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Piloting and Scaling Up Clean Energy Transitions: The Role of Development Finance Institutions

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- Characterization of SDG-compatible investments
- Business Models
- Governance
- Financial regulation
- Global Development Finance Architecture

Partners and coordinators

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Piloting and Scaling Up Clean Energy Transitions: The Role of Development Finance Institutions

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Abstract
In this paper, we examine the role of development finance institutions (DFIs) in piloting clean energy transitions by conducting in-depth case studies with representative multilateral development banks (MDBs) and national development banks. Our key findings include: (a) technical risk is the most compelling challenge for piloting new clean energies with huge uncertainties, and development-oriented DFIs endowed with industrial expertise can make forward-looking pilot investments (sometimes throughout the supply chain) to demonstrate the viability of new technologies to attract private capital to follow suit; (b) policy and regulatory risks are a key hindrance in scaling up clean energies, and as public entities development banks have comparative advantages of coordinating and even shaping policy discussions with government agencies to mitigate such policy and regulatory risks; and (c) foreign exchange risk is an undeniable challenge for NDBs to attract foreign investment or for MDBs to invest renewable energy projects in developing countries especially given the fact that shadow financial markets make hedging costly, which encourages MDBs to explore local (green) bond issuances.

Keywords
Development finance institutions, development banks, clean energy, renewable energy technology, policy risks, market incubation

Résumé
Dans cette publication, nous examinons le rôle des institutions financières de développement (IFD) dans le pilotage des transitions vers les énergies propres, en menant des études de cas approfondies avec des banques de développement multilatérales (BMD) et des banques nationales de développement représentatives. Nos principales conclusions sont les suivantes : (a) le risque technique est le défi le plus pressant pour piloter les nouvelles énergies propres avec d'énormes incertitudes, et les IFD axées sur le développement et dotées d'une expertise industrielle peuvent réaliser des investissements pilotes tournés vers l'avenir (parfois tout au long de la chaîne d'approvisionnement) pour démontrer la viabilité des nouvelles technologies afin d'attirer des capitaux privés ; (b) les risques politiques et réglementaires sont un obstacle majeur à la mise à l'échelle des énergies propres, et en tant qu'entités publiques, les banques de développement ont des avantages comparatifs pour coordonner et même orienter les discussions politiques avec les agences gouvernementales afin d'atténuer ces risques politiques et réglementaires ; et (c) le risque de change est un défi indéniable pour les BND pour attirer les investissements étrangers ou pour les BMD pour investir dans des projets d'énergie renouvelable dans les pays en développement, surtout compte tenu du fait que les marchés financiers parallèles rendent la couverture coûteuse, ce qui encourage les BMD à explorer les émissions d'obligations locales (vertes).

Mots-clés
Institutions de financement du développement, banques de développement, énergie propre, technologie des énergies renouvelables, risques politiques, incubation du marché

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Introduction

The world community has committed to ambitious goals to mitigate climate change and advance the 2030 Agenda for sustainable development. In order to meet these goals, a tremendous effort is needed to transform the world economy in a manner that is lower carbon and more environmentally friendly. A swift and radical transformation of energy systems is needed to achieve the goal of the Paris Agreement on Climate Change that seeks to limit average global temperature rise to well below 2 degrees Celsius in the present century compared to pre-industrial levels. Renewable energy (or clean energy) is at the heart of the transformation of energy systems. The Report titled Global Energy Transformation: A Roadmap to 2050 by the International Renewable Energy Association (IRENA) maintains that renewable energy needs to be scaled up at least six times faster for the world to meet the decarbonization and climate mitigation goals set out in the Paris Agreement. Yet the business-as-usual scenario predicts a modest growth of renewable energy to about one quarter of total final energy consumption (IRENA, 2018). Achieving the accelerated deployment of renewable energies entails a large amount of investments in low-carbon technologies within a relatively short period of time.

While it is widely recognized that clean energy transitions is of paramount importance in achieving the Paris Agreement on Climate Change and Sustainable Development Goals 7, 9, and 13 (clean energy and access, infrastructure, and climate action), the business-as-usual scenario predicts a modest growth of renewable energies. Development financial institutions are potentially well positioned to take up the task of piloting and scaling up clean energy transitions, as they pursue development-oriented official mandates and rely on long-term funding to provide long-term and high-risk investments.

Yet little has been done to systematically investigate the role of development finance institutions (DFIs) in achieving clean energy transitions. Our paper aims to fill the gap by exploring the following research questions including what are the key barriers to financing renewable energies, how do such barriers or binding constraints vary at different stages of development, what financing models DFIs deploy to pilot and scale up clean energy transitions, and what comparative advantages DFIs have in achieving clean energy transformation.

Few studies have been done to explore the role of DFIs in supporting clean energy development despite the pilot practices of DFIs and the huge potential of DFIs for taking up the task in practice. Griffith-Jones, S. (2016) studied the role of KfW in fostering clean energies. As it is a single case study, our research makes a comparative analysis of NDBs from different income levels which can help us to grasp different kinds of risks, if any, at different stages of development, as well as different approaches taken by DFIs. Xu and Gallagher (2020) proposed an analytical framework for DFIs to fostering clean energy transformation that goes beyond the project-level viability analysis. The present paper builds on this approach to delve deeper into case studies to better

understand how DFIs help to achieve clean energy transitions.

For the purpose of our research, we primarily deploy case studies to grasp the nature of risks and underlying mechanisms for tackling such risks by DFIs. To ensure a representative case selection, we have selected 9 DFIs, including 4 MDBs and 5 NDBs. To ensure representativeness, we have selected both Northern-led MDBs such as the World Bank's International Finance Corporation (IFC) and European Investment Bank (EIB) and Southern-led MDBs such as Development Bank of Latin America (CAF) and Asian Infrastructure Investment Bank (AIIB). As for NDBs, we have selected NDBs from different income levels and with different sizes of total assets. They are and Development Bank of Japan (DBJ) from high-income countries, China Development Bank (CDB), and Mexico's Nacional Financiera (NAFIN) from upper-middle-income countries, Indonesia's PT Sarana Multi Infrastruktur (PTSMI) from lower-middle-income countries, and Development Bank of Rwanda (DBR) from low-income countries (see Appendix I for the basic information of selected DFIs). We have conducted in-depth interviews with practitioners from the above selected DFIs to collect the firsthand information.

The rest of the paper proceeds as follows. In Section I, we analyze the key risks of financing renewable energies and explore the extent such risks differ at different stages of development. In Section II, we synthesize the comparative advantages of DFIs in achieving clean energy transformation. In Section III, we present financing approaches and models taken by selected DFIs in piloting and scaling up clean energies. Finally, we conclude with key findings and policy implications.

I – Barriers to Renewable Energy Sector Financing for DFIs

Based on our analysis and interviews with different DFIs, this section of the paper identifies four main categories of risk that DFIs face as they seek to finance RE across the world. Interestingly, we find that the vast majority of these barriers occur regardless at which level of development of the country in question. The exception to that generality is foreign exchange risk in developing countries.

We group the key barriers across the DFI in our sample into four categories:

Technology risk: risks that that face the financial attractiveness of development bank finance for RE. Such risks relate to the length of the innovation and diffusion cycle of RE, the scale and distribution of technology opportunities, and associated infrastructure that makes financing RE difficult or risky.

Political, Policy, and Regulatory Risks: are risks that pertain to political and regulatory uncertainty and/or policies that bias away from RE technology and toward incumbent fossil fuel technologies.

Macroeconomic Risks: are rife and include the availability of credit in general, current account issues related to the need to import key RE technologies, and supply chain risks and barriers due to the lack of domestic production of associated equipment.

Bankability Risks: pertain to the lack of investment-ready projects that DFIs can participate in. When commercial viability is lacking, then it will be difficult for even DFIs to be a first mover to bring a project to life.

Drawing on our interviews and analysis, the rest of this section discusses how these risks vary across DFIs in our sample.

1.1. Technology Risk

A number of the DFIs in our sample saw a variety of technological and capacity related risks as significant barriers to the successful financing of RE projects across the world especially when piloting the REs. For frontier RE sectors such as battery storage, hydrogen, offshore wind and floating solar have high technical risks mainly associated with new and untested technologies which are germane to all countries regardless of their level of development.

For some frontier RE sectors such as geothermal or large hydroelectric power, there is high technical risk especially around environmental, social and governance issues and specific exploration risk. Regardless of the size of the DFI, this has been identified as a key barrier. The AIIB and DBJ each have a large number of developed countries as part of the shareholder structure, but see these risks as significant for these technologies. Similarly, PERSERO in Indonesia, a country that has faced a number of controversial hydropower projects, also identified these as significant hurdles.

The length of innovation cycles was also seen to pose distinct challenges for piloting and scaling up REs. If innovation cycles are too long, few private investments would like to venture into untested REs that entail long-term investment horizon. By contrast, if innovation cycles are too short, forerunners may be hesitant to scaling up the REs to benefit from the economics of scale. None of the DFIs in our sample finance the upstream part of the innovation cycle and have been hesitant to becoming first users.

Certain types of REs are small in scale, most emblematically distributed solar and wind in developing countries. The Development Bank of Rwanda has had difficulty in financing distributed solar or attracting partners for co-financing. The larger DFIs with significant capital often prefer larger projects because they have lower transaction costs per project and because of staff salary incentives. The AIIB for example, tends to seek and invest in large ticket investment over $100million.

Certain REs are very dispersed both geographically and demographically. To unleash their potential, they need to be tailored transmission lines and sometimes storage facilities unless they are distributed. The Development Bank of Japan, the EIB, and others in our sample stressed that without these supplementary investments in corollary infrastructure, it is not feasible to tap into the potential of these REs for some DFIs.

1.2. Political, Policy, and Regulatory Risks

Political, policy, and regulatory barriers are seen as the most significant barrier for many DFIs in our sample, regardless of level of development, in scaling up the RE financing.

Many DFIs in our sample, from NAFIN, the Development Bank of Japan, the IFC, and EIB all noted political uncertainties as a barrier to financing. These banks cite concern of swings in political leaders in terms of priorities and policies that ultimately unsettle market environments. Both NAFIN and the IFC each noted that Mexico had created a sense of stable market and regulatory environments for RE such that DFI finance was able to crowd in significant commercial sector financing for RE and energy efficiency programs over the past decade. However, a new government has created new priorities and legal barriers that have begun to jeopardize those markets.

Though the lack of stable regulatory frameworks was cited by every DFI in our sample, with the IFC and EIB noting that such variability can pose very significant barriers for LICS, such problems are also rife in developed countries as well. The Development Bank of Japan and EIB both cited that fact that different regimes have different priorities that change regulatory frameworks. Not only does the DBJ see this as a concern in Japan but notes how some countries evolve from Feed-in-Tariffs to auctions for RE that the change from one regulatory framework to another—albeit often a better performing one, causes risk as well.

Another political risk relates to the political influence that fossil fuel technologies have on government policy-making regardless of the level of development. This lack of a level playing field makes it difficult for RE technologies to earn financial, regulatory, and infrastructure support, further locking in fossil fuel development. In many cases then, states subsidize fossil fuel technologies. As we now know, in all but a handful of countries most RE

technologies are cheaper than their fossil fuel counterparts, but subsidies can continue to lock in fossil fuel technologies for years to come. Subsidization and the lack of correcting for externalities can lead to significant levels of market power on the behalf of fossil fuel-based incumbent technologies which can allow the firms in these sectors to pose significant barriers to entry to RETs. The IFC, NAFIN, EIB particularly emphasized these dynamics as barriers to RE DFI finance.

If enabling frameworks are in place, RE, with the right support of development banks can take off. In general, it was hinted during interview by IFC that policy and regulatory risk were inversely correlated with country's level of development. For many LICs the regulatory framework is a key challenge, but MICs are also susceptible to political risk as demonstrated in Mexico where a change in government policy affected the attractiveness of RE market in Mexico. Yet it turns out that interviews are suggesting a country's level of development does not necessarily determine the policy and regulatory risk. Illustrating this point is the case of two Asian LMICs, Vietnam versus Indonesia. Despite the same income level, the predictability of regulatory frameworks differs. Despite Vietnam being perceived as riskier from a private investors perspective than Indonesia[1], it is easier to crowd in private investment in RE in Vietnam as there is a clear framework in place which specifies feed in tariffs (e.g. through PPA) whereas in Indonesia, the government has restructured the framework several times and it is still not attractive for the private investor as there are no feed in tariffs so everything has to be negotiated with the state owned electricity utility.

1.3. Macroeconomic Risks

DFIs across our sample all pointed to macroeconomic risks as well and one key macroeconomic risk was seen as particular relevant to developing countries: foreign exchange risk. Foreign exchange risk was identified as a universal risk for DFIs hindering the scale up of RE investment in developing countries, as often the investment is frontloaded and denominated in hard currency, but the revenues which accrue over time are in local currencies and prone to depreciation and volatility. Private investors thus want a quick payback if the foreign exchange risk can't be affordably hedged. The majority of IFC's investment is denominated in international currencies. Its treasury department offers products to hedge risk but it can be costly or not available for more local currencies. AIIB mainly finances in US$ but it does offer some local currency financing (Indonesian rupiah, Turkish Lira, Russian Rouble, Indian Rupee, Chinese Renminbi and Thai Bhat).

For DFIs from developing countries foreign exchange risk also acts as a barrier to attracting direct foreign investment or indirect foreign investment through the issuance of bonds on the international capital markets. What is more, some DFIs such as the Development Bank of Rwanda (though even the Development Bank of Japan) express real concern that there is an increasing concentration of production in RE in just a handful of European and Asian countries. Therefore, developing countries need to import these technologies rather than produce them. For countries with large current account deficits this can pose macro-economic problems, especially in the face of volatile exchange rates that can balloon

[1] Vietnam S&P rating BB (April 2019) compared to Indonesia BBB S&P rating in May 2019 (pre Covid-19 downgrade to negative).

foreign debt in depreciations. This was also seen as a concern for a surplus developed nation such as Japan however, which expressed concern over the market concentration of RE technologies and the equipment needed to deploy them.

Another macroeconomic problem cited was the availability of credit altogether. If an international DFI is not able to blend its balance sheet with local DFIs such as the Development Bank of Rwanda, those local DFIs face high interest rates for financing. This was also cited by the EIB as a reason why it is difficult to find local DFI partners, especially in LICs.

1.4. Bankability Risks

Lack of investment ready projects for both mature and frontier RE technologies in developing and developed economies. At the national level PT SMI identified a lack of bankable projects and the need for grant funding or high-risk equity capital to fund viability, feasibility studies, exploration and project preparation. It is very difficult to mobilise private investment before commercial viability can be established. Private investors are not willing to take that risk and so the bank plays a critical role in bringing projects to market. A good example of this is geothermal in Indonesia and the need to explore the geothermal potential through drilling, which is generally unattractive for private investors given the investment required and the high risk that a 'dry hole' may be drilled. However, PTSMI indicated that its ability to provide grant financing and high-risk equity is limited by the need to remain profitable. The AIIB echoed this concern.

II – Comparative advantages of DFIs

Compared with alternative financial arrangements, DFIs have the following comparative advantages when it comes to piloting and scaling up investment in RE.

2.1. Provision of affordable patient capital

As can be seen from table x, all DFIs identified one of their main comparative advantages as their ability to provide affordable, long term capital compared to the private financial sector. This is key due to the often-high upfront capital costs and lengthy development periods until commercially operational of RE infrastructure, which requires long-term financing to match long payback periods. Affordable capital is required given the inherent risk in such projects often linked to technological and policy and regulatory risk.

EIB can provide debt financing with a tenor of up to 40 years and has one of the lowest costs of capital compared to other banks and even sovereigns. At the other end of the scale BRD can provide debt finance up to 10 years compared to 5 years in the domestic private market. This is due to their funding models. The DFIs studied do not take household deposits and except for BRD, all DFIs had high credit ratings and relied on bond issuance in the international and/or domestic capital markets to fund their operations. This enables them to raise long term financing to better mitigate the problem of maturity mismatch and at more affordable cost than what the private sector can access. For MDFIs this is because of their preferred creditor status and their callable capital. For NDFIs this is because they benefit from explicit or implicit state guarantees.

This ability to provide affordable patient capital is further enhanced by the ability of the DFIs studied to mobilise and access external concessional resource (except for DBJ which does not use). This further reduces their cost of capital enabling them to offer more flexible investment instruments which invest in the risker parts of project capital structures, thereby enabling investment in RE projects which their own balance sheets would not normally allow. For example, this enables DFIs such as PTSMI to take subordinated loan positions which the commercial banking sector in Indonesia can't take.

Related to this, DFIs signaled their advisory role acting as an 'honest' broker and matchmaker bringing together project developers and financiers.

2.2. Technical expertise

Apart from AIIB, all DFIs identified their technical and sectoral expertise compared to the commercial banking sectors as a key comparative advantage. Unlike commercial banks, DFIs (to varying degrees) have inhouse teams of sector specialists, engineers and monitoring and evaluation experts (EIB, IFC, PTSMI, NAFIN, DBJ, and BRD). This enables DFIs to play a critical role in project preparation to bring projects to the market for funding and investment. This is not something that commercial banks have the expertise or resources to

do. Further, the involvement of the DFI in the project preparation gives a degree of comfort to potential investors.

Some DFIs seek to offer a one stop shop to support the development of RE infrastructure and offer services which cover project development through to financing and investment (PTSMI, IFC, EIB). A few DFIs also offer a fairly comprehensive range of instruments to support the development of RE infrastructure across the project lifecycle from patient equity through to senior debt (IFC, DBJ, PTSMI (through SDG Indonesia 1).

CDB piloted the photovoltaic power since 2003 at the early stage of its development. Commercial banks were risk averse and reluctant to enter into untested investment areas, as they primarily made investment decisions based on project-level risk-return analyses and had little knowledge of the industry or technology. By contrast, CDB was born out of six state-owned investment companies that were created in 1988, responsible for the management and operation of fixed asset investment projects funded by the central government. Hence, CDB benefited from industrial expertise from the six investment companies. Energy experts at CDB aimed at system-level development outcomes by investing in the whole supply chain of the photovoltaic power industry including upstream . Accordingly, this helped to incubate the market successfully so that commercial banks followed suit to make investments in this renewable energy.

2.3. Country risk mitigation

Some DFIs can also offer products to mitigate country risk. For example, the IFC can leverage in and coordinate World Bank upstream policy and regulatory advisory support with guarantees to mitigate country risk such as MIGA's political risk insurance and world bank guarantees which can guarantee government payment obligations under PPA's.

CDB and the National Energy Administration (NEA) of the Chinese government jointly issued Recommendations on Financial Services in Support of the Dispersed Photovoltaic Power in August 2013 when this renewable energy is at the early stage of development.[2] To speed up the development of the dispersed photovoltaic power system, NEA made a national planning and designed the pilot demonstration zones in collaboration with CDB. NEA requires local administration to ensure the consistent policy support for this renewable energy. CDB helped the local governments to establish local government financing vehicles that operated on the market principle and received long-term loans (as long as 15 years) and diversified financial products from CDB. CDB provided incentives to first movers in the national demonstration zones by adopting the differentiated pricing strategy. By collaborating with the government, CDB can help to reduce and mitigate policy and regulatory risks.

[2] Recommendations on Financial Services in Support of the Dispersed Photovoltaic Power No.〔2013〕312, 22 August 2013, accessed 12 June 2020, http://www.nea.gov.cn/2014-09/04/c_133620586.htm

2.4. Demonstration effect to overcome the first-mover challenge

All DFIs identified that their involvement in a project acts as a signaling effect and offers 'soft' enhancement (e.g. credibility). The involvement of the DFI signals that the project has been examined in depth from an ESG perspective (e.g the project is compliant with high technical, environmental and social standards) and that the project is bankable. This seal of approval is very important for private investors who are often unfamiliar with the RE sector and/or geography.

DFIs have played an important role in piloting RE investment to demonstrate viability and kick start market development. Good examples of this role can be found in the geothermal sector as discussed above. A key barrier to geothermal development as noted above is resource risk. The only way to confirm the resource is to drill with very high upfront cost. NAFIN and PTSMI in partnership with MDFIs providing access to external concessional finance are funding the exploratory drilling to confirm resource, ascertain commercial viability and inform potential project development. This is a risk that private financiers are not willing to bear. Some DFIs are also providing high risk start up capital to develop and pilot frontier RE technologies such as battery storage. For example, about 20% of the IFCs RE portfolio is invested in this area. EIB also invests using INNOFIN in new RE technological development. Another good example of this demonstration effect is DBJ's investment in the European off-shore wind market. One of the primary objectives of this investment is to learn about the cutting edge technology and the development of the off-shore wind market (regulatory and policy frameworks) in Europe to inform its approach to supporting the development of the off-shore wind market in Japan, which has not yet been developed. DBJ is also leveraging this experience and learning to inform its supply of risk capital to enable the development of new renewable energy business overseas for Japanese energy companies and cultivate the investor base for off-shore wind investment in Japan.

CDB piloted the forest-solar complementary power in the City of Jiangshan of Zhejiang Province and supported the project with RMB 212 million (USD 31 million) to achieve the demonstration effect (CDB, 2016). Take the Longyangxia Solar-hydro 320MW Photovoltaic Power Station for another example, the project has been one of the largest photovoltaic power projects in the world and the first solar-hydro hybrid photovoltaic power project in China. The project has a total installed capacity of 320MW and a total investment estimation of 3.73 billion RMB (542 million USD), and the Bank committed 2.98 billion RMB (433 million USD) in loans. CDB is currently piloting offshore wind and optothermal techonologies in China.

2.5. Coordinated approach to scale up renewable energies

Many DFIs go beyond project investment to support the development of complementary RE infrastructure (aside from the IFC). For IFC investment in transmission and distribution accounted for only 4% of its energy portfolio. Reflecting the fact that it only operates in the private sector and thus it is very country specific and depends on the whether transmission and distribution have been privatized. It does, however, coordinate with World Bank and IBRD on upstream advisory work. For many DFIs transmission and distribution is very important as they often work to support 'electricity access' /electrification objectives. For example, energy access is the first objective of the AIIB's energy strategy, so this is a key investment area but

the need is huge. About 22% of its energy portfolio is invested in electricity transmission and distribution. EIB invests in transmission and distribution including smart grids. This is an important area for the EIB. Within the EU, the EIB has committed to work with countries on their energy plans and this necessitates approaching from a whole grid perspective

At the country level NDFIs work to support government objectives so this means supporting complementary investment in transmission and distribution. In Indonesia the Government has set a target to electrify the whole country. Downstream distribution is dominated by the state-owned electricity company PLM and PTSMI invests to support PLM achieve this target. In Japan DBJ recently made its first investment in the largest transmission project for onshore wind in Japan and aims to help solve grid connection issues that hinder the expansion of renewable energy through its future investment. CDB finances storage technology, transmission lines and renewable energy industrial parks to go beyond the project level analysis of financial viability of a single renewable energy project.

III – Financing Models of DFIs in Piloting and Scaling up Renewable Energies

The financing approaches and instruments used by the DFIs studied can be grouped into four categories. Those which:

(1) help mobilise private investment at scale (loan syndication, issuance of green bonds, product standardisation and pooled equity financing);

(2) provide risk capital across the three risk levels in the capital structure of an investment from equity at the bottom of the capital stack which carries the most risk, through to mezzanine finance (preferred equity, convertible grants and loans, subordinated debt), through to senior debt at the top of the capital stack which carries the least risk;

(3) support the development of renewable energy projects for investment through grants and technical assistance; and

(4) provide access to capital for SMEs and households who undertake small scale renewable energy investment.

As can be seen from Table II.1 in Appendix II, a diverse set of approaches and instruments are deployed by the DFIs studied. Except for the IFC and Development Bank of Japan (DBJ), few have a comprehensive product offering across the range of instruments and approaches. A mixture of factors can account for this including: conservative business models, institutional set up, geographic focus, sovereign versus non -sovereign split of operations etc.

3.1. Mobilising renewable energy investment at scale

3.1.1 Loan syndication

Loan syndication (LS) is predominately used to finance large RE infrastructure investment and much of the syndication is in the form of A/B loan structures, where the DFI provides a senior loan from its own balance sheet and retains a portion of the loan ('A' portion) for its own account and sells the remainder to private investors ('B' portion). The IFC's Managed Co-lending Portfolio Programme (MCPP) syndicated loan platform develops this concept further by deploying a 'blind pool' approach, which enables institutional investors to passively invest in IFC's future loan portfolio, including RE. A good example of this was the construction of the 88 MW La Genoveva wind farm project in Argentina, which was partly financed by a $46.1m facility from the IFC's MCPP.

LS is a common approach for National Development Finance Institutions (NDFIs) and for IFC and CAF out of the multilateral DFIs (MDFIs). It is not generally used by EIB as 90% of its activities are within the EU where there is less need for LS given the deep and developed capital markets. The majority of EIB's activities are direct lending and co-financing. This contrasts with other MDFIs who work mainly in developing economies with less developed capital markets (such as IFC and CAF). As a relatively new institution, AIIB is still developing its toolkit but like EIB most of its operations are direct lending and co-financing.

In Japan the role of DBJ in LS for RE depends on the stage of development of the RE sector. In the past DBJ was very active in LS in solar and onshore wind but as these sectors matured so did their financing markets so this role is now redundant for DBJ. DBJ does, however, envisage a LS role in the development of a new offshore wind sector in Japan which will need large scale financing.

For the reasons set out below LS is one of the main approaches of NAFIN to scale up RE investment. It has led numerous LS including the financing for Phase II Puebla wind farm £177m, Aguascalientes PV solar plant and the Yucatan wind park. LS has also been one of the main approaches of PTSMI in RE infrastructure investment. To date PTSMI has syndicated loans for 11 projects in biomass, hydro, min-hydro, wind and geothermal. Except for one syndication PTSMI has taken the senior portion. Only in one syndication did PTSMI take a subordinated position and this was enabled by an AFD first loss guarantee (Box 3).

LS enables DFIs to manage balance sheet exposure (i.e. diversify risk on balance sheet), leverage their origination capacities to leverage larger financing package for RE investment and for smaller NDFIs such as the BRD LS has allowed the BRD to overcome limitations on lending imposed by the small size of their balance sheets. The approach also leverages one of the key comparative advantages of DFIs in supporting investment in RE which is the soft enhancement that their involvement in the syndication plays, giving comfort to private investors. A good example of this kind of soft enhancement is the involvement of CAF in syndicated loans in Latin American countries which have volatile macroeconomic fundamentals and high risks of capital controls. CAF's preferred creditor status gives private investors preferential access to foreign currency in the event of a foreign exchange crisis.

3.1.2 Product standardisation

DFIs can standardise the financing structure of their instruments to reduce transaction cost of small-scale renewable energy projects and which enables aggregation of projects for bundling projects into larger pooled portfolios or allowing for securitization. For example, since the scale of onshore wind power and dispersed photovoltaic power is often very small, CDB has tried to take a bundled approach to finance a group of renewable energy projects to reduce transaction costs.

IFC scaling solar a good example of how scalable markets can be created through consistent tendering and bankable documentation (for proven technologies). WBG program to support countries procure 'utility-scale' solar power and make operational within 2 years. Provides templates for all processes and standardized documents (that eliminate negotiation (i.e. the documentation is bankable) which help quick preparation, transparent tendering and rapid financial close.

3.1.3 Green Bonds

Green bond issuance is a common approach for DFIs to scale RE investment except for BRD which does not raise funds on the capital markets. EIB and IFC have large well-established large regular programmes since 2007 and 2010 respectively, whereas AIIB has only issued sustainability themed bonds since 2019. In 2019 AIIB established with Amundi (Europe's largest asset manager) a $0.5billion Asia climate bond portfolio to develop the climate bond market in member countries. The fund will invest in 'labeled' and unlabeled green bonds and support issuing companies transition to green business models.

NDFIs have newer and less established (regular) green bond programmes. It is clear that DFIs have played a pioneering role in kickstarting and developing the green bond markets at the international level (for EIB and IFC) and at national level for the NDFIs. All NDFIs were the first country issuers, helping develop the green bond market and expand their renewable energy investment by mobilising institutional investors (e.g. 70% of PTSMI's green bond issuance has been bought by institutional investors).

However, these initiatives have proved to be a challenge for NDFIs where domestic capital markets are less developed, where there is a lack of bankable projects and where currency mismatch and foreign exchange risk concerns have dampened desire to issue on international capital markets (e.g. PTSMI). In Mexico, the election of a new President in 2018 has caused some consternation among green bond investors.

Table 1: DFI green bond issuance

DFI	Green bond programme
EIB	EIB issued world's first Green Bond, called a Climate Awareness Bond (CAB). As at 31/12/19, EIB had issued EUR 26.7bn raised in 13 currencies. (EUR 3.4bn raised in 2019).
IFC	Established in 2010. As at 31/3/20 IFC had issued $10.3 billion across 172 bonds in 18 currencies.
AIIB	First $2.5billion AIIB sustainability themed bond including RE infrastructure issued in 2019.
CAF	Launched in 2018. The Green Bonds Program placed three emissions for a total amount of USD 132 million. In 2019, CAF reinforced its support for the Green Bonds Program to identify and assess credit operations to back the first public issue of the green bond, for EUR 750 million
CDB	CDB priced its debut international green bond on 9 November 2017. The Bonds consists of a 5-year USD 500 million tranche and a 4-year EUR 1 billion tranche.
DBJ	First Japanese green bond issuer in 2014. Regular annual issuance. Green element now wrapped into Sustainability bonds. Issue in euro markets. Large appetite from European and Japanese institutional investors.
PTSMI	First corporate issuer in Indonesia in 2018. First issuance $70m, part of $210m programme.
NAFIN	First Mexican green bond issuer in 2015 and first Latin American green bond. $500m to exclusively finance RE investment (mainly wind farms). Due to expire. Considering whether will issue another. Thinking of issues a sustainability bond that incorporates green considerations but expands to address social challenges. Future uncertain with election of new government in 2018 (left wing).

3.1.4 Pooled equity funds

Pooled investment vehicles can overcome size issue, attract institutional capital who look at large ticket size and offer attractive risk diversification. These can be funds that directly invest in RE projects or fund-of-fund structures which invest indirectly through sub-funds. The latter approach can be much more catalytic as it not only mobilises private investment in the fund of funds itself, but it mobilises private investment into the funds it invests in and mobilises more equity and debt investment at the project level.

Most DFIs state that they are development banks and as such they are not investment managers. Except for IFC's Asset Management Company, DFIs do not actively manage third party capital or equity funds (either generally or specifically for RE investment). It is common, however, for MDFIs (e.g. AIIB, IFC, EIB, CAF), to invest in 3rd party managed funds which focus on RE investment or include RE as a target sector if a more general fund. Often the investment of the DFI is seen as a seal of approval and helps mobilise institutional investment in RE, which again leverages one of the comparative advantages of DFI investment. Examples of this of investment include AIIB investment of $100m in the SUSI Asia Energy, a target fund of $250million to mobilise investment in RE, energy efficiency and microgrid projects, EIB's investment in numerous infrastructure funds which invest in RE inside and outside of the EU. NDFIs did not invest in pooled equity vehicles except for DBJ. DBJ has invested in several funds designed to mobilise private Japanese investment in RE both inside and outside Japan. The DBJ set up the Overseas renewable energy fund with the Sumitomo Corporation and Sumitomo Mitsui Banking corporation to mobilise Japanese investment into overseas offshore wind power projects. Several new offshore wind power projects are in the planning stages in Japan and this inaugural overseas off-shore wind fund helps cultivate the Japanese investor base for off-shore wind in Japan. DBJ has also established mechanisms to effectively recycle capital for RE investment (Box 1).

Box 1 - A Capital recycling model: Japan Wind Development Joint Fund

In 2016 DBJ established the Japan Wind Development Joint Fund. This private joint-investment fund is the first Japanese Fund to adopt the capital recycling model for wind power projects. The fund acquires and operates wind turbines owned and operated by Japan Wind Development, a Japanese wind developer and its affiliates. This ¥50Billion fund will be financed with equity investments by JWD and DBJ in equal amounts, and DBJ loan.

The fund markets its debts to local banks and private institutional investors seeking socially-responsible investment opportunities. To increase its transparency and creditworthiness, the Fund has acquired a BBB rating from the Rating and Investment Information, Inc., a Japanese credit rating agency. DBJ believes that through its successful adoption, the capital recycling model, will serve as an archetype for the market.

Box 2 - Use of external concessional finance by NDFIs to fund guarantee deployment in the RE sector

NAFIN

The objective of the "Eco Crédito Empresarial Masivo" Program is to modernise the electrical equipment of MSMEs to promote cost savings and energy efficiency, through the substitution of obsolete equipment (mainly refrigerators) for new and more efficient ones, ,as well as the installation of solar panels. The scheme as been in operation for 8 years and has been funded throughout by several loans from KfW, which has enabled its continuity. It is now totally financed with a loan agreed with KfW in December 2018. The resources obtained from the loan are directed to Nafin's Guarantee Fund through which a credit line is made available to the financial intermediary, FIDE (Fideicomiso para el ahorro de energía). FIDE. FIDE as the executing agency of the Program, then extends loans to the final beneficiaries, MSMEs.

BRD

In 2018 BRD and SIDA agreed a $20m RE portfolio guarantee facility over 8 years. It covers $15m of direct BDR RE lending and $5m indirect lending through SACCOs and LFIs. The SIDA guarantee covers 50% of any losses if the end borrower is Male and 70% for female borrowers. Scheme can cover any loan that DBR makes in RE (including through REF). It covers up to 50% loss if end male and 70% of loss if female. 'The intervention expects to support the development of, and access to, affordable and clean energy solutions in areas not covered by Rwanda's national Energy Access Roll-Out Programme (EARP) for grid expansion.'

PTSMI

Through SDG Indonesia 1 platform AFD provided a first loss guarantee (FLG) on the debt finance PTSMI provided to the Air Puith Mini-hydro power plant project (total project cost $50.44 million). The structure included a senior loan from a commercial bank and a subordinated loan from PTSMI. In the event of project failure before commercial operation, PTSMI could use a AFD grant finance to cover PTSMI's loss up to 15% to a maximum of 15% of the loan capped at $2 million. This FLG de-risks PTSMI and enables PTSMI to invest in the riskier parts of the capital structure for higher risk projects (technology or bankability risk). PT SMI taking the junior position gives commercial banks confidence on the bankability of project.

The IFC's Asset Management Company (AMC) opens the investment range of investment opportunities for institutional investors, giving them access to an expanded investment universe and enables the IFC to mobilise institutional investment into RE. The IFCs AMC manages a number of funds which mobilise RE investment: (1) a IFC $418m catalyst fund of funds which invests in private equity funds, platform companies and co-investments focused on RE and energy efficiency projects; (2) a 1.2billion IFC Global Infrastructures Fund for equity and equity-related infrastructure investments which includes a small RE subset of its portfolio, and includes the AREF fund and other funds investing in RE in Africa, Asia and Latin America; and (3) a IFC Africa, Latin America and Caribbean fund which includes a small RE subset of its portfolio.

PTSMI have not invested in pooled equity yet for RE but are exploring replicating pooled equity funds successful in SME financing to RE.

3.2. Providing risk capital

Much DFI investment (funded by own balance sheet resources) provides vanilla senior debt financing to corporates or projects. Most provide risk capital, but this does not constitute the majority of DFI investment in RE, for many NDFIs this is often financed by external concessional resource. Only a few provide mezzanine and direct equity investment funded from their own balance sheet (e.g IFC, DBJ, PTSMI,). For some, specialist sister equity institutions provide equity investment as ins the case for NAFIN, EIB within Europe (although it can make equity investment outside Europe funded by mandate).

3.2.1 Guarantees

Guarantees issued by DFIs can help mitigate various types of RE investment risks, including political, policy, regulatory, credit and technology risk. However, their use to support RE investment remains limited, especially amongst NDFIs. Where these are deployed by NDFIs they are funded by the use external concessional capital. For the MDFIs, their RE investment can be supported by guarantees issued by sister institutions such as WB and MIGA for IFC investment (for example MIGA provided the political risk insurance for the Nachtigal hydropower project in Cameroon, without which the private investors would not have invested and the provision of partial risk guarantees by the WB to 'mitigate against offtaker credit risk, a key bankability issue and a PRG allowing for tenor extension of local currency trance to 21 years, a first in sub-Saharan Africa'. For the EIB, EIF provides guarantees for EIB investment within EU. Outside the EU, EIB can offer guarantees but this is funded by mandated funds. AIIB also provides credit enhancement funded by its own balance sheet.

The extent of use of guarantees is limited by NDFIs. PTSMI does not yet deploy guarantees in the RE sector as this is a relatively new sector for PTSMI and so PTSMI does not yet have the track record to understand and price risk, policy uncertainty further compounds this challenge. However, PTSMI recognises the need to deploy such instruments to mitigate and/or transfer risk are currently in discussion with GIZ under the SDG 1 platform to establish a $15m guarantee premium facility (funded by GIZ) aimed at small scale RE projects which would comprise of a $10m facility to fund premiums of loan guarantees issued by third parties such as Guarantco, ITF etc and $5m for technical assistance. It is envisioned that a

third party would guarantee the loan and GIZ would pay the premium. The project owner would not know about the guarantee but would benefit from a lower cost of financing and moral hazard would be avoided. NAFIN also provides guarantees focused on guaranteeing commercial bank lending to SME's as part of programmes aimed at modernising electrical equipment and enhancing energy efficiency funded by a KfW loan (Box 2). DBJ can offer guarantees if this is requested by co-financiers (often to boost the credit worthiness of the company as not rated) but prefers to invest directly and own the asset.

3.2.2 Equity and mezzanine financing

As can be seen from table x in annex x some DFIs do provide mezzanine finance such as subordinated debt, convertible finance, preferred equity etc and do also make direct equity investment. In general, however, the use of these instruments has been limited compared to traditional senior corporate or project lending in RE.

IFC offers mezzanine financing for RE investment (preferred equity, subordinated loans, income participating loans, convertible loans). The EIB does very little equity investment from its own balance sheet.[3] It does deploy equity capital outside the EU for RE investment but this is financed under mandate. In this way the EC and/or member states take the credit risk on this kind of investment. Within the EU, the EIB's subsidiary, the EIF deploys equity capital. To date the EIB has not really used mezzanine finance, although it is starting to use it, for example, in supporting the development of new green technology or piloting this within EU through the INNOVFIN mandate.

The DBJ is especially noteworthy for its focus on the provision of equity and mezzanine capital. In Japan it has moved away from senior lending in solar and onshore wind to focus on mezzanine and equity investment as the development of these sectors means that commercial banks can provide the necessary financing and DBJ not want to crowd out. As the private financing market is now established and can fund this. Little role for senior lending by DBJ. It does, however, envisage a LS role in offshore wind as this is a new sector in Japan which will need large scale financing which private market not provide.

Outside Japan, the form of investment depends on whether DBJ is coinvesting with Japanese partners. Typically, DBJ prefers mezzanine equity as it does not want to be involved in the operation and wants to exit quickly once the project is complete. Mezzanine equity allows DBJ to do this. This was the case for its investment with Jpower where DBJ provided the investment vehicle established by J-Power with preferred equity for the acquisition of 25% equity stake of UK offshore wind power 'Triton Knoll'. For projects where there is no Japanese coinvestor and the market is new to DBJ, DBJ uses less riskier instruments and prefers to play a smaller role, for example, the 'B' portion of a syndicated loan with the objective participating to learn so that DBJ can play a bigger role when the technology comes to Japan. In Mexico equity investment is done by separate government owned specialist institution CMIC.

[3] EIB noted the issue of regulation and the provisioning requirements for equity which acts as a disincentive.

3.2.3 Convertible financing

This kind of instrument is very useful where the risk is very high such as the development of new technologies or where there is resource uncertainty. A good illustration of the latter is geothermal development where you need to drill and incur significant capital expenditure without knowing ex ante what the geological resource available is. The upfront cost can be between 35% to 40% of the total project cost and without resource certainty the private sector is unlikely to do the exploration. This is the highest risk stage in geothermal development. DFIs, in partnership with donors, climate funds and MDBs have used innovative instruments such as convertible/contingent grant instruments to help address exploration risk. We found examples of this by PTSMI and NAFIN, see boxes 3 and 4 respectively. In both cases we noted that the DFI itself does not carry any of the exploration risk on its balance sheet. If drilling is unsuccessful, the sunk costs are funded by external grant finance (e.g. GCF, CTF) or in the case of PTSMI the Government Geothermal development fund.

Box 3 - Use of convertible financing instruments to address geothermal exploration risk

PTSMI

Indonesia has significant geothermal potential, estimated at 29GW, but only 1.95 GW of this is currently realised. Exploration drilling risk and large upfront capital investment are key barriers to developing Indonesia's full geothermal potential. This stage of development is highly risky as there is a risk that exploration drilling costs and capital investment are not be recovered further downstream if developers find insufficient resource is insufficient or that commercial exploitation is unviable. This risk is further compounded by current policy and regulatory framework which allows for the issue of exploration-only (not full development) licenses and tariff uncertainty (tariff only agreed after success in exploration). Further, policy that caps tariffs at the average regional electricity generation cost adversely affects the competitiveness of geothermal energy in certain regions.

The Government with support of GEF, CTF and World Bank has implemented two initiatives

1) Greenfield exploration drilling by Government to understand exploitation potential (data) prior to concession tender. If sufficient resource is confirmed, the winning bidder repays the exploration costs plus margin to PT SMI. PTSMI manage a revolving fund part funded by Government of Indonesia's geothermal fund (which PTSMI has been assigned to manage and which was transferred to PTSMIs balance sheet by way of capital injection). It pays back the debt component of donor and M/L financing. If resources are not confirmed and/or the private sector is not interested, the Government tops up the fund plus margin to PTSMI (through capital injection) if donor and multilateral funds have not been used for the project, otherwise donor grants finance the sunk costs.

2) The Geothermal energy risk mitigation facility (GREM) supports greenfield exploration drilling by SOEs or private concession holders. Provides loans with partial 'forgiveness'. The GREM is financed by (1) loans and contingent grant facilities from the World Bank, CTF and GCF and (2) the Government geothermal fund which PTSMI has been assigned to manage (transferred on to balance sheet by way of capital injection). The public window is operational. This window lends to SOEs (50% loan financed by WB, CTF and GCF, 50% loan from geothermal fund). If drilling unsuccessful, the geothermal fund can forgive 50% of the loan but CTF, GCF loan is repaid by SOE. The private window is not yet operational. It is envisaged that private sector developers will be lent 50% of the project cost funded by the WB loan and 50% in the form of a subscription to an innovative instrument issued by the developer funded by a convertible grant from GCF or CTF. If drilling is unsuccessful, 50% of sunk costs would be funded by GCF and CTF grant resources. Essentially, losses are absorbed in the public window by the Government geothermal fund (which is topped up through capital injection) and GCF and CTF grant in the private window. (The other 50% is repaid by SOE/private developer?) Thus, PTSMI don't carry any of this risk on their balance sheet.

This is also a good illustration of the comparative advantage of PTMSI. Commercial banks who provide senior lending can't provide this flexibility.

3.2.4 Foreign exchange hedging

Foreign exchange risk has been identified as a big risk especially by NDFIs who face currency mismatch as they secure funding in hard currency which the Bank needs to manage. At the project level many RE investment projects are subject foreign exchange due to the currency mismatch of assets and liabilities, much of the equipment/technology is imported and purchased in foreign currency but the revenue to service the project financing is generated in local currency. Currency risk mitigation measures include hedging instruments resolving currency mismatch in renewable energy projects, as well as mechanisms to deal with the high cost of hedging itself, although hedging only works for debt.

Box 4 - Use of convertible financing instruments to address geothermal exploration risk

NAFIN

The NAFIN Geothermal financing and risk transfer programme seeks to mitigate exploratory geothermal risk (highest stage risk in geothermal development) and mobilise private investment to increase electricity generation from geothermal resources in Mexico. Currently, it is estimated that Mexico has a total potential for geothermal electricity generation estimated at 13.4 GW.

Initially, the Program will support 4 exploration projects with grant resources from the Clean Technology Fund (CTF) funding non-reimbursable technical cooperation and exploratory drilling; and a loan from and Inter-American Development Bank (IDB) for the construction, modernization and expansion of power plants and transmission lines.

There are two phases to the programme:

Phase 1. The grant from CTF which is used for exploratory drilling. If drilling is unsuccessful, the non-refundable grant is activated which represents the end of that project. If the drilling is successful, the grant turns into a credit that the developer will begin to pay when the power plant goes into operation.

Phase 2. The loan from IDB will be used for the construction, modernisation and expansion of operating plants and transmission lines. The developer will begin to pay the loan when the power plant goes into operation.

All MDFIs studied offer local currency financing but this is very limited and often in a small selection of currencies. MDFIs can lend in local currency where there are developed SWAP markets. The IFC can offer products through its treasury department to mitigate foreign exchange risk but this can be costly and is not available for many local currencies This was raised as a big issue by CAF who mainly lend in US$ and only lend in a few local currencies where there are good SWAP markets such as Columbia or Mexico. Lending in US$ in Brazil is often a deal breaker. However, for the EIB foreign exchange risk is not issue within the EU where the EIB does 90% of its business and it can match borrowing currency with revenue currency, outside the EU foreign exchange risk is a big issue. The EIB lends in hard currency. The foreign exchange risk can be borne by the EC (which has instruments to mitigate foreign exchange risk) or the project not by the EIB. Where foreign exchange risk is hedged this often increases the cost of debt financing provided by the DFI.

All NDFIs identified foreign exchange risk as a challenge to investing in RE. For BRD this is an especially big issue due to its limited capitalisation and reliance on hard currency borrowing from international development partners, To help manage the mismatch on its balance sheet the Bank makes use of the central bans SWAP window and is currently in discussion with TCX. Hedging, however, is not cheap and the cost of the hedge is passed on to the customer or project which increases the cost of financing, on occasion eroding the ability of the bank to provide lower cost financing than commercial banks. The bank needs to find a solution to this and is seeking to diversify its funding sources and increase its access to local currency financing. For PTSMI currency mismatch has meant that it had to issue its green bond in the domestic market. Even for DBJ foreign exchange risk is a big issue affecting its ability to invest in foreign markets. The bank does issue Eurobonds but enough to cover their euro renewable energy investments due to very strict foreign bank exchange exposure limits and risk management. To mitigate foreign exchange risk the DBJ hedges in commercial markets but this increases the cost of funding. Foreign exchange risk will also be an issue for the development of offshore wind in Japan as the turbines will need to be imported from EU or USA. DBJ will use SWAPs to hedge foreign exchange risk which will increase the cost of funding.

Several DFIs identified that the state of play regarding local currency lending and foreign exchange risk was unsatisfactory and that more needs to be done especially by the MDFIs. In some countries the solution has been for the PPA to index the price of electricity index to $ or euro. Another example of a more innovative approach to address this issue is the creation of local syndicate of banks who could provide local currency financing with a MDFI guarantee covering the loan syndication.

3.2.5 Blending external concessional resourceForeign exchange hedging

All MDFIs identified a need to access and blend externally provided concessional finance with their own account resource, due to their financing models which rely on funding from the international capital markets and the need therefore to preserve their triple A credit rating. Blending is important when making higher risk lending or investment in frontier RE technologies where there is high technological risk and which is impossible to finance commercially (e.g. hydrogen transport) or in riskier geographies such as LICs and fragile states. The IFC has access to numerous donor trust funds specifically focused on RE which it uses to blend, as well as international climate finance such as CIF and the GEF. The AIIB does not yet have access to this kind of resource but sees the need for this to be able to invest in LDCs. To date its approach has been to partner with other DFIs who can bring his type of concessionality to the table and it is in the process of seeking accreditation to the WB Global Infrastructure Facility. The EIB has access to external concessional resource from the EC or EU member states (known as EU mandate funds) and is accredited to the GCF. The majority of the EIB's investment outside the EU is funded by EU mandate or EC funds and this is the case for RE. It is very rare for the EIB to invest using its own account outside the EU. If it does, the investment must be rated. This is to do with the capital provisioning requirements against non-rated business. As a result the use of instruments differs. Within the EU EIB invests directly using debt finance or indirectly through private equity funds. Outside EU, the EIB has set up several blended finance vehicles. Different geographical mandate funds allow for use of different kind of instruments, the most flexible of all, allowing the use of any instrument is the ACP mandate. The EIB also blends within the EU for high risk business and has benefited from the European Fund for Strategic Investments which provides EIB with a first loss guarantee on high risk investment which can include RE infrastructure projects. CAF also has access to external concessional resource to help fund RE investment (e.g. AFD, KfW and GCF). It also gets approached by other agencies to collaborate because it has the local knowledge and country connections.

Box 5 – SDG Indonesia 1: a blended finance platform to scale sustainable investment in Indonesia

Established in 2018, SDG Indonesia 1 is a blended finance platform which blends public and private funds from donors, philanthropies, equity investors, commercial banks and multilaterals into SDG infrastructure projects in Indonesia. To date about 70% of the blended investment has been in RE. Commitments in the platform secured so far total $3.03billion from a diverse group of 32 public and private investors. PTSMI manages the platform and blends the resources. The Government of Indonesia appointed PTSMI to manage the PT SMI to manage the platform based on its strong track record in managing various funds from donors, bilateral and multilateral, its ability to structure investment and develop innovative financial solutions and its ability to monitor project implementation.

Each investor has a different risk appetite and sector preferences. Donor and philanthropic capital can absorb high risk, commercial bank partners can only take senior in capital structures.

The platform offers four facilities: (1) development facilities to fund project preparation (readiness of RE projects has been a challenge ($2.4billion); (2) de-risking products($10million) to increase project bankability such as interest rate subsidies, first-loss mechanisms and cost overrun insurance (projects that are marginally profitable/not profitable enough for private sector but have high social impact); (3) financing facility ($0.5billion); and (4) an equity fund ($0.2billion) to crowd in private investment in infrastructure investment which can fund new greenfield and a brownfield investment enabling the recycling of assets.

For renewable energy 10 partners are supporting TA and capacity building; 1 partner is providing grant financing, 1 partner is supporting the de-risking facility and 1 partner is supporting the financing facility.

The platform enables PTSMI to provide end-to-end financing to support RE infrastructure development in Indonesia.

All developing economy DFIs identified the need to access external concessional capital. For PTSMI which funds itself partly on the domestic capital markets access enables the bank to invest in marginal projects with high impact which its own balance sheet would not allow. This is a key part of PTSMIs strategy to scale up RE investment in Indonesia. The bank has developed several key partnerships with AFD and the World Bank, is accredited to the GCF and has access to CTF and GEF funds through the World Bank and has established a blended finance platform called SDG 1 (Box 5). For BRD which has a low level of capitalisation and high cost of capital (average 15%), it enables the bank to lower its cost of capital and pass this on in lower costs of lending. However, BRD does not have extensive access to this kind of funding. It is actively seeking to diversify its funding base, seeking out low-cost long-term financing

to help lower its cost of capital and cost of lending. BRD has embarked on the GCF accreditation process. By way of example in 2019, the bank was able to mobilise external funds with the average cost at 6.4 percent and tenor of 8 years. NAFIN is the designated financial agent of the Mexican federal government administering loans and long-term financing from international organisations and it relies on external concessional finance (Box 3 and 4) and has been very important in financing the development of the wind sector in Mexico.

3.3. Providing access

3.3.1 On-lending

All MDFIs tend to look at large scale direct RE infrastructure investment due to the high transaction costs associated with smaller scale RE investment such as household solar. For smaller RE projects MDFIs on-lend to LFIs to support this kind of investment, predominately to MSMEs and households. Local LFIs are also better placed to assess risk of this lending. AIIB tends to seek and invest in large ticket investment over $100m, below this AIIB on lends through local reputable financial institutions. For RE projects within the EU less than 100m Euros the EIB also on lends through LFIs. The EIB opens a credit line to fund the on lending. It only takes the intermediary risk, not the actual credit risk of the individual loans made by the FI. This keeps the LFI focused on the quality of lending.

Not all NDFIs on lend for RE investment, because they only invest or lend directly (PTSMI). For PTSMI, the key challenge of small scale RE is the quality of the project sponsor and the structure of the financing itself as many projects are off grid in remote areas where there is not the certainty of demand. For these type of projects PT SMI is using grant resources and wants to mobilise SDG 1 grant financing to pilot this kind of investment BRD on lends for RE investment as LFIs have better networks which are better informed to do credit risk assessment as is the case in Rwanda. BRD manages the Renewable Energy Facility (REF) which on lends through savings and credit cooperatives (SACCO) to increase electricity access through off-grid technology with private sector participation (Box 6).

Box 6 - Increasing electricity access through off-grid technology in Rwanda

The Renewable Energy facility (REF) in Rwanda is $48.94 million fund financed by the Scaling-Up Renewable Energy Program (SREP) – a multi-donor trust fund managed by the World Bank to mobilise private investment in RE. The REF is part funded by a loan (approx. $27m) and part funded by a grant (approx. $21m) and the facility agreement is signed by the Ministry of Finance. The Ministry of Finance appointed BRD as the project implementing entity and the bank manages the fund. The objective of the REF is to increase electricity access through off-grid technology with private sector participation and is designed to address consumer affordability and access to finance constraints as Rwandan FIs are cautious about RE lending due to the perceived high risk.

The REF has four windows providing local-currency financing*: (1) on-lending through savings and credit cooperatives (SACCOs) to households and micro enterprises (tenor 3 years and a grace period); (2) on-lending through local banks and micro financial institutions to households and SMEs (tenor 6 years); (3) direct lending to mini-grid developers (tenor 15 years); and (4) direct lending to off-grid solar companies (tenor 4 years).

One of the main objectives of the REF is to provide low cost affordable financing but this ow cost financing is still not affordable for some households. The BRD is currently developing a concessional subsidy window to address these household affordability constraints. This new window will provide a grant for part of the capital cost of the home solar system. $15m has been allocated to the subsidy window which will be channelled to households through the off-grid solar companies. The subsidy will be targeted according to four household income levels. For example, if the home solar system costs $120, a very poor household (category1) would get a subsidy of 90% subsidy ($108) and would borrow the remaining $12.

*The Ministry of Finance provides BRD with local currency to lend.

3.4. Providing development

All DFIs studied had project development facilities which support the development of pipelines of bankable RE infrastructure projects which help overcome a key constraint to scaling RE investment. These facilities can help fund project expenses such as feasibility studies; economic, social and environmental assessments, viability studies etc. For developing country DFIs these facilities were often part or majority funded by grants and or concessional debt confirming the importance of access to concessional finance for many NDFIs. The development facility under the SDG Indonesia 1 is the largest facility of the platform totaling $2.4billion funded by grant finance of $24.6m and concessional debt totaling $2.3billion. The allocation reflects the significance of a lack of investible projects. PTSMI has identified project development as one of three strategic objectives for the bank and sees this as a unique role and contribution. Commercial banks are keen to invest in Indonesia but they don't have the expertise to do the project preparation of the funding to

fund project preparation. DBJ provides project development support as part of its equity or mezzanine investment. It also used to provide TA and capacity building to other regional DFIs funded by external concessional finance from WB or AsDB. This stopped in 2008.

Some MDFIs also rely on trust funds to fund project development. For example, the AIIB draws on a Project Preparation Special Fund which is a multidonor funded. Through this the AIIB can provide technical assistance grants. The bank can also offer project advances to finance project preparation for sovereign-backed financing.

For the IFC, IFC InfraVentures is a fund which combines early stage risk capital and project development expertise to help bring projects to financial close mainly in IDA countries. It can fund up to $8m in project preparation costs (including feasibility studies, environmental, social and economic studies, financial modelling, negotiating financial and legal terms of project documents etc). This support then gives the IFC to the right to an equity stake at financial close and the right for IFC to arrange the long-term debt finance for the project. This codeveloper approach has been used for example in Cameroon (Nachtigal 420 MW hydro) in 2019; SSO Mali (Segou) 33MV solar in 2017, Kipetc 100MW Wind in Kenya in 2013, Upper Trishuli-1 216 MW hydro in Nepal in 2012.

Conclusion and Policy Recommendations

Based on the in-depth interviews with practitioners, we have the following key findings. First, we identify key risks of piloting and scaling up RE: technology risk, political, policy and regulatory risk, macroeconomic risks, and bankability risks. Technology risk is the top risk hindering the pilot effort of financing RE, whereas political, policy and regulatory risks are the core binding constraint of scaling up RE. Though technology risk and political, policy and regulatory risks, and bankability risks are relevant to countries at all stages of development, foreign exchange rate is particularly acute for developing countries. Second, we examine the financing models of DFIs in making investments in RE in great depth, including deploying loan syndication, product standardization, green bonds, and pooled equity funds to moblise renewable energy investment at scale, utilising guarantees, equity and mezzanine financing, convertible financing, foreign exchange hedging, and blending external concessional resource to provide risk capital, and focusing on project development. Last but not least, DFIs have comparative advantages in the provision of affordable patient capital, technical expertise, country risk mitigation, demonstration effect to overcome the first-mover challenge and coordinated approach to scale up RE.

We derive six key insights and policy recommendations from the preceding analysis which are relevant for policy makers:

1. The vast majority of DFI instruments and approaches focus on scaling or piloting investment of established renewable energy technologies (solar, onshore wind and hydro). All DFIs engage in loan syndication and all DFIs who access capital markets issued green bonds to develop the green finance market and scale investment. In contrast, few DFIs were active in supporting the development of frontier technologies and storage solutions. For those that were this formed a relatively small part of their business and the high-risk early stage development capital was often funded off balance sheet by blending external resource. Large MDFIs who have access to external/cheaper capital than NDFIs should seek to step up their engagement and actively support the development of new frontier RE technologies either directly or indirectly through fund investment.

2. Except for DBJ, no DFI deployed capital recycling models. Advanced economy DFIs and MDFIs are well placed to make use of this kind of approach and should actively explore options to securitise their operational RE infrastructure portfolios.

3. Traditional senior lending and co-financing dominates the DFI approach. The more innovative instruments and approaches tended to be financed using blended finance or the deployment of special funds managed off balance by the DFIs. This was especially the case for NDFIs, which reinforces the need to channel more international public climate finance through NDFIs (Griffith-Jones et al, 2019) and for MDFIs and donors to actively step up their collaboration and support of developing country DFIs. Only 1 of the 3 developing country DFIs was accredited to the GCF highlighting the cumbersome and resource intensive process as a disincentive to seek accreditation. The GCF should work with regional DFI associations to review accreditation barriers; explore how to prioritise NDB accreditation and develop new forms of access for NDBs (Attridge, 2019).

4. DFIs especially developing country DFIs play a very important role in building the project pipeline in close collaboration with MDFIs. This is a critical role for NDFIs and a critical collaboration between MDFIs and NDFIs. Much of the support that NDFIs provide for project development is funded in part by external concessional finance. This reinforces once more the need to channel more international public climate finance through NDFIs and for greater collaboration.

5. Foreign exchange risk is a big barrier to scaling RE investment. All DFIs identified this as a key issue and remains an unsolved issue. The use of guarantees to solve foreign exchange may be explored by DFIs, as was the case in Chad where the EIB guaranteed the local bank loan syndication. MDBs may also enlarge the local currency denominated on-lending to NDBs.

6. NDFIs are key intermediators of international climate funds at the country level. Each NDFI had been entrusted by governments to play this role. Other national governments should entrust this role to their DFIs and give NDFIs clear green mandates and integrate these into policy frameworks. Policy coherence is key, as in several countries policy and regulatory uncertainty worked against NDFI efforts to pilot and or scale RE investment.

References

Attridge, S. (2019),
How to get climate finance to flow through national development banks. ODI blog

Griffith-Jones, S.; Attridge, S; and Gouett, M. (2019),
Securing climate finance through national development banks. ODI report.

Monk, A. and Provaggi, A. (n.d),
Leveraging private investment for renewable energy infrastructure. Global Projects Center, Stanford University.

Griffith-Jones, S. (2016),
'National Development Banks and Sustainable Infrastructure: the case of KfW.' Working Paper 006, Global Economic Governance Initiative.

IRENA (2018),
Renewables 2018 Global Status Report GSR. *http://www.ren21.net/status-of-renewables/global-status-report/* (accessed 16 July 2019).

Xu, J. and Gallagher, G. (2020),
Coordinating Clean Energy Transformations: Role of Development Finance Institutions, working paper.

Appendix – 1

Sources of data

Bankfocus database and annual reports. Data on total assets, total equity and gross loans is from the year of 2018.

Table A1: Basic Information of Selected DFIs

Name	Headquarter	Founding Year	Mandate	Total Assets (USD bn)	Total Equity (USD bn)	Gross Loans (USD bn)
EIB	Kirchberg, Luxembourg	1958	The purpose of the EIB is to contribute, by having recourse to the capital market and utilizing its own resources, to the balanced and steady development of the internal market in the interest of the Union.	692.28	79.56	382.29
IFC	Washington, USA	1956	IFC uses capital, expertise, and influence to help end extreme poverty and boost shared prosperity.	92	25	24
AIIB	Beijing, China	2016	The purpose of the AIIB shall be to: (i) foster sustainable economic development, create wealth and improve infrastructure connectivity in Asia by investing in infrastructure and other productive sectors; and (ii) promote regional cooperation and partnership in addressing development challenges by working in close collaboration with other multilateral and bilateral development institutions.	18.97	18.96	9.64
CAF	Caracas, Venezuela	1970	To promote a sustainable development model through credit operations, non-reimbursable resources, and support in the technical and financial structuring of projects in the public and private sectors of Latin America.	0.04	0.01	0.03
BRD	Kigali, Rwanda	1967	To be a trusted and strategic partner for Rwanda's development by availing financing and advisory services to impactful entrepreneurs in key priority sectors.	0.00026	0.00006	0.00018
PTMSI	JAKARTA, Indonesia	2009	PTSMI is established with the main mandate to become the catalyst of National infrastructure development acceleration. Since its inception in 2009, PT SMI continues to develop its capabilities and competencies, and strives to create innovations in implementing its roles as the government fiscal tools, and the catalyst of infrastructure development acceleration in Indonesia.	4.32	2.46	3.21
NAFIN	Mexico City, Mexico	1934	To promote savings and investment; To promote financial and technical support for industrial development and, in general, for the national and regional economic development of the country.	29.62	1.89	4.03
CDB	Beijing, China	1994	CDB provides medium- to long-term financing facilities that serve China's major long-term economic and social development strategies.	2,360.98	189.80	1,688.33
DBJ	Tokyo, Japan	2008	To build customer trust and realize an affluent society by problem-solving through creative financial activities	160	29	120