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# Money Talks?

## Risks and Responses in India's Solar Sector

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CEEW's major projects on energy policy include India's largest energy access survey (ACCESS); the first independent assessment of India's solar mission; the Clean Energy Access Network (CLEAN) of hundreds of decentralised clean energy firms; India's green industrial policy; the $125 million India-U.S. Joint Clean Energy R&D Centers; developing the strategy for and supporting activities related to the International Solar Alliance; modelling long-term energy scenarios; energy subsidies reform; decentralised energy in India; energy storage technologies; India's 2030 renewable energy roadmap; solar roadmap for Indian Railways; clean energy subsidies (for the Rio+20 Summit); and renewable energy jobs, finance and skills.

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strategic industries and technologies for India's National Security Advisory Board; Maharashtra-Guangdong partnership on sustainability; and building Sustainable Cities.

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# About the Author

## Kanika Chawla

Kanika Chawla is a Senior Programme Lead at the Council on Energy, Environment and Water (CEEW), India. Her primary areas of work are renewable energy finance, climate diplomacy, clean jobs and renewable energy policy. Prior to her association with CEEW she worked at the Renewable Energy Policy Network for the 21st Century (REN21) Secretariat in Paris for close to four years. She has worked extensively on distributed renewable energy in developing countries, urban energy policy and investment in sustainable energy. Kanika specializes in international cooperation and renewable energy policy.

She has researched energy policy issues in developing countries around the world with a specific focus on policy making, clean energy finance and gender. She has previously also worked with GIZ on sustainability reporting.

Kanika holds an M.Sc in Economics and Development Economics from the University of Nottingham and an undergraduate honors degree in Economics from Miranda House, University of Delhi. She is fluent in English and Hindi and speaks basic French.

# Abstract

Total investment requirements to meet India's 100 GW solar target, including the costs of project, metering infrastructure and gas-based back up, would range between USD 120 billion and USD 147 billion. However, the current trajectory of solar PV investment in India is significantly short of the mammoth annual investment required. The flow of finance in the Indian solar market is constrained by several risks, some specific to solar power projects (like technology risks, off-taker risk, evacuation risk), and other risks that are common across sectors in India like foreign exchange risks and regulatory risks. Additionally, some features of the Indian financial market also limit the supply of finance that is available and accessible to the solar power developers. This paper analyses the role of risks in inhibiting existing sources of finance. It asks if new efforts to find alternative sources of finance for solar power in India manage to mitigate such risks. The analysis is based on interviews with 50 financiers, including experts from public banks, private banks, international funding agencies, and private equity and venture capital firms. Analytic induction forms the basis of this study such that the interview responses are assessed and grouped as per common patterns, in order to identify the key risk variables inhibiting the flow of finance. The top risks impeding the flow of finance from each source (public banks, private banks, international agencies, private equity and venture capital) are ranked. Further, current and proposed financial instruments as well as policy interventions are assessed for their likely impact on the key risk variables.

# Contents

# 1. Introduction

The Indian solar industry has grown over three hundred times in the last five years, from a mere installed capacity of 17.8 MW[1] in March 2010 to nearly 5,500 MW[2] in March, 2016. However, the real solar boom is yet to come, as the country works to realise its ambitious target of 100 GW of installed Solar PV capacity by 2022.[3] The upward revision of the solar mission target from 20 GW to the mammoth 100 GW has been indicative of the government's commitment toward solar power. It has also resulted in the solar landscape of the country changing rapidly. The government's firm commitment to scaling up solar power, combined with initiatives such as 'Make in India' and 'Skill India', have the intention of giving impetus to solar developers, manufacturers and investors. However, availability of finance for solar projects has not kept pace with the optimistic commitments being made by the government and developers alike.

At the February 2015 RE Invest Meet & Expo, the Government of India invited Green Energy Commitments from developers, manufacturers, and financiers. This resulted in solar and wind developers committing to nearly 240 GW of capacity addition by 2022, but financiers submitting commitment certificates to finance only a fraction of that capacity, as highlighted in Table 1 below.

TABLE 1: GREEN CERTIFICATE COMMITMENTS FOR RENEWABLE ENERGY AT RE-INVEST, 2015

| | | Commitment in GW |
|---|---|---|
| Solar Power Producers | Private developers | 156 |
| | Public sector/government companies | 34.26 |
| | Total | 190.26 |
| Wind Power Producers | Private Developers | 48 |
| | Public sector/government companies | 0.23 |
| | Total | 48.23 |
| Solar Manufacturers | | 16.25 |
| Wind Manufacturers | | 37.35 |
| Financiers | | 70.26 |

*Source: RE Invest, MNRE[4]*

Government estimates suggest that an investment of USD 92 billion (INR 600,000 Crore) would be required to reach the 100 GW target.[5] Independent analysis suggests that the investment requirement may be higher than government estimates. The investment required under optimistic conditions of rapid fall in module prices (30% decline by 2021-22) and the balance of system costs and a moderate inflation rate of 6.5%, amounts to USD 100 billion. However, in a conservative scenario with high inflationary conditions (~9%) and moderate decline in module and balance of system costs, an additional USD 13 billion (INR 80,000 Crore) would be required.

1 http://mnre.gov.in/file-manager/UserFiles/draft-jnnsmpd-2.pdf
2 http://www.cea.nic.in/reports/monthly/inst_capacity/jul15.pdf
3 http://pib.nic.in/newsite/PrintRelease.aspx?relid=122566
4 http://2015.re-invest.in/Document/orginal/Green_Energy_Commitments.pdf
5 http://pib.nic.in/newsite/pmreleases.aspx?mincode=28

Furthermore, it is important to note that these investment requirements do not account for the costs associated with energy balancing, backup or grid integration. Analysis suggests that under varying price scenarios and energy balancing requirements, total investment requirements to meet the 100 GW target (including the costs of project, metering infrastructure and gas-based back up) would range between USD 120 billion (INR 722,000 Crore) and USD 147 billion (INR 880,000 Crore).[6]

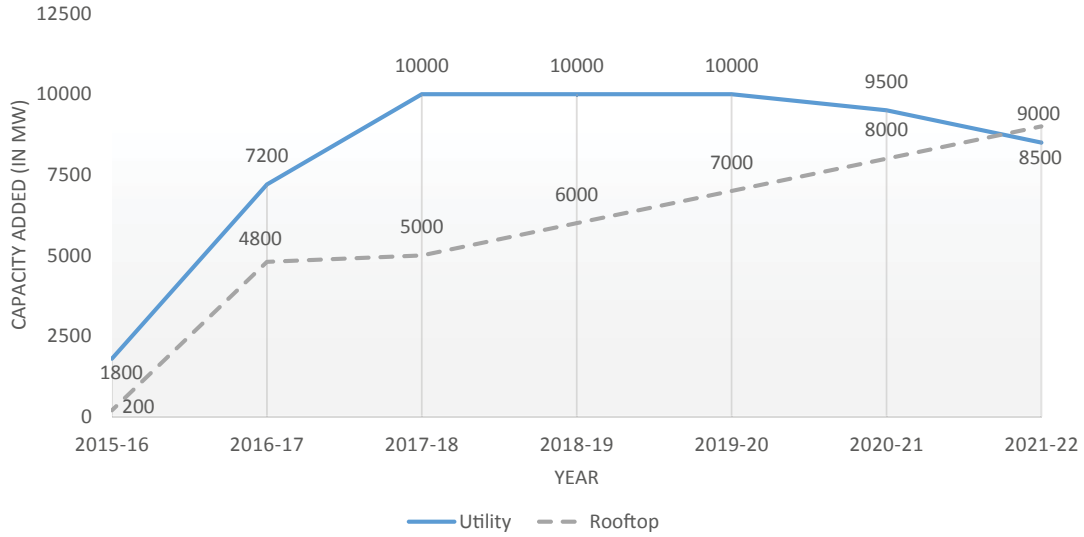
In 2015, total global investment in all renewable energy projects (excluding large hydro) was USD 285 billion,[7] resulting in a capacity addition of 134 GW. India's total investment in renewable energy in 2015 was USD 10.2 billion[8], 22% higher than the country's renewable energy investment in 2014. A majority of the total global investment (USD 160 billion) was directed toward solar PV projects, with a global capacity addition of 56 GW of solar PV. It is also important to note that of the total global investment in solar PV in 2015, half (USD 80 billion) was invested in developing countries.

As per the Ministry of New and Renewable Energy (MNRE), 7.2 GW of grid scale solar PV capacity would be added between April 2016 and March 2017. An additional 4.8 GW of rooftop solar capacity is being targeted during the same period. Adding 12 GW[9] of PV capacity would require investment to the tune of USD 15 billion[10] (INR 98,400 crore) (cost of rooftop capacity being higher than large grid scale capacity, see figure 1 and 2), more than three times India's investment in solar PV in 2015.

However, comparison between the total global investment in solar PV in 2015 (USD 160 billion) and the total investment India's solar target requires (USD 120- 147 billion) over seven year (2015 – 2022) suggests that globally finance for solar power is not in very short supply. In China, investments in solar PV in 2015 amounted to USD 43 billion.[11] While investment in utility scale solar PV in India jumped 75% from 2014, to USD 4.6 billion in 2015[12], the current growth trajectory in the total solar PV investment in India is far short of the mammoth investment required each year. This limited flow of investment could be attributed, at least in part, to the risks perceived by lenders while investing in solar projects in India.

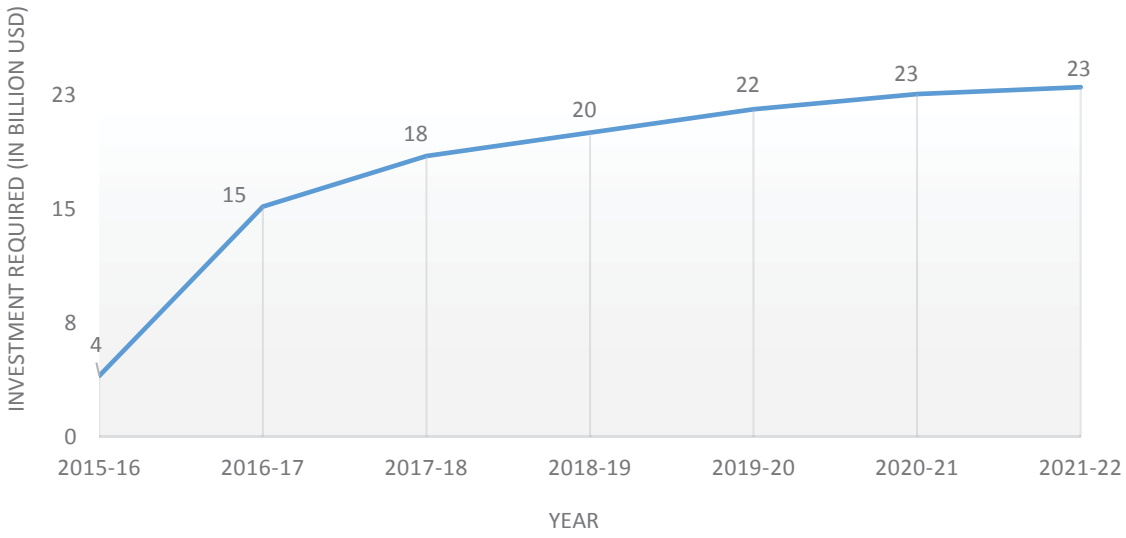
6 CEEW Analysis
7 Global Trends in Renewable Energy Investment 2015, UNEP – Frankfurt School, http://fs-unep-centre.org/sites/default/files/publications/globaltrendsinrenewableenergyinvestment2016lowres_0.pdf
8 Global Trends in Renewable Energy Investment 2015, UNEP – Frankfurt School, http://fs-unep-centre.org/sites/default/files/publications/globaltrendsinrenewableenergyinvestment2016lowres_0.pdf
9 http://mnre.gov.in/file-manager/grid-solar/100000MW-Grid-Connected-Solar-Power-Projects-by-2021-22.pdf
10 CEEW Cost Analysis [Utility scale capacity at INR 7 crore/MW and Rooftop capacity (with storage) at INR 10 crore/MW]
11 Ibid
12 Global Trends in Renewable Energy Investment 2015, UNEP – Frankfurt School, http://fs-unep-centre.org/sites/default/fi les/publications/globaltrendsinrenewableenergyinvestment2016lowres_0.pdf

FIGURE 1: PROJECTED SOLAR CAPACITY ADDITION TRAJECTORY TO REACH 100 GW BY 2022




*Source: Ministry of New and Renewable Energy (MNRE), Government of India*

FIGURE 2: PROJECTED ANNUAL INVESTMENT REQUIRED TO REACH THE 100GW SOLAR TARGET BY 2022




*Source: MNRE, CEEW Analysis*[13]

The financial structure of solar projects typically consists of 70% debt and 30% equity. Equity is usually contributed by the project developer, but there is a growing trend to raise privately funded equity from third parties such as PE firms.. Debt is currently raised almost entirely from asset financed bank loans, making the solar sector heavily reliant on bank debt, unlike other infrastructure projects which are also funded by government raised monies through issuing bonds.. This implies that debt upwards of USD 90 billion would be required to realise the 100 GW solar target. The expectation that this debt can be raised from banks in India appears to be overly optimistic as the total power sector exposure of commercial banks in India stood at USD 89.2 billion in September 2015.[14]

13 CEEW Cost Analysis [Utility scale capacity at INR 7 crore/MW and Rooftop capacity (with storage) at INR 10
14 http://www.icra.in/Files/ticker/SH-2015-Q4-1-ICRA-Power.pdf

Despite the government's commitment to the scaling up of solar power, it has yet to implement a policy to mobilise debt from outside the banking system. Public sector banks have committed USD 10 billion (~INR 65,000 crore) to solar power projects over the next six years[15], with additional commitments being made by private banks such as YES Bank and ICICI Bank. However, the Indian banking system is already close to its recommended sectoral of 15% for the power sector, of which renewables comprise a small part, making every additional unit of investment hard to secure. The problem of availability of finance is further compounded by several risks specific to solar power projects that make access to finance for these projects even more tenuous.

Despite the current optimistic climate for renewable energy and the existing finance commitments that have already been made towards solar power projects, the quantity of finance available for the solar sector in India is limited. Then is India's solar optimism misplaced? Recommendations and policy initiatives are working to increase the supply of finance for solar projects from new sources and markets. However, the risks perceived by current financiers are curtailing the flow of finance from existing sources, and are likely to impede the flow of finance from the new sources of finance as well. While tapping new markets would increase the pool of available finance, access to that finance will be curtailed by the risks plaguing the Indian solar market. Are investments in solar inherently risky? Are their particular financial risks that need special attention?

The perceived risk of an investment is informed primarily by the different risk variables but is also influenced by subjective factors such as level of comfort of the financier with the project developer/promoter, knowledge about the type of project/technology, prior experience with similar projects etc. This paper seeks to capture the various impediments (risk variables) that financiers perceive and how financial flows react to each of these risk variables. This paper analyses the risks prevalent in the solar finance market based on the responses of 50 financiers, who have either already contributed or evaluated proposals to contribute debt or equity, to solar power projects in India.

15 https://www.db.com/cr/en/docs/Deutsche-Bank-report-Make-way-for-the-Sun.pdf

# 2. Methodology and structure

The financial sector approaches investments in solar energy in the same manner as it would any other investments. This includes understanding the influence of policy and regulation on the viability of the investment, including the legal basis and durability of agreements, subsidies, grants, tradeable certificates or tax credits.[16]

Solar developers can source debt either by borrowing from banks or the open market. It could also raise equity finance by selling a stake of its business to private equity or venture capital investors. There are some investors who could contribute debt or equity, depending on the solar project. Examples of such sources of finance investors include institutional investors such as pension funds, multilateral banks, infrastructure funds, and individual investors. Table 2 below lists the various sources of finance for solar projects:

TABLE 2: SOURCES OF FINANCE – WHO INVESTS WHAT?

| | Debt | Equity | Grants and Guarantees |
|---|---|---|---|
| Domestic Banks | ✓ | | |
| International Banks | ✓ | | |
| Non-Banking Finance Companies | ✓ | | |
| Debt Fund Investors | ✓ | | |
| Venture Capitalist | | ✓ | |
| Private Equity Investors | | ✓ | |
| Government(s) | | ✓ | ✓ |
| Multilateral/Bilateral Development Banks | ✓ | ✓ | ✓ |
| International Development Agencies | ✓ | ✓ | ✓ |
| Institutional Investors | ✓ | ✓ | |
| Individual Investors | ✓ | ✓ | |

*Source: Author's compilation*

There are a range of variables that impact project success and many that will evolve over the project lifespan. These need to be understood, and then managed or mitigated. Before investing either debt or equity, investors undertake a detailed assessment of these risk factors. In order to better understand the risks prevalent in the Indian solar market, and how they are perceived by various categories of financiers, this paper develops theoretical risk hypotheses for each source of finance.

16 http://fs-unep-centre.org/sites/default/files/media/financeguide20final.pdf

## Understanding the Sources of Finance

Theoretical analysis of the various groups of financiers suggests that while the risk climate in India is common for all investors, different risk variables could impact the financial flows from different sources of in varying degrees.

**Banks and Non-Banking Finance Companies[17]:** The solar industry in India relies heavily on bank loans for accessing debt.[18] This results in banks facing a problem of over-exposure, and the sectoral lending caps prohibiting any additional lending to power projects. Additionally, there is uncertainty in cash flow due to the poor health of DISCOMS.[19] Banks fear non-compliance of the power purchase agreements (offtaker risk), if DISCOMs are unable to pay.[20]

Technology risks that may exist due to a lack of banker familiarity with solar energy technologies, or lack of irradiation data, performance data, information about quality of parts etc. could also limit debt flows from banks to solar projects.[21]

Banks could also limit their financial commitment to solar projects due to lack of policy certainty over the enforcement of the renewable purchase obligations (RPOs) and the lack of support to the Renewable Energy Certificates (RECs). The operational constraints of land acquisition and clearances, etc. could also pose a threat to the flow of finance from banks.[22]

Thus, literature suggests that debt from banks and NBFCs is most constrained by offtaker risk, followed by technology risk. Construction and regulatory risks in the form of clearances, land acquisition, rule of law, etc. also raised the risk profile of solar projects.

**International Agencies:** Multilateral and bilateral development banks and international organisations like the World Bank, ADB, KfW, GEF, etc. finance solar projects in India either directly or by extending lines of credit to the Indian Renewable Energy Development Agency (IREDA) or other public sector commercial banks. Contributions from international agencies may be in debt, equity, or in risk abatement mechanisms. An example of a risk abatement mechanism was the Asian Development Bank Risk Guarantee Program, where ADB had partnered with L&T Infrastructure Finance (L&T Infra) and Singapore-based Norddeutsche Landesbank (NORD/LB) to fund solar projects with capacities below 25 MW in India. Under this arrangement, L&T Infra and NORD/LB provided loans to solar projects, and ADB provided a partial risk guarantee to L&T Infra and NORD/LB. ADB in turn collected a guarantee fee (ranging between 1.5% and 2.5%) from L&T Infra and NORD/LB.[23]

17 (NBFCs) are financial institutions that provide banking services without meeting the legal definition of a bank, i.e. one that does not hold a banking license and, thus, are not allowed to take deposits from the public. Example IREDA, Power Finance Corporation, L&T Infra, Tata Capital etc.
18 http://fs-unep-centre.org/sites/default/files/publications/globaltrendsinrenewableenergyinvestment2016lowres_0.pdf
19 http://dev.bridgetoindia.com/wp-content/themes/newbridge/pdf/BRIDGE%20TO%20INDIA_Bankability%20and%20Debt%20Financing.pdf
20 https://www.db.com/cr/en/docs/Deutsche-Bank-report-Make-way-for-the-Sun.pdf
21 Ibid
22 https://www.db.com/cr/en/docs/Deutsche-Bank-report-Make-way-for-the-Sun.pdf
23 http://www.pace-d.com/wp-content/uploads/2013/10/RE-Finance-Report.pdf

Given the type of financial contribution, the risk variable that impedes the flow of finance may vary. All investments are likely to be constrained by the poor health of DISCOMS.[24] The risk posed by the fluctuation in currency exchange rates (forex risk) is a major risk to dollar denominated (or any foreign currency) debt investments, either limiting investment or significantly raising the cost of loans.[25] Debt investments by international agencies could also be constrained by regulatory issues, just like bank debt. Equity investments by international agencies are likely to be constrained by technology risks.[26] If projects have a quality certification, then that improves investor confidence in the project.

Foreign exchange risk is significant for any debt investment made by an international investor.[27] However, when making equity investments, the diverse global portfolio of international investor could provide a risk hedge, such that the losses from currency fluctuation in one part of the world are offset by the gains from currency fluctuation in another part of the world. This, however, is incumbent on the diversity in the portfolio of the investor.[28]

Development agencies are also often urged by the national government, as well as by their own mandate to promote renewable energy, to set up credit enhancement mechanisms or forex hedging instruments. Both these are advantageous for mobilising finance for the market but make the agency highly vulnerable to offtaker risk (non-compliance of power purchase agreements due to poor DISCOM health) and forex risk, respectively.

Thus, it is important to note that debt and equity from international agencies is likely to respond differently to different risks. Debt from international organisations is constrained by offtaker risk, foreign exchange risk and construction and regulatory risk. Equity from international organisations is highly sensitive to the technology risk associated with a solar project.

**Venture Capital and Private Equity Investors:** The equity market for renewable energy projects usually includes promoters who enjoy a certain level of confidence with debt lenders. However, as the solar market is set to grow, the role of equity from new sources, both domestic and international, is envisioned to increase significantly. Indian renewable energy companies received USD 548 million in VC/PE funding in 2015, putting India far ahead of the USD 300 million private equity and venture capital investment in renewables in all of Europe in 2015.[29]

The risks that are likely to plague equity investors are technology risks, offtaker risk, foreign exchange risk and construction and regulatory risks. Equity investors are especially affected by policy uncertainty and project delays, which have been categorised as regulatory risks.[30] Often land acquisition and obtaining the necessary clearances can result in the project being delayed, which is a huge setback for all investors, but impacts equity investors the most due to the nature of their investment that exposes them to a greater share of the risk.[31] Foreign equity investors are

24 https://www.db.com/cr/en/docs/Deutsche-Bank-report-Make-way-for-the-Sun.pdf
25 http://fs-unep-centre.org/sites/default/files/media/financeguide20final.pdf
26 Ibid
27 http://www.pace-d.com/wp-content/uploads/2013/10/RE-Finance-Report.pdf
28 https://www.cfainstitute.org/learning/products/publications/cp/Pages/cp.v27.n4.2.aspx
29 http://fs-unep-centre.org/sites/default/files/publications/globaltrendsinrenewableenergyinvestment2016lowres_0.pdf
30 http://fs-unep-centre.org/sites/default/files/media/financeguide20final.pdf
31 http://www.crisil.com/pdf/ratings/CRISIL&%20PHD%20Chamber%20white%20paper_Indian%20solar%20and%20wind%20energy%20sector_12Feb2015.pdf

likely to face a significant forex risk, if their portfolio does not counter balance the risk, at least in part, with investments in other parts of the world.

**Institutional Investors:** Institutional investors such as pension funds, provident funds and insurance companies could contribute debt or equity to solar projects. Their large corpuses and preferred terms of lending, in case of debt contributions, make them a preferred source of investment for solar projects. In 2014-15, foreign institutional investment of nearly USD 38.45 billion came in to India[32] but only some of this found its way into solar projects. One recent example of institutional investment for solar deployment is the USD 150 million invested by global infrastructure investment manager I Squared Capital in to Amplus Energy, which sets up distributed solar power projects around the country.[33]

However, the reason more institutional investment is not being directed towards solar is that institutional investors invest in low risk projects, with high credit ratings. There is, therefore, a need to bridge the gap between the low risk appetite of institutional investors and the relatively high credit-risk profile of renewable energy projects. The low credit rating of solar projects in India is a result of several risks plaguing a solar project.

The primary among these is the risk of non-compliance of the power purchase agreement by the distribution companies (offtaker risk).[34] Credit ratings and institutional investor confidence in solar projects is also limited because several solar technology applications are still emerging technologies with no proven long term performance standards. However as solar technologies are scaled up, and performance information is aggregated and shared widely, investor confidence is likely to rise.[35]

TABLE 3: PREDOMINANT RISKS EXPECTED TO IMPACT DIFFERENT INVESTOR GROUPS

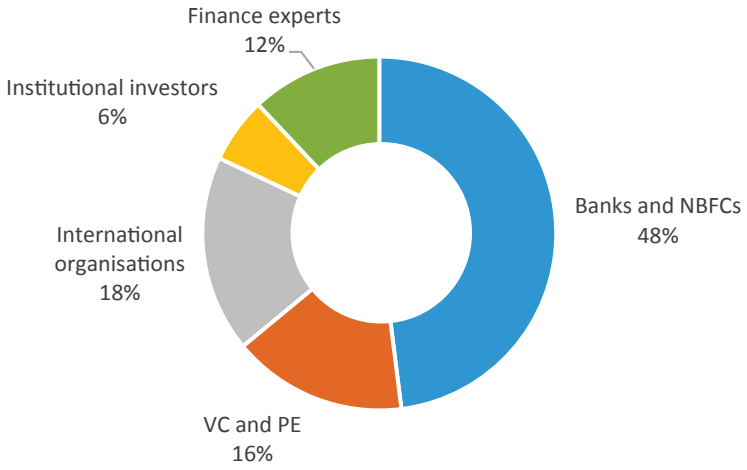
| Investor Group | Predominant Risks |
|---|---|
| Banks and NBFCs | - Offtaker risk<br>- Technology risk<br>- Construction and regulatory risks |
| International Organisations (Debt) | - Offtaker risk<br>- Foreign exchange risk<br>- Construction and regulatory risk |
| International Organisations (Equity) | - Technology risk<br>- Offtaker risk |
| Venture Capital and Private Equity | - Technology risk<br>- Offtaker risk<br>- Foreign exchange risk<br>- Construction and regulatory risk |
| Institutional Investors | - Offtaker risk<br>- Technology risk |

*Source: Author*

32 http://www.sjec.edu.in/pdf/Foreign%20Institutional%20Investment.pdf
33 https://www.pwc.com/gx/en/technology/moneytree/assets/pwc-moneytree-india-q3-2015.pdf
34 http://www.crisil.com/pdf/ratings/CRISIL&%20PHD%20Chamber%20white%20paper_Indian%20solar%20and%20wind%20energy%20sector_12Feb2015.pdf
35 http://shaktifoundation.in/wp-content/uploads/2014/02/RE-Financing-Final-report.pdf

The risks expected to plague each investor group were contrasted with the responses received from the financiers interviewed for this study. A sample of financiers from each category were interviewed to determine if the risks they perceived were in line with the expected risks outline in the hypotheses above. Of the total fifty interviews that were conducted, twenty four of them were with bankers, spanning public sector banks, private banks, and public and private non-banking financial corporations. Nine interviews were with representatives from international organisation and another eight interviews were with private equity and venture capitalists. Reaching out to institutional investors proved to be difficult, as a result of which only three of the fifty interviews were with institutional investors. In addition to these, six interviews were with finance experts both from India and overseas, to better understand how some of the risks perceived by financiers influence each other, and the larger financial market. Figure 3 gives the composition of the interviews by investor type.

FIGURE 3: COMPOSITION OF FINANCIERS INTERVIEWED




*Source: Author*

Analytic induction forms the basis of the analysis of the interview responses (Hatakka et al, 2013), such that interview responses were assessed for common patterns and grouped to identify the key risk variables inhibiting the flow of finance. The different risk variables are then explained in detail, and the effectiveness of financial and policy instruments or interventions are then reviewed in the context of mitigating these risks. The interview responses have informed the recommendations and analysis of policy instruments, which could counter the impediments to finance. Existing literature has mapped the features perennial to the Indian renewable energy finance market and their impact on project deployment.[36] Similarly, the impact of various financial instruments on risk abatement has also been analysed.[37]

However, the impact of each risk variable on the financiers' decision making process has not yet been assessed. Existing literature does not provide insight into how different types of investors perceive the various risks, and which of those risks is the most prohibitive for the different types

36 http://climatepolicyinitiative.org/wp-content/uploads/2012/12/Meeting-Indias-Renewable-Targets-The-Financing-Challenge.pdf

37 CEEW NRDC, Reenergizing India's Solar Energy Market through Financing, August 2014

of investors. Furthermore, the impact of each financial instrument and policy intervention on the different risk variables has also been assessed in this paper. This could support policymakers in determining the impact of the intervention/policies in mitigating the risks perceived by financiers.

A qualitative approach (such as analytic induction) is likely to be more beneficial when trying to capture the knowledge, perceptions, views, experiences and understanding of people (Mason, 2002). Bearing this in mind, an open ended questionnaire was used to capture the perceptions of financiers towards solar energy projects. All 50 interview responses were collected through in-person or telephonic interviews, using guiding questions to explore the risks perceived, problems inherent in financing in India and effective mechanisms to boost financing. Since data was collected through in-person meetings and phone interviews, there were no unanswered questions, thus eliminating the problem of missing data points.

The interview responses provided the empirical data needed for the subsequent qualitative data analysis, to better understand what is being said and how (Silverman, 2001). Interview questions centred around three broad themes;

- What are the risks perceived by lenders?
- What are the problems inherent to financing solar power in India?
- What are the effective mechanisms to boost financing for renewable energy?

The first set of questions focused on the risks associated with technology and the ease of doing business, as well as on the risk of policy uncertainty, rule of law, honouring of contracts, and health of DISCOMs. These questions were designed to identify the main risks, as identified by each respondent for himself or herself. They are specific to the investor. Findings have been summarised in section III. This section also includes the responses to follow up questions, that were asked to better understand the impact of each type of risk identified on the decision making process of the investor.

Questions related to the problems inherent to financing in India were bracketed in to questions on equity financing and debt financing. These questions captured the problems that are prevalent in the Indian debt and equity market, as well as the risks faced by foreign investment in infrastructure in India. Important questions included discussion on foreign exchange risk, sectoral exposure, maturity and size of markets. Respondents discussed these questions with a broad perspective, beyond their own risk variables, with a focus on the sector-wide risks. Findings have been summarised in section IV.

The last set of questions addressed the government mechanisms and instruments, which could effectively counter risk to boost financing. The questions looked beyond just the identification of the problem, into the effectiveness of policy initiatives and financial instruments in not just increasing the sources of supply of finance, but also mitigating the risks that have been identified by the financiers. Respondents reacted on the effectiveness and feasibility of current and proposed mechanisms to increase the availability of finance for solar power. These findings have been combined with analysis of risk abatement mechanisms in section V.

# 3. Why do investors not invest?

Respondents affiliated to banks and NBFCs, which are operational in the solar energy market consistently reported offtaker risk to be the greatest impediment to their investment in solar projects. As many as twenty one of the total twenty four bankers interviewed, reported offtaker risk as the primary risk inhibiting their decision to invest in solar projects. Interviewees further added that the health of the DISCOM with whom the developer had/would sign the power purchase agreement was one of the key criteria upon which they their decision to invest.

## Bankers are saddled with offtaker, construction, and regulatory risks

For bankers, offtaker risk is followed by construction and regulatory risks, as well as the risk associated with the project promoter and the equity stability. Bankers reacted well to the government's upward revision of the renewable energy targets and took that as indicative of improved policy certainty for solar in the coming months and years. However, as many as 75% of the bankers interviewed expressed concern over the delays in projects due to the policy paralysis plaguing clearances, and land acquisition. Bankers and representatives from NBFCs also raised the issue of lender confidence in the project promoter. Nearly 67% of the respondents suggesting that private equity from foreign investors, or lack of familiarity with the project developer, especially in the case of first time developers, raised the risk profile of the project. While only one interviewee listed this as the primary risk, it was interesting to note that bankers preferred extending credit to projects where the equity investment came directly from the developer. In the follow-up questions to the interviewees, it became clear that most interviewees expected the risk associated with equity stability to go down as the solar market matures.

The risks identified by the respondents were only partly in line with the risks identified in the hypothesis. Offtaker risk, as suggested by the hypothesis, was confirmed as the most prohibitive risk for financiers. Interview results also suggested construction and regulatory risk to be a limiting factor. However, technology risk, as identified in the hypothesis as a major risk, was not a big roadblock for most interviewees affiliated to banks and NBFCs.

### a. Offtaker Risk: posed by poor DISCOM health and PPA non-compliance

The creditworthiness of the power distribution company with whom the project developer has or will have a power purchase agreement is a critical factor in the acessibility of finance to that developer. Projects commissioned through the reverse bidding process, under the National Solar Mission have power purchase agreements with a government implementing agency (either the NTPC Vidyut Vyapar Nigam Limited (NVVN) or the Solar Energy Corporation of India (SECI)). This modality reduces the offtaker risk as the solar power producer is not directly reli-

ant on the DISCOMs for the purchase of generated power.[38] However, for projects for which PPAs are signed directly with the DISCOMs, the ability of the distribution company to honour the purchase agreement is a critical variable. For example, for solar projects to be commissioned in Karnataka in 2016-17, NTPC tendered 600 MW of solar capacity, whereas another 300 MW of capacity was tendered directly by the state.[39] In the case of the former, the solar developers will have power purchase agreements with NTPC, whereas in the latter the power purchase agreement would be directly with the DISCOM of Karnataka. Projects commissioned by NTPC lower the offtaker risk for the developer, as a PPA default from the utility is absorbed by the intermediary (NTPC).

The problem of PPA non-compliance permeates both debt and equity investments. For a majority of the respondents offtaker risk was identified as the main impeding factor for financing projects in regions where the distribution company had poor financial health. While the reaction of different categories of financiers to offtaker risk differs in impact, it does not differ in criticality. This is best understood by the difference in the accounting practices of different banks. As reported by respondents, public sector banks do not consider a delay in payment from the DISCOM as bad debt; whereas for private banks, both domestic and international, a delay in payment counts as a default and is written off as bad debt at the end of the accounting cycle.

### b. Construction and Regulatory Risks: posed by policy uncertainty and project delays

The risk associated with acquiring land and the necessary clearances to construct a solar power plant is a significant roadblock to the flow of finance. Land acquisition, specifically, was identified by several respondents as a critical factor, with much finance flows being unavailable till the power producer had already acquired the land. Similarly, clearances, timely approvals and enforcement of policies such as the RPOs, often limit the flow of debt from banks. Just as in other parts of the world, the cost and accessibility of finance during the construction and commissioning phase can sometimes be prohibitive, and always significantly higher than cost of finance for an operational solar project.[40] However, once the plant is operational, finance becomes available at more preferential terms as much of the construction and regulatory hurdles have already been crossed by then. This allows developers to refinance their loans with finance available at preferential rates.

The high construction and regulatory risks result in a decline in the 'ease of doing business' making investment in solar projects less attractive, especially for international investors of both debt and equity, including international organisations, due to their unfamiliarity with the Indian regulatory process. However, certain government policies such as single window clearances for solar projects in some states, such as Andhra Pradesh[41] and Tamil Nadu,[42] and the setting up of solar energy zones (SEZs) and solar parks, reduce the construction and regulatory risk significantly.[43] A total of thirty three solar parks have been approved, across twenty one states in India, with a

38 http://mnre.gov.in/file-manager/UserFiles/Draft-Guidelines-for-1500%20MW%20NSM-Ph_II-%20Batch_II.pdf
39 mnre.gov.in/file-manager/UserFiles/GW-Solar-Plan.pdf
40 http://fs-unep-centre.org/sites/default/files/media/financeguide20final.pdf
41 http://www.nredcapswc.ap.gov.in/NREDCAP/Downloads/Guidelines/Guidelines_for_Single_Window_Clearance_Mechanism_for_Solar_and_Wind_Power_Projects.pdf
42 http://www.dicnmkl.in/brochure/Single_Window_Clearance_Application.pdf
43 CEEW NRDC, Reenergizing India's Solar Energy Market through Financing, August 2014

total sanctioned budget of USD 57.5 million (INR 374 crore).[44] In the proposed SEZs and solar parks, the government will earmark land and provide all the evacuation infrastructure, making the process of mobilizing finance much easier.

### c. Technology Risk: posed by lack of product standards and incomplete data

Technology risk is determined by several variables such as the quality of the solar panels and the balance of system, resource data (irradiation data) availability and the margin of error in the data, and variability in the plant load factor. Given the relatively short history of solar power generation in India, there is lack of data on lifetime of panels, their performance over time, and the impact of weather on their operations.[45] These factors reduce the comfort levels of investors, especially debt investors. However, improved irradiation and performance data is being collated in order to abate technology risk.[46] Certification and standardisation of solar technology could bring down the cost of due diligence required to be done by the lenders. Currently, certification of solar PV modules is not mandatory. The high cost of testing and certification, ranging between USD 38,500 – 41,500 (INR 25 – 25 lakhs) per project[47], deters developers from getting certified despite the benefits.

## For venture capital and private equity players, evacuation infrastructure is a major concern

Respondents affiliated to private equity or venture capital funds investing equity in solar projects in India also listed offtaker and regulatory risks as the principal impediments to their investments. While five of the eight interviewees suggested that offtaker risk severely impedes the certainty of year on year returns, four interviewees highlighted construction and regulatory risks as the cause of significant delays in the project that adversely impact equity investor confidence in the Indian solar market. Additionally, five respondents also stated evacuation infrastructure risk as a roadblock to increased equity investment in solar projects, but reported it to be a less severe risk than offtaker risk. When compared, there is little convergence between the risks identified by the interviewees and those in the hypothesis for the VC and PE equity investors. The hypothesis that technology risk impacts equity investment significantly was nullified by the interview responses. The equity investor respondents felt comfortable with the level of technology advancement and data available. Respondents, especially foreign equity investors, did not identify forex risk as a significant impediment to their investments as they had enough diversification in their global portfolio to absorb currency fluctuations.

44 http://pib.nic.in/newsite/PrintRelease.aspx?relid=136580
45 MNRE monitors some solar plant performance, data for which is available under the RE Solve initiative. http://www.re-solve.in/perspectives-and-insights/solar-plant-performance-data-for-april-2014-released-by-mnre/
46 http://www.crisil.com/pdf/ratings/CRISIL&%20PHD%20Chamber%20white%20paper_Indian%20solar%20and%20wind%20energy%20sector_12Feb2015.pdf
47 http://niti.gov.in/mgov_file/report%20of%20the%20expert%20group%20on%20175%20GW%20RE.pdf

### d. Evacuation Infrastructure Risk: posed by the (non) ability of the grid to efficiently integrate solar power

Evacuation infrastructure risk includes the availability of physical infrastructure to evacuate solar power being generated, as well as the stability of the grid to integrate the evacuated solar power. The physical infrastructure of the grid in India poses a challenge that has resulted in significant project delays in the past.[48] States with high solar potential do not have intra-state transmission systems to evacuate power. However the proposed green corridor project would provide a dedicated transmission network for renewable energy, connecting solar parks around the country. The project development is already underway in Andhra Pradesh, Gujarat, Himachal Pradesh, Karnataka, and Maharashtra[49], and is expected to provide long-term respite.[50]

## Foreign exchange risks dominant for international organisations

Respondents from international organisations, which invest debt and equity and set up hedging and credit enhancement facilities, identified foreign exchange risk as a severe impediment to their investments – especially on debt investments. Five of the nine interviewees attributed the high cost of debt to foreign exchange risk, suggesting that the cost of hedging for foreign currency fluctuations could be as high as 7-8% raising the total cost of debt by over 50%. (Such that interest rates on loans could rise from 9% to as high as 13%.)[51]

Interviews with respondents also indicate that offtaker risk and construction and regulatory risk were constraints to increasing the quantum of investment in solar power in India. Nearly sixty seven percent of the nine interviewees mentioned offtaker risk as a constraint, while 44% felt that policy lethargy on clearances and land acquisition resulted in significant project delays, raising the risk profile of solar projects.

Eight of the nine respondents within this category acknowledged an institutional focus on renewable energy, which made the technology and evacuation risk constraint less important. As they could not avoid investing in solar power, their task is to choose the most creditworthy projects. Risks perceived by international organisations, confirm the risks outlined for debt investment by international organisations in the hypothesis. For equity investment, interviewees affiliated to international organisations suggest construction and regulatory risks caused by policy lethargy and project delays have a greater impact than technology risks, as proposed by the hypothesis.

48 CEEW, Tapping Every Ray of the Sun, Solar Roadmap, October 2014
49 http://mnre.gov.in/file-manager/UserFiles/outcome-budget-mnre-2015-16.pdf
50 CEEW, Tapping Every Ray of the Sun, Solar Roadmap, October 2014
51 http://www.adb.org/sites/default/files/linked-documents/46268-001-sd-03.pdf

## e. Foreign Exchange Risk: posed by currency fluctuations

Foreign finance plays a critical role in India's renewable energy deployment. International investors have increased their market share in India, with investments in more than 78% of renewable energy capacity under development.[52] The interest and reliance on foreign debt is not just a function of the availability of finance domestically, but also a function of the preferable terms attached to foreign funds. Foreign debt is a cheaper means of financing due to the lower interest rates in developed markets. Furthermore, foreign banks offer longer tenure loans extending the loan period by as much as five years. Typical loans to solar projects in the US and EU markets are available at 7% for 10-15 years.[53] Foreign capital and bond markets offer even longer tenures on debt, providing debt for as long as 20 years, compared to Indian banks that lend for a 7 – 12 year tenure, on an average rate of 12-13%.[54] These factors make foreign finance significantly more attractive than domestic finance.

However, the benefits of foreign finance are often countered by the high costs of hedging associated with the lack of liquidity and the depth of the derivative markets. The fluctuation in exchange rate between the currencies invested and the local currency (INR), changes the quantum of investment and the associated return. For example a solar project that is financed in dollars but sells electricity to the DISCOM in rupees, a depreciation in the rupee results in an asset liability currency mismatch, increasing the liability of the project developer.[55] In order to correct for this, hedging costs are built in to the terms of the foreign finance, diluting the preferential interest rates offered by foreign finance. Market-based currency hedging in India is expensive, adding approximately 7 percentage points to the cost of debt. This makes fully-hedged foreign debt nearly as expensive as domestic debt.[56]

TABLE 4: RISKS PERCEIVED ARE NOT ALWAYS WHAT ONE EXPECTS

| Investor Group | Predominant Risks Reported |
|---|---|
| Banks and NBFCs | - Offtaker risk<br>- Construction and regulatory risk<br>- Equity stability risk |
| International Organisations (Debt) | - Foreign exchange risk<br>- Offtaker risk<br>- Construction and regulatory risk |
| International Organisations (Equity) | - Offtaker risk<br>- Construction and regulatory risk |
| Venture Capital and Private Equity | - Offtaker Risk<br>- Evacuation infrastructure risk<br>- Construction and regulatory risk |

*Source: Author*

52 CEEW NRDC Green Bonds Policy Brief, May 2016 (upcoming)
53 Shrimali, et al, Meeting India's Renewable Energy Targets:The Financing Challenge, December 2012
54 http://ireda.gov.in/writereaddata/Manual/SOLAR.pdf
55 https://www.iisd.org/sites/default/files/publications/currency-risk-project-finance-discussion-paper.pdf
56 Farooquee and Shrimali, Reaching India's Renewable Energy Targets Cost-Effectively: A Foreign Exchange Hedging Facility, June 2015

# 4. Why is access to debt financing so challenging?

In addition to the risks perceived by financiers, there are some features of the Indian debt market that further curtail the supply of finance in to the Indian solar market. Several existing studies[57,58,59] have detailed these features. This section of the paper summarises the impact of these features, which are unique to India but not specific to solar power, on the investments in solar energy in India.

## Inferior terms of debt

Solar projects, given their long life of twenty to twenty five years, require long term financing ranging from fifteen to twenty years. The ideal sources of long-term funding are insurance and pension funds, which seek long term investments with low credit risk. However, in India of the various financial instruments, household financial savings are mainly invested in bank deposits Over 53% of household financial savings were invested in bank deposits in 2013-2014.[60] Insurance and pension funds account for only a small percentage of household financial savings making bank loans the primary source of financing solar projects. These debt contributions are typically for ten-year periods at a rate of 13%, as banks are constrained in providing long-term financing because of an asset liability mismatch arising from their relatively short maturity deposits.[61] The short tenure and high servicing costs add significantly to the cost of the project. These inferior terms of debt can be attributed to high inflation, underdeveloped bond market and competing investment needs in the domestic market.

This problem manifests in two ways. The first impediment is the inferior terms of debt from bank loans. The inferior bank debt terms are a function of the high base rate of lending, and it is not likely for the terms of bank loans to change significantly. While more finance has been mobilized from domestic banks because of improved technological data, policy certainty and the inclusion of renewable energy projects into priority sector lending, the high cost and short tenure of the loans continue to be a problem.[62] The high initial capital expenditure and long life of infrastructure assets require long-term debt financing. A strategy that relies solely on rolling over short-term debt exposes the project to rollover or refinancing risk. New debt might not be available or available only at high interest rates, leading to a risk of financial distress.

57 Ghosh, Jaiswal, et al., Renergising India's Solar Energy Market through Financing, September 2014
58 http://climatepolicyinitiative.org/wp-content/uploads/2012/12/Meeting-Indias-Renewable-Targets-The-Financing-Challenge.pdf
59 http://shaktifoundation.in/wp-content/uploads/2014/02/RE-Financing-Final-report.pdf
60 http://articles.economictimes.indiatimes.com/2014-08-31/news/53413220_1_savings-rate-household-sector-rbi-report
61 http://www.iimahd.ernet.in/assets/snippets/workingpaperpdf/2857185372014-03-23.pdf
62 http://climatepolicyinitiative.org/wp-content/uploads/2012/12/Meeting-Indias-Renewable-Targets-The-Financing-Challenge.pdf

The second is the state of the bond market and the competing investment opportunities in the market. India does not have a robust bond market. Investors typically invest in highly secure bonds (government bonds or AAA rated bonds) or other low risk investment options. Most solar developers in India are not yet at the level of securitization to have the credit worthiness to successfully have an independent bond issue. So they seek finance on preferential terms through other sources. One such source is capital raised from the market through a green bond issued by a bank or NBFC, which is then disbursed in the form of loans to green projects at preferential terms. Bank issued green bonds are more successful at raising money from the market as the risk of non-performance of the green project lies with the bank, instead of it falling on the investor directly.[63]

## Regulatory constraints on lending

The financial architecture in India groups all power sector projects and places a sectoral lending cap of 15% for banks. Solar projects get crowded out by the large sums loaned out to conventional power projects, which continue to receive loans due to relatively greater investor confidence in such projects. The Indian banking system is already close to its sectoral ceiling of ~15% for the power sector, so every additional unit of investment for solar projects is hard to come by (as per data from the financial year 2015-16).[64] In order to promote the flow of finance from banks to renewable energy projects, the RBI categorized renewable energy as a priority sector in April 2015, which is helpful both for the flow and cost of finance for solar projects. However, RBI guidelines stipulates a loan ceiling of USD 2.3 million (INR 15 Crore) per borrower for purposes like solar based generation.[65] Given the scale at which financing is required, this loan ceiling does not mobilise enough debt at preferential terms to have a large impact on the cost of solar projects.

63 CEEW-NRDC, Green Bonds Policy Brief, May 2016 (upcoming)
64 https://www.db.com/cr/en/docs/Deutsche-Bank-report-Make-way-for-the-Sun.pdf
65 https://www.rbi.org.in/Scripts/NotificationUser.aspx?Id=9688&Mode=0

# 5. Risk mitigation or new sources of supply?

As India moves towards realising its lofty solar targets, the need to mitigate the risks identified by financiers becomes critical. While several financial instruments and mechanisms exist, even more are being proposed and piloted. While this is an encouraging development for the solar sector, it is important to assess whether these instruments actually address the risks identified by the financiers. Several interventions, both operational and proposed, have been recommended by existing literature,[66] as solutions to the features of the Indian debt market discussed in section IV above. This section provides details about some existing and planned financial instruments, and their impact on mitigating the risks that have been identified in section III of this paper.

## Infrastructure Debt Funds

There is a growing need for the intermediation of long term savings (such as pension funds, insurance funds, etc.) into infrastructure (specifically solar power) investment through low risk securities.[67] This requires financial intermediaries with adequate due diligence, monitoring and financial structuring skills for infrastructure projects. The Indian government has taken several steps through the market and banking regulators – SEBI and RBI – to provide regulatory frameworks for specialized infrastructure financing intermediaries. Regulatory frameworks were put in place by the RBI in 2010 (for IFCs) and 2013 (for IDFs), for a special category of Non-Banking Finance Companies (NBFC), called Infrastructure Finance Companies (IFC), and Infrastructure Debt Funds (IDF).[68]

IDFs issued by NBFCs used to face regulatory constraints, as imposed by the Reserve Bank of India, which made them available only to public private partnership projects. This condition was relaxed in 2015 to include all projects, operational for over one year with satisfactory commercial operation, such that the credit exposure to a single borrower cannot exceed 15% of capital funds of the financial institution.[69]

To some extent, IDFs can help in mitigating offtaker risk. For solar projects, IDF- NBFCs enter in to a tripartite agreement between the investor, the developer and the power distribution company (DISCOM). This feature acts as a credit enhancer for the bond as the participation of the DISCOM in the agreement alleviates the offtaker risk. However, the poor health of several Indian DISCOMs is a major roadblock to such agreements. The government can mitigate this risk by creating a model agreement for IDF-NBFCs, which includes government guarantees for off-taker risk and robust termination provisions. This could go a long way in attracting large sums of institutional finance, into operational solar projects, freeing up bank debt for new proj-

66 Ghosh, Jaiswal, et al., Renergising India's Solar Energy Market through Financing, September 2014 http://climatepolicyinitiative.org/wp-content/uploads/2012/12/Meeting-Indias-Renewable-Targets-The-Financing-Challenge.pdf http://shaktifoundation.in/wp-content/uploads/2014/02/RE-Financing-Final-report.pdf
67 http://www.iimahd.ernet.in/assets/snippets/workingpaperpdf/2857185372014-03-23.pdf
68 ibid
69 https://rbi.org.in/Scripts/BS_ViewMasCirculardetails.aspx?id=9825

ects and lowering the cost of finance, as well as increasing the tenure of debt by at least 5 years (pension funds lend for an average of 15 years, as compared to 10 year loan periods of commercial banks in India).

## Credit Enhancement Mechanisms

Institutional investors are restricted to investing in projects above a certain credit rating threshold, which is AA or above in the case of India. Most solar energy projects currently fall below this threshold because of low levels of securitization of the issuers. Thus, there is a need for credit enhancement measures. The government can lower the risk premium of projects by leveraging its high (sovereign) credit rating to stand guarantee over a specific proportion of the borrowing. Investing government finance in partial credit guarantee mechanisms could result in large inflows of institutional finance.

Furthermore, renewable energy bonds with a partial credit guarantee face regulations that limit institutional investors to investing only up to 10% of the bond offering. This would require more than ten institutional investors per bond offering, which is difficult given associated transaction costs and the small number of institutional investors in India.[70] Relaxing this regulation so that investors could subscribe to 25%-33% of the bond offering would help address this barrier, making it possible to raise the required debt from only three to four institutional investors.

In principle, India has several credit enhancement mechanisms[71] operationalised by infrastructure debt funds, infrastructure investment trusts, and most recently a Reserve Bank of India (RBI) notification allowing all scheduled commercial banks to provide partial credit enhancements.[72] A recent example of the impact of credit enhancement can be personified by the credit enhancement scheme run by the Indian Infrastructure Finance Company (IIFCL) and the Asian Development Bank (ADB).[73] A solar project in Gujarat was refinanced through a USD 58.5 million project bond that received an AA+ rating through the IIFCL-ADB partial credit enhancement facility, resulting in diversifying the source of debt beyond just banks.[74]

The cost of credit enhancement of a BBB rated bond to AA ranges from 1.2%- 3%.[75] Bond issuers can decide on using this instrument depending on the differential in the terms of credit, before and after the credit enhancement. Similar partial credit guarantees could be set up and managed through international organisations, leveraging their high credit rating to lower the risk premium on select solar projects, such that grants or investments being made by international organisations could be used to finance such a facility, rather than directly investing in individual projects.[76]

Credit enhancement mechanisms do not mitigate any specific risk, rather the nature of the enhancement mechanism is to guarantee a proportion of the debt it is leveraging.[77] This implies

70 http://climatepolicyinitiative.org/wp-content/uploads/2014/04/Instruments-to-Provide-Low-cost-Long-term-Debt.pdf
71 http://blogs.adb.org/blog/yes-we-need-dedicated-bond-guarantee-fund-indian-infrastructure
72 https://www.rbi.org.in/Scripts/NotificationUser.aspx?Id=10035&Mode=0
73 https://www.iisd.org/sites/default/files/publications/credit-enhancement-green-projects.pdf
74 http://www.business-standard.com/article/companies/iifcl-s-credit-enhancement-debuts-with-renewable-energy-issuance-115092301088_1.html
75 http://climatepolicyinitiative.org/wp-content/uploads/2014/04/Instruments-to-Provide-Low-cost-Long-term-Debt.pdf
76 CEEW-NRDC Green Bonds Policy Brief, May 2016 (upcoming)
77 http://climatepolicyinitiative.org/wp-content/uploads/2014/04/Instruments-to-Provide-Low-cost-Long-term-Debt.pdf

that the proportion of the borrowing that is guaranteed is insured of all risks, and so credit enhancement mechanisms mitigate all risks in part but do not do so specifically for any type of risk.

## Green Bonds

Green Bonds are standard, fixed income financial instruments for raising funds through the debt capital market for projects with environmental benefits. The green bond issuer raises capital from investors for a defined time period. The issuer then pays a fixed interest rate to the investor, returning the entire capital amount upon maturity. The financial risks and return on green bonds are the same as that of regular bonds.[78]

Globally, green bonds worth USD 46 billion were sold in 2015.[79] Until June 2015, green bonds worth USD 65.9 billion were in circulation, with greater diversification in bond issuances. In India the green bond market has emerged recently, with smaller size issuance of USD 100 to USD 200 million but with high potential of scaling up. In 2015 alone, green bonds in India raised a total of USD 1.85 billion (INR 1,237 crore).[80] With sectoral investment guidelines limiting lending from banks, green bonds could play an important role in filling some of the financing gap, mobilizing large quantities of finance at lower interest rates, and often for longer tenures than bank loans.

However, typically green bonds do not address the foreign exchange risk, nor are they able to attract institutional finance if they have inadequate credit rating. Box 1 below gives an example of a credit enhanced green bond issue by a bank. Green bonds serve to address the problems inherent to India's debt market, as discussed in section IV, but do not mitigate the risks discussed in section III. While green bonds may add a new source of debt for solar projects, the risks plaguing the current sources of finance are likely to extend to green bond investors as well.

GREEN BOND CASE STUDY

Yes Bank issued its second green bond in August 2015. The entire issue of this 10-year, USD 50 million (INR 315 crore) green bond was subscribed by the International Finance Corporation (IFC). In order to tap the foreign bond market, the issue was listed in the London Stock Exchange by the IFC with a AAA rating (rating enhancement due to IFC's credit rating) as a "Green Masala Bond". This essentially capitalized the Yes Bank green bond and lowered the cost of lending to green projects. Proceeds from the offering will support a forthcoming infrastructure bond issuance by Axis Bank.[81] The bonds are intended to increase foreign investment in India by mobilizing international capital markets to support infrastructure development in India.[82] The projects to be funded by Yes Bank's green bonds must meet the IFC green bond eligibility criteria, which leverages the development bank's expertise in assessing green credentials.[83]

78 What are Green Bonds? The World Bank, 2015 http://treasury.worldbank.org/cmd/pdf/What_are_Green_Bonds.pdf (Assessed October 15, 2015)

79 BNEF, http://www.bloomberg.com/news/articles/2016-02-04/china-s-230-billion-green-bond-thirst-to-supercharge-market

80 Narae Kim, "India's Green Issuers Set to Make a Dash for Cash," Global Capital: Emerging Markets, March 23, 2016 http://www.globalcapital.com/article/x1jfh4plghkx/indias-green-issuers-set-to-make-a-dash-for-cash

81 IFC, IFC Issued First Masala Bonds in London to Attract International Investment for Infrastructure in India, http://www.ifc.org/wps/wcm/connect/region__ext_content/regions/western+europe/news/ifc+issued+first+masala+bonds+in+london+to+attract+international+investment+for+infrastructure+in+india

82 IFC, IFC Issued First Masala Bonds in London to Attract International Investment for Infrastructure in India, http://www.ifc.org/wps/wcm/connect/region__ext_content/regions/western+europe/news/ifc+issued+first+masala+bonds+in+london+to+attract+international+investment+for+infrastructure+in+india

83 CEEW NRDC, Green Bonds Issue Brief, May 2016 (upcoming)

## DISCOM Debt Restructuring

The government's Ujwal Discom Assurance Yojna (UDAY) to restructure the debt of the utilities, and improve their efficiency could prove to be a significant step in improving the ability of DISCOMS to honour PPAs. This, in turn, would have a large impact on the risks perceived by investors in the Indian solar market. Designed as an integrated approach between the Ministry of Power, Coal and New and Renewable Energy, such that state governments will take over 75% of the debt held by DISCOMs as of September 30, 2015.[84] The debt transfer will be done in a phased manner from September 2015 to March 2017. The UDAY programme also focusses on improving the efficiency of the DISCOM. For example, in Jharkand a pre-determined trajectory of decline in transmission losses is mandated as a part of the restructuring deal between the DISCOM and the state.[85]

Fifteen of the fifty respondents noted the value in the programme, noting that the debt restructuring would increase their willingness to invest in states that previously had high offtaker risk. By January 2016, 15 states had joined the UDAY programme, accounting for nearly 90% of the losses made by DISCOMs. Six of the fifty respondents were sceptical about the UDAY programme, suggesting that debt restructuring in the past had not resulted in a systemic change in the problem of DISCOM debt. Previous attempts at bailing out state owned DISCOMs, like the plan announced in September 2012, did not yield any results. The bailout plan of 2012 failed as most of the states could not improve the financial health of their state electricity boards, as required by the financial restructuring plan under the scheme.[86] The transferring of debt to states will result in the financial health of states deteriorating, especially if it is converted to equity against which the state issued bonds.

Debt restructuring interventions like UDAY are likely to reduce the offtaker risk significantly as the risk of non-payment from DISCOMs is reduced. The efficiency gains that are a part of the UDAY programme are likely to lower the evacuation risk associated with some lending. However, since electricity tariffs are not determined by market mechanism, it is likely for the problem of DISCOMs having large outstanding debt to reoccur.

## Dollar Tariff Policy

In order to circumvent foreign exchange risk and mobilise finance from international lenders, the Government of India contemplated adopting a dollar tariff policy proposal, which creates a currency hedge for INR – USD/EUR/Yen fluctuations, backed by a government guarantee. This would be operationalised by a government entity such as NTPC, such that dollar tariff PPAs would be signed between the developer and the intermediary entity (NTPC or similar), and a rupee denominated PPA would be signed between the intermediary entity and the DISCOM. The rupee PPA would also include USD 0.02/kWh (INR 1.25/kWh) as part of the levelised tariff, which would contribute to the hedging escrow.[87] The sovereign guarantee of such an escrow account would lower the hedging costs for infrastructure project developers as the credit profile of

84 powermin.nic.in/upload/pdf/Power_Sector_Reforms.pdf
85 http://pib.nic.in/newsite/PrintRelease.aspx?relid=134184
86 Bailout plan for discoms fizzles out, Mint, 9 September 2014
87 Goyal, Dollar Tariff Policy: A New Dawn For a Renewables Revolution in India –Energy, Environment, Economy and Employment, May 2015

the government is higher than that of individual project developers. The proposed policy suggested that the intermediary entity/NTPC/PTC would be responsible for making pay-outs to the developer against generation. This implied that the entire risk of non-payment by the DISCOMs to the intermediary entity would be borne by the intermediary, over and above the risk coverage against forex volatility (including the cost of escrow), which would be contributed by the DISCOMs as an added cost to the purchase price in the PPA.

As many as twenty two of the fifty interviewees considered the proposed modality of foreign exchange risk mitigation to be inadequate. The risk burden on the intermediary entity was seen as a significant barrier in the success of such a policy, if the non-payment by DISCOMs becomes a systemic issue. Additionally, the proposed intervention passes on the cost of hedging (forecasted to be USD 0.02/kWh) on to the DISCOM, further increasing the financial burden on an already overburdened entity, further increasing offtaker risk. In a scenario where the intermediary entity only provides risk coverage against rupee depreciation, and not on the risk against non-payment by DISCOMs (assuming, a tripartite agreement between developer, intermediary and DISCOM), then the investor confidence in the Indian solar market would continue to remain low as only the foreign exchange risk would be mitigated, leaving the offtaker risk unchecked.[88]

As an alternative, hedging facilities set up by the Government of India or international organisations, which are financed partially by grants or funding marked for the development of the solar sector in India (such as the NCEF), and the rest through dollar-denominated PPAs with the developer, could be used to absorb the forex risk of investors without adding additional cost to the distribution companies.

## Green Banks

A Green Bank is another supply enhancing mechanism. Structured as a public or quasi-public institution that finances the deployment of renewable energy, energy efficiency, and other clean infrastructure projects in partnership with private lenders. By using financial tools such as long-term and low interest rate loans, revolving loan funds, insurance products (such as loan guarantees or risk guarantee mechanisms), and low-cost public investments, a green bank catalyses private financing for low-carbon technologies.

Across the world, green banks have been established, at national and sub-national level, to mobilize private investment to meet domestic targets for renewable energy deployment, energy efficiency and GHG emission reductions. For example the UK Green Investment Bank has invested sixty eight green infrastructure projects in the last three years, most recently in a pilot by the Department of Energy and Climate Change (DECC) in South Africa, East Africa and India with and investment of USD 283 million (GBP 200 million). Green banks leverage public money to crowd-in private capital to fill financing gaps. They do so by using multiple mechanisms that improve the terms of finance. For instance, solar projects in India do not get long tenure loans from banks as it builds pressure on the asset – liability management for banks. However if green banks provided blended finance, such that lines of credit from green banks were extended to developers at lower rates and longer tenures, then the overall cost of finance for the developer

88 http://www.careratings.com/upload/NewsFiles/SplAnalysis/Solar%20Article%20-%20CARE%20Ratings%20.pdf

would reduce. This would give private investors the chance to learn about a new market opportunity with the security of government partnership.[89]

Green banks helps lower the overall risk associated with solar energy investments by offering products such as partial credit guarantees, insurance, or loan-loss reserves. For example, Connecticut Green Bank (CTGB) in the US provides credit enhancements for working capital loans for Connecticut-based solar companies.[90] However, it does not include mechanisms that mitigate specific risks.

Green banks also lend their name, capital, and credibility to projects, making these projects more attractive for private investors. Additionally, green banks use an aggregation technique to reduce transaction costs and facilitate investment. Small projects are bundled together to reach a scale where they become attractive for on-sale to large investors or for securitization through bond issuances.[91]

A green bank in India would operate as Non-Banking Financial Company (NBFC) and it could roll out mechanisms that addresses foreign exchange risks, by setting up an escrow facility. Additionally it could also improve the terms of debt for developers by providing blended lines of credit. An India green bank could also help developers tap into new sources of finance by leveraging its high credit rating, as a public institution, to get preferential terms on debt. The mechanisms that could be operationalised by green banks would increase the sources of finance, from bond markets, high net worth individuals, etc. but it does not address the risks that would limit the flow of finance from existing or new sources of finance.

TABLE 5: MANY INNOVATIONS IN SOLAR FINANCE BUT SEVERAL RISKS REMAIN UNADDRESSED

| | Infrastructure Debt Funds | Credit Enhancement Mechanisms | Green Bonds | DISCOM Debt Restructuring (UDAY) | Dollar Tariff Policy | Green Banks |
|---|---|---|---|---|---|---|
| Offtaker Risk | Yes | No | No | Yes | Yes | No |
| Construction and Regulatory Risk | No | No | No | No | No | No |
| Technology Risk | No | No | No | No | No | No |
| Evacuation Infrastructure Risk | No | No | No | No | No | No |
| Foreign Exchange Risk | No | No | No | No | Yes | No |

*Source: Author*

89 CEEW NRDC Green Banks Factsheet, May 2016 (upcoming)
90 ibid
91 ibid

# 6. Conclusion

India's national commitment to the scaling up of solar energy combined with one of the highest irradiation levels received by any country in the world, makes the solar sector ripe for investment. However, the risks plaguing the sector, ranging from those specific to solar technology to those specific to India's finance market is restricting the flow of finance in to India's solar market. While investment in the Indian solar market is greater than ever before, the pace of advancement could gain impetus if certain risks were addressed.

While the current finance and policy interventions, both operational and proposed, discussed in section V address the issue of supply of finance but as financiers have indicated, all sources of finance are likely to be plagued by the risks surrounding investment in solar energy. In this context, it is necessary that all interventions focus on risk mitigation, in addition to mobilising new sources of finance. As our analysis finds (summarised in table 5), most of the current instruments do not focus on risk mitigation. While instruments like credit enhancement and guarantees abate risk by providing a cover for a proportion of the risk, they do not lower any risk specifically.

This study focuses on the risks perceived by financiers, identifying offtaker risk as the principal inhibitor to the flow of finance across investor types. While recommendations like payment guarantees can significantly circumvent the problem of dishonouring power purchase agreements, it does not correct the larger systemic problem of DISCOM health. However, the government's Ujwal Discom Assurance Yojna (UDAY) to restructure the debt of the utilities, and improve their efficiency could prove to be a significant step in improving the ability of DISCOMS to honour PPAs.

The study also identifies construction and regulatory risk as a significant concern for both debt and equity investment. However, setting up of simple processes to acquire land, get connected to a grid, and obtain clearances could abate this risk to a large extent. Additionally, implementation of existing policies, timely disbursement of incentives, and the honouring of contracts could improve the ease of doing business in India's solar sector, in turn improving the flow of finance from both domestic and foreign sources.

Debt financiers, primarily banks, claimed that the flow of finance would benefit from improved technology data. As improved measurement and monitoring instruments and methodology emerge, there is likelihood of better irradiation and performance data. Data for overall project performance, as well as efficiency of the different types of modules could reduce the technology risk for financiers. New instruments could be designed that provide improved technology projections to further increase financier confidence in solar technologies. This, projects could result in more project finance becoming available for solar developers.

Equity investors in solar projects in India reported grid and evacuation infrastructure as a risk that constrained their investments. As India aims to scale up non-fossil fuel capacity to 40%

of its total electricity capacity by 2030,[92] a sizeable portion of which would be contributed by solar energy, it is important for the grid infrastructure to keep pace. Evacuation infrastructure needs to be improved both in its physical reach but also in the amount of solar energy that can be integrated in to the grid. Government initiatives like the green energy corridor are working to provide sustainable solutions that can evacuate power from 33 solar parks around the country. However, increased importance needs to be directed towards grid stability and integration of solar power.

Foreign finance plays a critical role in India's renewable energy deployment. As of July 2015, more than half of India's large grid connected renewable energy projects had some share of international funding. The role of international finance becomes increasingly important in the face of the 100 GW solar target. In order to attract international debt and equity, as well as lines of credit from international organisations, hedging for foreign exchange risk is crucial such that the investor does not have to bear the currency fluctuation risk. Competitive hedging instruments could result in the Indian solar market getting access to more foreign finance, at lower rates of interest, conditional on the hedging cost being lower than the difference between interest rates on borrowing from domestic and international markets.[93]

The need to use innovative instruments to mobilise finance from sources that have not yet been explored or tapped at scale, in line with the investments needed to reach 100 GW of installed solar capacity by 2022. However, respondents appeared to agree that the availability of equity and debt, between the domestic and foreign markets, to scale up solar power in India to beyond 100 GW if the risks identified were abated. Creating new instruments without commensurate and proportionate increase in financing betrays two uncomfortable truths: instruments are not delivering funds at the pace at which they are needed; and that they are unlikely to do so unless they are bolstered with efforts to mitigate a range of risks in a targeted and clinical manner.

92 http://ceew.in/blog/?tag=indc
93 http://climatepolicyinitiative.org/publication/reaching-indias-renewable-energy-targets-cost-effectively-a-foreign-exchange-hedging-facility/

# Annexure

## List of financiers and experts interviewed

| S. N. | Interviewee | Affiliation |
|---|---|---|
| 1 | A.K. Gupta | Punjab National Bank |
| 2 | Amit Mehta | Greenstone Energy Advisors |
| 3 | Anuraj Mishra | USAID |
| 4 | Anwesha Khattar | KPMG |
| 5 | Arnab Bose | Yes Bank |
| 6 | Arun Tyagi | Bank of Baroda |
| 7 | Ashish Golechha | ICICI Bank |
| 8 | Avnish Parashar | Solar Energy Corporation of India |
| 9 | Bharat Bhushan Agarwal | Bloomberg New Energy Finance |
| 10 | Bharat Kaushal | Sumitomo Mitsui Banking Corporation |
| 11 | Brij Mohan Sharma | IDBI |
| 12 | Daanish Varma | Yes Bank |
| 13 | Dhruv Kapoor | Helion Venture Partners |
| 14 | Dipankar Ghosh | Ernst & Young |
| 15 | Gaetan Tiberghien | International Finance Corporation |
| 16 | Gaurav Juneja | Sumitomo Mitsui Banking Corporation |
| 17 | Gireesh Shrimali | Climate Policy Initiative |
| 18 | Harmish Rokadia | International Finance Corporation |
| 19 | Jiwan Acharya | Asian Development Bank |
| 20 | K.S. Popli | Indian Renewable Energy Development Agency |
| 21 | M. Sudhakar | Indian Overseas Bank |
| 22 | M.G. Ajayan | Canara Bank |
| 23 | Manisha Gada | Axis Bank |
| 24 | Manoj Singh | SoftBank Energy |
| 25 | Michael Elchinger | National Renewable Energy Laboratory |
| 26 | Milind Kalkar | State Bank of India |

| S. N. | Interviewee | Affiliation |
|---|---|---|
| 27 | Mohua Mukherjee | World Bank |
| 28 | Nagaraja Rao | Climate Technology Initiative's Private Financing Advisory Network |
| 29 | P Sridhara Rao | Life Insurance Corporation of India |
| 30 | Pooja Singhal | L&T Infra |
| 31 | Prashanth Reddy | ICICI |
| 32 | R Nagarajan | Power Finance Corporation Limited |
| 33 | Rajiv Kumar | SIDBI |
| 34 | Rakesh Sharma | IDFC |
| 35 | Ram Boojh | UNESCO |
| 36 | Reji Pillai | Magnetar Ventures |
| 37 | Sangeet Shukla | Indian Banks Association |
| 38 | Satish Bhargava | Indian Renewable Energy Development Agency |
| 39 | Saurabh Lahoti | Ennovent |
| 40 | Shannon Cowlin | Asian Development Bank |
| 41 | Siddhartha Adak | IndusInd Bank |
| 42 | Sishir Guha | Infrastructure Development Finance Company |
| 43 | Sudipto Basu | ICICI |
| 44 | Sujata Gupta | Asian Development Bank |
| 45 | Usha Rao | KfW |
| 46 | Utsav Baijal | Apollo Management |
| 47 | V. Subramanian | IFCI |
| 48 | Vandana Gombar | Bloomberg New Energy Finance |
| 49 | Vinay Sekhar | IFCI Sycamore Capital |
| 50 | Vishal Sharma | Everstone Capital |

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