investment by leveraging limited public funds. GIBs will also intermediate and reduce risks, resulting in abundant and affordable capital to scale up clean energy projects.

5.3 IREDA is the Ideal Candidate for a Green Investment Banks in India

The India Renewable Energy Development Agency Limited (IREDA) was established in 1987 to promote, develop, and extend financial assistance to renewable energy and energy efficiency/conservation projects. It is a public financial institution and registered as a non-banking financial institution. IREDA's financial services include direct project financing, equipment finance, business development finance, loans for manufacturing facilities of energy efficiency equipment, and loans to banks and other financing institutions for on-lending. It is funded partly through the central government, and also receives funding from the German development bank (KfW), French development bank (AFD), Nordic Investment Bank (NIB), European Investment Bank (EIB), Japan International Cooperation Agency (JICA), World Bank, Asian Development Bank (ADB), and other international financial institutions. During 2006–2010, IREDA's total funding grew by 70% from approximately \$391 million–\$665 million.

One of IREDA's important functions is providing low interest-bearing funds and refinance schemes to viable renewable energy projects based on capital from the National Clean Energy Fund (NCEF). NCEF was established by the Government of India by levying a cess (tax) on coal produced in India as well as imported coal. The IREDA NCEF Refinance Scheme aims to bring down the cost of funds for renewable energy projects by providing refinance at concessional rates of interest, with funds sourced from the NCEF. Besides its financial offerings, IREDA has also set up its own low-carbon projects. IREDA floated its first green Masala bond in September 2017, making it the first green Masala bond to be listed on the London Stock Exchange International Securities Market (ISM). The five-year dated green Masala bond raised approximately \$300 million (Rs19.5 billion) with a coupon of 7.125%. The green bond is certified by the Climate Bonds Initiative. After IREDA floated its first international masala bond on the London Stock Exchange, it also filed a draft red herring prospectus for an initial public offering (IPO) in December 2017. The company plans to issue 139 million fresh shares through the IPO.

The lending model of IREDA is illustrated in Figure 6, which outlines its structure and lending activity, and its source of funds.

Figure 6: IREDA Lending Model

Source: Developed by the authors based on information available in the IREDA 2016–2017 Annual Report and at www.ireda.gov.in

Table 6: IREDA Resources, Operational Details, and Sector-Wise Disbursements**IREDA Resources for 2012–2017 (Rs billion)**

Resources	2012– 2013	2013– 2014	2014– 2015	2015– 2016	2016– 2017
Equity Capital	6.996	7.446	7.846	7.846	7.846
Reserves and Surplus	9.888	12.883	13.940	15.115	17.254
International Assistance	37.940	41.417	47.603	55.529	78.716
Domestic Borrowings	14.062	26.138	26.789	44.516	51.772
Total	68.885	87.883	96.177	123.005	155.588

IREDA Operational Details for 2012–2017 (Rs billion)

Operations	2012– 2013	2013– 2014	2014– 2015	2015– 2016	2016– 2017
Loan Sanction	37.474	38.184	45.488	78.065	101.990
Loan Disbursement	21.255	24.711	26.195	42.574	65.935
Repayment of Borrowers	4.368	8.910	19.630	27.698	33.704
Net Outstanding Loans (IREDA)	64.769	81.900	88.035	102.017	133.368
Working Results	2012– 2013	2013– 2014	2014– 2015	2015– 2016	2016– 2017
Total Income	7.296	8.954	11.184	11.745	14.817
Profit before Tax	2.506	3.403	3.786	4.176	5.282
Profit after Tax	2.027	2.405	2.719	2.980	3.650
EPS in Rs (Earnings per Share)	330.90	327.29	355.05	379.86	465.22

Source: IREDA 2016–2017 Annual Report.

IREDA Sector-Wise Sanctions and Disbursements FY 2016–2017 (Rs billion)

Sectors	Sanctions (Rs billion)	%	Disbursements* (Rs billion)	%
Wind Power	24.605	24.12	25.356	38.4
Solar Energy	48.304	47.36	15.240	23.11
Short-Term Loan	20.400	20.00	20.050	30.41
Hydro Power	3.297	3.23	3.409	5.17
Biomass & Co-Generation	1.464	1.44	0.868	1.32
Bridging Loan against GBI/Capital Subsidy to channel partners and loans against pending energy bills	0.352	0.35	0.505	0.76
Energy Efficiency and Conservation	2.950	2.89	0.066	0.10
Miscellaneous (Biomass Gasification + NCEF)	0.618	0.61	0.440	0.67
Total	101.990	100.00	65.935	100.00

*Amounts of disbursements include the projects sanctioned during the financial year 2016–2017 and previous years.

Source: IREDA 2016–17 Annual Report.

In addition to offering lower rates and longer terms, GIBs such as IREDA may cover 100% of the project cost, but more commonly use co-lending or risk mitigation strategies to bring in private investment. For instance, many GIBs use credit enhancements such as loan loss reserves to support more private lending on better terms.

Currently in India, credit enhancement schemes with entities such as the IDFC, Yes Bank, and the IIFCL have been providing first loss partial credit guarantees for many recently issued renewable energy bonds. However, there are still very few of these credit enhancement tools in place. IREDA, as a GIB, can offer attractive financing terms that support clean energy because it can act as an independent, non-regulated entity that is capitalized with government “grants” or contributions, rather than private investment capital.

However, for IREDA to be considered a full-fledged GIB, several key questions need to be answered. Does IREDA have the institutional flexibility to provide flexible, low-cost lending activity at the level a GIB can? Does IREDA’s legal status under the Reserve Bank of India as a Regulated Non-Banking Financing Institution and fully owned by the central government prevent it from engaging in certain kinds of financing that GIBs can otherwise provide? For example, can IREDA use the proceeds from the NCEF to create a reserve to support more lending? Does IREDA’s mandate and internal expertise allow it to perform the market development and demand generation activities of a GIB? How are its on-lending activities with other banking and non-banking institutions structured and managed?

Nevertheless, leveraging the financial assets and lending capability of the IREDA to increase green infrastructure projects would enable further channeling of finance toward meeting the Paris climate target. Currently, IREDA is categorized as a sector-specific development financial institution (DFI) and a non-banking financial institution, allowing it to make capital expenditure on new green products, approve modernization measures, and make power purchase agreements without government approval on deals up to a limit of \$80 million. A larger mandate as a GIB would allow it to harness domestic bond markets, deploying international funding through such facilities as the Green Climate Fund. In addition, currency swap and hedging could be undertaken by IREDA with other designated GIBs in Japan, Europe, and the US. This would allow it to issue credit guarantees and mobilize greater additional lines of finance to provide low-cost longer-term financing in India. Another crucial aspect would require IREDA to make amendments in its operating guidelines to improve its performance, bringing it on a par with other GIBs operating globally, including, but not limited to: (i) revision of the existing lending guidelines for approval of projects eligible for financing under green infrastructure; (ii) establishing monitoring, reporting, and verification procedures and processes for approved projects; (iii) eliminating barriers that have prevented the participation of other institutional and foreign investors..

6. CAPITALIZING JAPAN’S PRIVATE FINANCE SUPPORT FOR GREEN INVESTMENTS IN INDIA

To add to India’s list of solar projects, these now include the loan agreement between the Japan Bank for International Cooperation (JBIC) and SBG Cleantech, a clean-energy joint venture between Japan’s SoftBank Group, India’s Bharti Enterprises, and Taipei,China’s Foxconn Technology Group, for project finance. This is the first time a loan has been co-financed with a Japanese commercial bank, Mizuho Bank, and its financing portion will be insured by Nippon Export and Investment Insurance (NEXI).

JBIC is using this financing to increase the global competitiveness of Japanese companies, and promote green investments in India. Earlier in 2012, JBIC signed an untied loan agreement with other Japanese private institutions, in aggregate co-financing up to \$300 million (JBIC portion: \$180 million) with ICICI Bank, India's largest private bank incorporated in India. The loan was co-financed with Sumitomo Mitsui Banking Corporation (SMBC; lead arranger) and the Bank of Tokyo-Mitsubishi UFJ, with JBIC providing a guarantee for its co-financed portion. The loan was extended to finance green energy projects in the renewable energy and energy efficiency sector in India. This follows similar JBIC agreements signed in 2011 with ICICI Bank in support of its financing of environmentally related projects. Table 7 illustrates the list of JBIC project finance for green energy projects in India.

Table 7: JBIC Project Finance for Green Infrastructure in India (2010–2017)

No.	Public Sector Funder	Private Sector Participant	Financial Instrument	Year	Recipient Entities, Sector	Co-financing and Total Amount (\$ million)
1	JBIC	Mizuho Bank, Ltd.	Project finance loan	2017	SBG Cleantech ProjectCo Pvt. Ltd, Renewable Energy	Not available
2	JBIC – Green Initiative	Sumitomo Mitsui Banking Corp.	Loan co-financing, with partial guarantee	2014	ICICI Bank Ltd. For Renewable energy and energy efficiency projects	\$45 million of a total \$90 million
3	JBIC – Green Initiative	The Bank of Tokyo-Mitsubishi UFJ, Ltd.	Loan co-financing, with partial guarantee	2014	IDFC Bank Ltd. For Renewable energy and energy efficiency projects	\$45 million of a total \$90 million
4	JBIC – Green Initiative	The Bank of Tokyo-Mitsubishi UFJ, Ltd. (lead arranger) and SMBC	Loan co-financing, with partial guarantee	2013	State Bank of India (SBI) For Renewable energy and energy efficiency projects	\$45 million of a total \$90 million
5	JBIC – Green Initiative	SMBC	Loan co-financing, with partial guarantee	2013	ICICI Bank Ltd. For Renewable energy and energy efficiency projects	\$45 million of a total \$90 million
6	JBIC	Other private institutions	Loan co-financing	2012	ICICI Bank Ltd. For export of renewable energy-related equipment	\$30 million of a total \$50 million
7	JBIC – Green Initiative	SMBC (lead arranger) and the Bank of Tokyo-Mitsubishi UFJ, Ltd.	Loan co-financing, with partial guarantee	2012	ICICI Bank Ltd. For export of renewable energy-related equipment	\$180 million of a total \$300 million
8	JBIC	Bank of Tokyo-Mitsubishi UFJ, Ltd. (lead arranger)	Bank-to-bank loan to finance the export of thermal power boiler	2011	ICICI Bank Ltd. for joint venture between L&T and Mitsubishi Heavy Industries, Ltd. (MHI) to fabricate supercritical pressure boiler, exported by Marubeni Corp and sold to Jaiprakash Power Ventures Ltd. (JPVL)	Total of ¥15.3 billion
9	JBIC – Green Initiative	SMBC (lead arranger)	Loan co-financing, with partial guarantee	2011	ICICI Bank Ltd. for Renewable energy and energy efficiency projects	Total of \$200 million
10	JBIC (Equity) – Green Initiative	Subsidiary of (GEF)	Private equity fund	2011	South Asia Clean Energy Fund, L.P.	Total of \$20 million

Source: Compiled by the authors from JBIC Press Releases 2018.

A lot can be done to build on the momentum that existing initiatives, whether by the concessional PPPs across the sectors or by specialized channels such as GIBs, have provided. Improving the capacity of the financial sector around the low-carbon investment paradigm is critical needed. The G20 Green Finance Study Group (GFSG) constituted in 2016, has identified five thematic areas related to opportunities and

overcoming challenges in greening the banking system, greening the bond market, greening institutional investors, risk analysis, and measuring progress (UNEP and World Bank Group 2017). These five themes could further be explored to include areas of cooperation between Japan and India for improving the green investment environment (Table 8).

Table 8: Examples of Green Finance Innovation since June 2016 Linked to at least One of the Seven GFSG Options, and PPPs and GIBs

Options Available for Green Finance	Japan	India
1. Provide strategic policy signals and frameworks		✓
2. Promote voluntary principles for green finance		
3. Expand learning networks for capacity building		
4. Support the development of local green bond markets	✓	✓
5. Promote international collaboration to facilitate cross-border investment in green bonds		✓
6. Encourage and facilitate knowledge sharing on environmental and financial risk		
7. Improve the measurement of green finance activities and their impacts		
8. Establish GIBs or quasi-public financial institutions that leverage public funds to mobilize private investment to lend to green projects at preferential rates and provide risk mitigation	✓	
9. PPPs in green sectors, especially for renewable energy green field projects, with/without the support of MDBs	✓	✓

Source: Adopted and amended by authors from the Green Finance Study Group, UNEP 2017

Table 9 summarizes the three common areas relevant to India's and Japan's cooperation in boosting green finance through PPPs and GIBs that can also be beneficial to other emerging markets in the region.

Table 9: Study Summary

Successfully Implemented in Japan	Particularly Relevant to India	Regionally Relevant
Measures to make GIBs an investment channel	Green PPPs and GIBs when public financing options are limited	Role of FDI in PPPs and GIBs as an investment channels for meeting Paris targets
Risk assessment measures related to PFIs/PPPs	Integrating financial inclusion as an enabling frame work for GIBs and PPPs	Access to green finance by SMEs and mini-grid communities through market principles
Definition and disclosures on green bonds and securities in support of PPPs and GIBs	Effectiveness of public finance to crowd in private capital	Integrating green financing factors into public procurement of financial services

7. CONCLUSIONS AND POLICY RECOMMENDATIONS

While it is clear that many emerging economies, such as India, and advanced countries, such as Japan, are adopting innovative approaches to financing the clean energy transition, it is equally clear that the potential to harness private capital through concessional PPPs and GIBs is opportune. Experiences from the UK and Germany confirm that investment and finance through such channels serve optimally to advance the transition.

India is committed to speeding up the transition through PPPs. For countries like Japan, banking is the focus of green financing efforts. However, in both the countries' capital markets, institutional investors, such as insurance and pension funds, are also considering the development of green bonds as complimentary to PPP and GIB approaches.

Following the ratification of the Paris agreement, emerging economies such as India are taking actions that will help accelerate investments in low-carbon infrastructure. While PPPs and GIBs differ in name, scope, and approach, they share the following core characteristics: a mandate focusing mainly on mobilizing private investment using interventions to mitigate risks and enable transactions; innovative transaction structures and market expertise; independent authority; a focus on cost effectiveness and public–private win-win.

Both concessional PPPs and GIBs can address investment gaps for projects with very large upfront capital costs, as well as gaps arising when lending costs are too high or when there is a limited source of public capital. GIBs also perform a de-risking role to mobilize the investment of private capital in low-carbon projects. Concessional PPPs and GIBs can also foster knowledge in the area in the case that country-level specialist expertise does not exist, enabling better assessment of risks, the creation and standardization of innovative de-risking instruments, and then the diffusion of this new knowledge throughout the industry. PPPs, through co-financing large-scale projects, ensure they “crowd in” additional private finance. GIBs also take on the risky role of supporting “first or early mover” projects, investing in technologies that need to be tested or scaled in the context of the local regulatory and financial environment. They can also support new green technologies, new business models, or new entrants, such as a first-time developer or equipment supplier.

Key areas with potential for enhancing Japan–India cooperation in support of PPPs and GIBs include the following.

- They can enable market education and capacity building for green PPPs and GIBs, building learning networks between Japanese and Indian stakeholders, which will play a key role in scaling up initiatives. It may be useful for institutions like the JBIC to map the broad set of domestic policy initiatives and regulatory reforms that could be taken up by the emerging markets, taking India as a test bed. Such a roadmap building exercise could assess what works and where the gaps are, including overlaps and opportunities for further improving financial efficiency through knowledge sharing.

- Many states in India are making the initial move into the green finance space through concessional PPP- and GIB-funded projects, but they are slowed by a general lack of familiarity among the investors with the concept, definitions, purposes, legal framework and advantages of the approaches, and by a lack of advisory services available in the area. Much could be done were a network of banks and institutional investors, both within India and between India and Japan, to be established to build awareness and develop guiding materials based on best cases.
- Japan and India, as members of the G20, are using green infrastructure investment as a means of coalition for engaging with overseas institutional investors. Given the importance of concessional PPPs and GIBs, a key challenge is how to support green lending effectively to enable the securitization of those lending portfolios linked with a Monitoring Reporting and Verification System (MRV) on emission reductions. Japan's technical assistance in the development of an MRV and how best it could be used to support inbound FDI will be critical.

While the PPPs and GIBs recognize the importance of private capital, the nature of green investments in India, as well as in other emerging markets, involves a combination of public and private finance. Hence it is also critical to learn lessons from Japan and other advanced economies on how to mobilize such blended finance in the most efficient way to meet NDC targets. Many states in India have SPVs that are policy influenced or state owned, such as pension funds linked to state-owned enterprises. These institutions could be a starting point in drawing a new roadmap and articulating the policy, regulatory, and institutional development to foster green private finance through limited public finance.

REFERENCES

- V. Anbumozhi and X. Yao. 2016. Serendipity of Low Carbon Energy Systems and the Scope of Regional Cooperation. In V. Anbumozhi, K. Kalirajan, F. Kimura, and X. Yao, eds. *Investing in Low-Carbon Energy Systems: Implications for Regional Economic Cooperation*. Springer Singapore.
- V. Anbumozhi and T.F. Rakhmah. 2018. Prospects of Catalysing Regional Solutions and the Role of Low Carbon Transition Fund. In V. Anbumozhi, K. Kalirajan, and F. Kimura, eds. *Financing for Low-Carbon Energy Transition: Unlocking the Potential of Private Capital*. Springer Singapore.
- V. Anbumozhi, K. Kalirajan, and F. Kimura. 2018. Unlocking the Potentials of Private Financing for Low-Carbon Transition. In V. Anbumozhi, K. Kalirajan and F. Kimura, eds. *Financing for Low-Carbon Energy Transition: Unlocking the Potential of Private Capital*. Springer Singapore.
- A. Baietti. 2013. Green Infrastructure Finance: A Public–Private Partnership Approach to Climate Finance. World Bank, Washington, DC. <https://openknowledge.worldbank.org/handle/10986/14857>
- Climate Policy Initiative. 2017. Global Landscape of Climate Finance 2017, October 2017. <https://climatepolicyinitiative.org/wp-content/uploads/2017/10/2017-Global-Landscape-of-Climate-Finance.pdf> and <http://www.climatefinancelandscape.org/>
- EIU and ADB. 2015. Evaluating the Environment for Public–Private Partnerships in Asia-Pacific: The 2014 Infrascopes. London: Economist Intelligence Unit. <https://www.adb.org/sites/default/files/publication/158409/2014-infrascopes.pdf>
- A. Gardiner, M. Bardout, F. Grossi, and S. Dixon-Declevé. 2015. Public-Private Partnerships for Climate Finance, Nordic Council of Ministers, TemaNord 2015:577. <http://dx.doi.org/10.6027/TN2015-577>
- A. Geddes, T.S. Schmidt, and S. Bjarne. 2018. The Multiple Roles of State Investment Banks in Low-Carbon Energy Finance: An Analysis of Australia, the UK and Germany. *Energy Policy*. 115 (2018). pp. 158–170. <https://www.sciencedirect.com/science/article/pii/S0301421518300090>
- Green Bank Network. 2018. Green Finance Organization (Japan). <http://greenbanknetwork.org/green-finance-organisation-japan/>
- UK Green Investment Bank. 2017. UK Green Investment Bank Limited Annual Report and Financial Statements 2016–17, Edinburgh. <http://greeninvestmentgroup.com/media/185901/gib-annual-report-2016-17-final.pdf>
- GTDT. 2018a. Project Finance in Japan. Getting the Deal Through. April 2018. <https://gettingthedealthrough.com/intelligence/168/article/6057/project-finance-japan>
- . 2018b. Project Finance in India. Getting the Deal Through. April 2018. <https://gettingthedealthrough.com/intelligence/168/article/6055/project-finance-india>
- . 2018c. In India – An Interview with Anjan Dasgupta. Getting the Deal Through. June 2018. <https://gettingthedealthrough.com/intelligence/21/article/3042/project-finance-india>

- T. Hongo. 2016. Circular Economy Potential and Public–Private Partnership Models in Japan. In V. Anbumozhi and J. Kim, eds. *Towards a Circular Economy: Corporate Management and Policy Pathways*. ERIA Research Project Report 2014-44. Jakarta: ERIA, pp. 17–29.
- . 2018. Prospects of Quality Infrastructure Program and Private Sector MRC for Accelerating the Transition towards Low-Carbon Energy System. In V. Anbumozhi, K. Kalirajan, and F. Kimura, eds. *Financing for Low-Carbon Energy Transition: Unlocking the Potential of Private Capital*. Springer Singapore.
- IREDA. 2017. IREDA 30th Annual Report for 2016-17. India Renewable Energy Development Agency Limited. http://www.ireda.in/writereaddata/Ireda_Annual_Report_Final_2016-17.pdf
- JBIC. 2018. Environment. Individual project details extracted from JBIC Press Releases for Environment website. Japan Bank for International Cooperation. <https://www.jbic.go.jp/en/information/press/environment.html>
- KfW. 2017. Responsible Banking, Financial Report 2016. Frankfurt. https://www.kfw.de/PDF/Download-Center/Finanzpublikationen/PDF-Dokumente-Berichte-etc./3_Finanzberichte/Finanzbericht-2016-D
- . 2016. Responsible Banking, Financial Report 2015. Frankfurt. https://www.kfw.de/PDF/Download-Center/Finanzpublikationen/PDF-Dokumente-Berichte-etc./3_Finanzberichte/KfW-Finanzbericht-2015-E.pdf
- Konrad-Adenauer-Stiftung e.V. 2017. Climate Finance Report 2017: Private Sector and Climate Finance in the G20 Countries. http://www.kas.de/wf/doc/kas_49478-544-2-30.pdf?171025093514
- S. Kumar, M. Anisuzzaman, and P. Das. 2017. Estimating the Low-Carbon Technology Deployment Costs and INDC Targets. In V. Anbumozhi and K. Kalirajan, eds. *Globalization of Low-Carbon Technologies – The Impact of the Paris Agreement*. Springer Singapore.
- J.P. Meltzer. 2016. *Financing Low Carbon, Climate Resilient Infrastructure: The Role of Climate Finance and Green Financial Systems*. Washington, DC: Brookings Institution. https://www.brookings.edu/wp-content/uploads/2016/09/global_20160921_climate_finance.pdf
- MOSPI, Government of India. 2018. National Accounts Statistics 2018. Ministry of Statistics and Program Implementation (MOSPI), Government of India. <http://www.mospi.gov.in/publication/national-accounts-statistics-2018>
- NRDC and CEEW. 2016. *Greening India's Financial Market: Opportunities for A Green Bank in India*, Natural Resources Defense Council International: India (NRDC), New York and Council on Energy, Environment and Water (CEEW), New Delhi. August 2016. <https://www.nrdc.org/sites/default/files/india-financial-market-opportunities-green-bank-report.pdf>
- OECD. 2017. *Green Investment Banks: Innovative Public Financial Institutions Scaling Up Private, Low-Carbon Investment*. OECD Environment Policy Papers, No. 6. Paris: OECD Publishing. <https://doi.org/10.1787/e3c2526c-en>
- OECD and Bloomberg Philanthropies. 2015. *Green Investment Banks: Leveraging Innovative Public Finance to Scale Up Low-Carbon Investment. Policy Perspectives*. <https://www.oecd.org/environment/cc/Green-Investment-Banks-POLICY-PERSPECTIVES-web.pdf>

- RBI. 2015. Corporate Bond Markets in India: A Framework for Further Action, Speech by Shri Harun R. Khan, Deputy Governor – October 27, 2015 at FICCI CAPAM – 2015, Mumbai. https://www.rbi.org.in/scripts/FS_Speeches.aspx?Id=980&fn=6
- D. Saha. 2017. PPPs in India – Will They Regain their Former Glory? Blog. World Bank Group: Infrastructure & Public–Private Partnerships. <http://blogs.worldbank.org/ppps/ppps-india-will-they-regain-their-former-glory>
- T. Sueyoshi. 2016. Green Fund Japan’s Experiences. Presentation at the Green Bank Congress 2016, 13 October 2016.
- K. Treco, C. Stephens, and D. Marten. 2018. Estimation of Current Flows and Future Needs of Low-Carbon Transition in Major Economies of Asia until 2030. In V. Anbumozhi, K. Kalirajan, and F. Kimura, eds. *Financing for Low-Carbon Energy Transition: Unlocking the Potential of Private Capital*. Springer Singapore.
- UNEP. 2016. Delivering a Sustainable Financial System in India. UNEP Inquiry. Nairobi, Kenya: United Nations Environment Programme. http://unepinquiry.org/wp-content/uploads/2016/04/Delivering_a_Sustainable_Financial_System_in_India.pdf
- . 2017. Green Finance Progress Report. The UN Environment Inquiry, July 2017, Geneva Switzerland. http://unepinquiry.org/wp-content/uploads/2017/07/Green_Finance_Progress_Report_2017.pdf
- UNEP and the World Bank Group. 2017. Roadmap for a Sustainable Financial System. UN Environment Inquiry. <http://unepinquiry.org/publication/roadmap-for-a-sustainable-financial-system/>
- World Bank. 2018. Private Participation in Infrastructure Database. <https://ppi.worldbank.org/snapshots/country/india> (accessed on 13 March 2018).
- World Bank Group. 2017. January–June 2017, Private Participation in Infrastructure (PPI) Half Year Update. World Bank Group: Public–Private Partnerships. https://ppi.worldbank.org/~media/GIAWB/PPI/Documents/Global-Notes/PPI2017_HalfYear_Update
- N. Yoshino and F. Taghizadeh–Hesary. 2017. Alternatives to Bank Finance: Role of Carbon Tax and Hometown Investment Trust Funds in Development of Green Energy Projects in Asia. ADBI Working Paper 761. Tokyo: Asian Development Bank Institute. <https://www.adb.org/publications/alternatives-bank-finance-role-carbon-tax-and-hometown-investment-trust-funds>
- . 2018. Alternatives to Private Finance: Role of Fiscal Policy Reforms and Energy Taxation in Development of Renewable Energy Projects. In V. Anbumozhi, K. Kalirajan, and F. Kimura, eds. *Financing for Low-carbon Energy Transition: Unlocking the Potential of Private Capital*. Springer Singapore.