COST OF DEBT 13-14%

LIBOR 0.7%

CUMULATIVE LOSSES OF DISTRIBUTION COMPANIES

₹ 1.9 TRILLION

HEDGING RATE 6.5%

DEBT REQUIRED FOR SOLAR PROJECTS IN 2013

₹ 60 BILLION

DEBT-EQUITY RATIO 70:30

RBI BASE RATE 10.25%

DISPUTED DEBT TO BE RECOVERED

₹ 2 TRILLION

US TREASURY RATE 2.5%

PREFERRED EXCEEDANCE PROBABILITY P90

Illustration by Kavya Bagga

BRIDGE TO INDIA

INDIA SOLAR DECISION BRIEF

Bankability and Debt Financing for Solar Projects in India

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KEY FINDINGS

1. According to estimates, debt claims worth more than ₹ 2 trillion (€ 30 billion/$ 40 billion)[1] are pending in debt recovery tribunals. Debt recovery and the legal enforceability of claims for any type of non-recourse debt in India remains a key risk for the lenders.
2. On the intermediate level, lenders have two main concerns: the first is the limited availability of irradiation data, which forms the basis for projecting future revenues. The second is the strength of public power purchasing agreements (PPAs) due to the weak financial health of India's public utilities.
3. According to industry sources, the margin of error for irradiation data at specific locations could be as high as 10% and can be a significant risk from a lender's perspective. International lenders insist on P90 exceedance probability for irradiation data.
4. Majority of SEBs in India have negative net internal revenues and the situation is getting worse. The distribution utilities' cumulative losses rose to ₹ 1.9 trillion (€ 29 billion/$ 38 billion) in FY-2011 from ₹ 1.22 trillion (€ 18 billion/$ 24 billion) in the year before. This puts the PPAs signed by them at risk.
5. A preliminary review of the power production data from January to April 2012 by BRIDGE TO INDIA[2] shows that in spite of similar irradiation and temperature conditions, while most of the plants have a CUF of around 20%, a few plants have achieved a CUF as high as 25% and as low as 14%.
6. Unavailability of non-recourse financing is a critical hurdle in the expansion plans of developers as they cannot continue to accumulate recourse on their balance sheets.
7. Due to liquidity shortages, short timelines and delayed disbursements of debt amounts, bridge financing plays a key role in letting developers complete their projects on time.
8. Bridge finance can be arranged through short-term construction loans from financial institutions, suppliers' credit and pre-financing by EPC companies.
9. First movers in terms of financing solar projects in India have been Bank of Baroda, Axis Bank, ICICI Bank, State Bank of India, IDBI Bank and Yes Bank.
10. Prominent non-banking financial companies (NBFCs) that are open to financing solar projects include: L&T Infrastructure Finance Company (subsidiary of L&T Financing Holdings), Power Finance Corporation (PFC), Mahindra Finance, IDFC, IL&FS, SBI Capital Markets and Indian Renewable Energy Development Agency (IREDA).
11. The US EXIM bank has been the most active Export Credit Agency (ECA) in the Indian solar market. According to a statement in July 2012, the US EXIM bank has approved solar project financing for ₹ 16.5 billion (€ 250m/$ 330m).
12. IFC, a member of the World Bank Group, is one of the most actively involved Development Funding Institutions (DFIs) in India. It has provided financing for projects by developers such as Green Infra, Mahindra Solar, Azure Power and SunEdison India.
13. ADB provides financing support under the India Solar Generation Guarantee Facility (ISGGF), under its Asia Solar Energy Initiative (ASEI) to promote the development of solar energy in India. Currently, two commercial banks have been approved by ADB as eligible partners: L&T Infrastructure Finance Company Limited (India) and the Norddeutsche Landesbank (abbreviated Nord/LB, Germany).

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[1] € 1 = ₹ 65; $ 1 = ₹ 50

[2] Refer to the July 2012 edition of the INDIA SOLAR COMPASS to read more

1. OVERVIEW

Lenders have concerns with debt recovery and the legal enforceability of claims in India in general. This is a concern that extends to any project-related finance in India.

On the intermediate level, with respect to the Indian solar market, banks have two main concerns: limited availability of irradiation data and the strength of public power purchasing agreements (PPAs)

Solar projects in India still struggle to raise debt finance. So far, only a small percentage of projects have attained non-recourse financing. Most have worked with either limited recourse or full recourse finance. Banks that have in the past provided non-recourse financing are either Indian commercial banks or international lenders with a development mandate. There are several reasons why non-recourse finance is difficult to obtain. They relate to three layers of the market:

1. On the macro level, lenders have concerns with debt recovery and the legal enforceability of claims in India in general. This is a concern that extends to any project-related finance in India. Even cross-defaulter clauses of converting debt into equity only have a limited appeal. The best way for a project promoter to reduce this concern is through a strong company reputation and banking relationship as well as through the actual track-record of debt repayment and future plans and debt requirements (the larger the risk to future business of being labeled a "defaulter", the higher the incentive to repay the debt). Recovery of Debts Laws (Amendment) Bill, 2011 was passed in December 2012 in the Indian parliament. Recent modifications of debt-recovery rules will make it easier for banks to recover bad loans and thereby to make more non-recourse financing available in the future.

2. On the intermediate level, with respect to the Indian solar market, banks have two main concerns: the first is the limited availability of irradiation data, which forms the basis for projecting future revenues. The second is the strength of public power purchasing agreements (PPAs) due to the weak financial health of India's public utilities. On account of these risks, the market is slowly maturing: more on-ground measuring stations and actual generation data from existing plants provide a stronger set of data. With respect to the strength of PPAs, payments are sometimes backed by guarantee funds and sometimes passed on to the private sector (through Renewable or Solar Purchase Obligations). For Renewable Energy Certificates (RECs)[3] the main questions hover around the enforcement of Solar Renewable Purchase Obligations (RPOs) and Solar Purchase Obligations (SPOs in Tamil Nadu)[4], which create the demand. The project promoter will need to be conservative on yield assessments and evaluate the off-take and REC options very carefully.

3. On the project level, there can be projects that are simply not well developed. A well- developed project usually starts from the perspective of the debt provider (bankability) by identifying and mitigating risks. The second step is proving viability to the lenders. Our report will primarily focus on steps for improving the bankability of the projects and arranging for project debt.

Currently, a dynamic, early stage, uncertain and regionally diverse regulatory environment also negatively impacts project bankability by keeping the transaction costs for lenders high and visibility low. The nature of solar power projects – with their high upfront capital requirements and low operational costs, typical of infrastructure projects – further emphasizes the bankability challenge. Another issue is that since many Indian banks currently have excess exposure to the conventional power sector, they have very limited funds left over for solar projects. Apart from that, interest

[3] Refer to BRIDGE TO INDIA's decision brief on 'REC Mechanism: Viability of Solar Projects in India'
[4] Refer to BRIDGE TO INDIA's 'Tamil Nadu Solar Policy Brief'

Unavailability of non-recourse financing is a critical hurdle in the expansion plans of developers as they cannot continue to accumulate recourse on their balance sheets.

Till the time non-recourse financing becomes more readily available in the Indian market, access to the right financing options will remain the key differentiator across different developers and their projects.

rates in India have been at an all-time high. Solar projects financed by Indian banks, non-bank financial companies (NBFCs) and infrastructure funds end up paying an interest rate of over 13% per annum.

Unavailability of non-recourse financing is a critical hurdle in the expansion plans of developers as they cannot continue to accumulate recourse on their balance sheets. In addition, the high cost of financing significantly adds to the cost of solar power in India as compared to more mature solar markets.

Till the time non-recourse financing becomes more readily available in the Indian market, access to the right financing options will remain the key differentiator across different developers and their projects. This is exceptionally important in a competitive project allocation landscape that exists in India. International financing from export credit agencies (ECAs) such as the US EXIM bank and development finance institutions (DFIs) such as the International Finance Coporation IFC has helped some developers secure a lower cost of debt. Even after completely hedging for currency, a project is able to derive a rate differential of around 100 basis points. These financing sources are also more open than commercial banks to financing solar projects as they tap into funds allocated for climate initiatives and/or have a mandate to promote exports from the host country.

As a trend, project developers and other key stakeholders in the solar industry realize that conventional financing from banks is not the sole answer to scaling up of solar power in the country. Innovative mechanisms need to be worked out. Currently, this innovation is working at two levels: lack of liquidity is prompting project developers to look for instruments like suppliers' credit and construction finance to get the projects up and running quickly (gaining speed) and at the same time, the high Indian interest rates are spurring efforts to acquire debt from outside the country without a full or partial financial hedge against currency fluctuations.

2. LENDER'S VIEW – RISKS AND MITIGATION STRATEGIES

According to estimates, claims worth more than ₹ 2 trillion ($ 37 billion/€ 30 billion) are processed in DRTs in India.

In December 2012, the Indian parliament has passed the Debts Laws (Amendment) Bill; 2011 to strengthen the regulatory and institutional framework related to the recovery of debt.

A lender's role is to assess the risks of a project and based on these, decide whether to lend and if so, at what terms. Project developers, sponsors, EPC companies and other stakeholders must work towards mitigating all critical risks to be able to secure financing at reasonable terms. Lenders' eligibility criteria refer to, for example, PPA type, strength of the power off-taker, long term cash flows, earnings before interest, taxes, depreciation, and amortization (EBITDA[5]), debt service coverage ratio(DSCR[6]), environmental and social impact and even, in some cases, anti-corruption due diligence. Sponsors and developers should work towards meeting these criteria right from the outset of their project activities.

Debt recovery and the legal enforceability of claims for any type of non-recourse debt in India remains a key risk for the lenders. Lenders usually have to rely on debt recovery tribunals (DRTs) for resolution and recovery of disputed loans. According to estimates, claims worth more than ₹ 2 trillion ($ 37 billion/€ 30 billion) are processed in DRTs in India[7]. In a situation, where recovery of assets can be cumbersome, banks are particularly wary of negotiating non-recourse terms of financing with the developers. At the same time, however, developers with a long-term strategy of solar asset ownership cannot continue to accumulate recourse-based debt on their balance sheets. If such players are unable to raise non-recourse debt, their growth will be stifled.

In December 2012, the Indian parliament has passed the Debts Laws (Amendment) Bill[8]; 2011 to strengthen the regulatory and institutional framework related to the recovery of debt. Previously, a debtor was able to get a 'stay order' from a judicial court on recovery of assets. This prevents and delays the recovery of assets by the lenders or asset recovery companies (ACRs). The new bill preventsany orders by the courts without first hearing the bank or ARC. This might give more comfort to the banks at the time of lending and thereby reduce the cost of borrowing, which would significantly aid the development of the Indian infrastructure sector.

A few solar project developers,such as SunEdison, Mahindra Solar, Astonfield and SunBorne Energy claim to have been able to secure non-recourse debt financing for their projects in India. Convincing lenders (especially the Indian lenders) to provide a non-recourse debt is challenging. The key to achieving a non-recourse financial closure is to convince them that their projects' risks are very well covered, the project development process has been very professionally executed, the project is financially viable and the borrower has sustainable, long-term plans requiring more debt in the future.

Apart from this, corporate credibility and the ability to raise equity (for the project itself, the project development company or an asset holding company) from prominent international financial investors such as Goldman Sachs, the Blackrock Group or Apollo Management and multilateral financial institutions such as the IFC can help build the case for non-recourse debt. In almost all the cases of non-recourse finance in India, debt is syndicated between multiple lenders, so that there is only a limited exposure on a single lender.

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[5] The EBITDA of a project company gives an indication on the operational profitability of the business, i.e. how much profit does it make with its present assets and its operations on the products it produces and sells, taking into account possible provisions that need to be carried out.
[6] The debt service coverage ratio (DSCR), also known as "debt coverage ratio," (DCR) is the ratio of cash available for debt servicing to interest, principal and lease payments.
[7] Article: MINT-Revitalize debt tribunals: Supreme Court tells government.
[8] The Enforcement of Security Interest and Recovery of Debts Laws (Amendment) Bill, 2011.

Over time, mature solar markets with a strong debt recovery framework, such as Germany and the US have moved towards mostly non-recourse financing at very high debt to equity ratios.

While the NVVN can be considered a credible off-taker, TANGEDCO cannot be considered a low-risk off-taker as it is in poor financial health and has a track-record of delayed and defaulted payments to wind power generators in the state.

In a non-recourse project financing structure, the plant assets themselves serve as a basis for the repayment of the loan. Thus, a proper and predictable forecast of the power production is of utmost importance. Other influencing parameters can be a sound technical planning, the experience and track record of the EPC contractor, reliable irradiation measurements, conservative financial modeling and availability of operational data from a plant close to the chosen location of the project at hand.

Over time, mature solar markets with a strong debt recovery framework, such as Germany and the US have moved towards mostly non-recourse financing at very high debt to equity ratios. In India, too, the perception of risk is expected to change as the market matures and lenders are able to refer to a larger body of performance and other statistical data to assess project performance.

In any case, to be able to secure financing at competitive terms, the project developers, EPC companies and other stakeholders need to do all they can to mitigate the risks at the project level.

This section deals with the project risks from a lender's perspective and looks at steps that can be taken to mitigate them. The risks have been broken down into three categories: (i) long-term risks related to payment security, (ii) long-term risks related to power generation and (iii) short-term risks related to delays in commissioning.

2.1 RISKS RELATED TO LONG-TERM PAYMENT SECURITY

2.1.1 Power off-taker risk

The power off-taker risk is the most crucial from the perspective of long term payment security. A payment delay or default can make a project unviable and possibly eliminate a project owner's ability to structure the debt.

Currently, most off-taker and payment risks are still directly associated with the various solar polices in place in India. For most FiT-based projects, a government entity is the off-taker. As an example, NTPC VidyutVyapar Nigam (NVVN), a government-owned power trading company, has been the off-taker for projects allocated under the National Solar Mission (NSM). Similarly, Tamil Nadu Generation and Distribution Corporation (TANDEGCO) is the off-taker forprojects allocated under Tamil Nadu's state solar policy. While the NVVN can be considered a credible off-taker, as it is an Indian AAA rated company with a healthy balance sheet, TANGEDCO cannot be considered a low-risk off-taker as it is in poor financial health and has a track-record of delayed and defaulted payments to wind power generators in the state. The selection of a PPA signing authority and payment security measures such as payment guarantee funds together determine the risk associated with payment security.

Apart from the bankability of the PPA signing authority, the exact terms under the PPA itself are equally crucial. For example, the PPA in Gujarat does not explicitly guarantee that all the power produced will be bought by the off-taker.

Going forward, the government-entity-backed PPAs are slowly giving way to private third-party PPAs. These PPAs are partially driven by the increasing commercial viability of solar power in India and may avail additional benefits under mechanisms such as the REC mechanism or Viability Gap Funding (VGF). In addition, Solar RPOs and SPOs in Tamil Nadu) on various private obligated entities also drive private PPAs.

For state policy-backed PPAs that are usually signed with the state distribution companies (DISCOMS), it is important to assess the financial health of the counterparty.

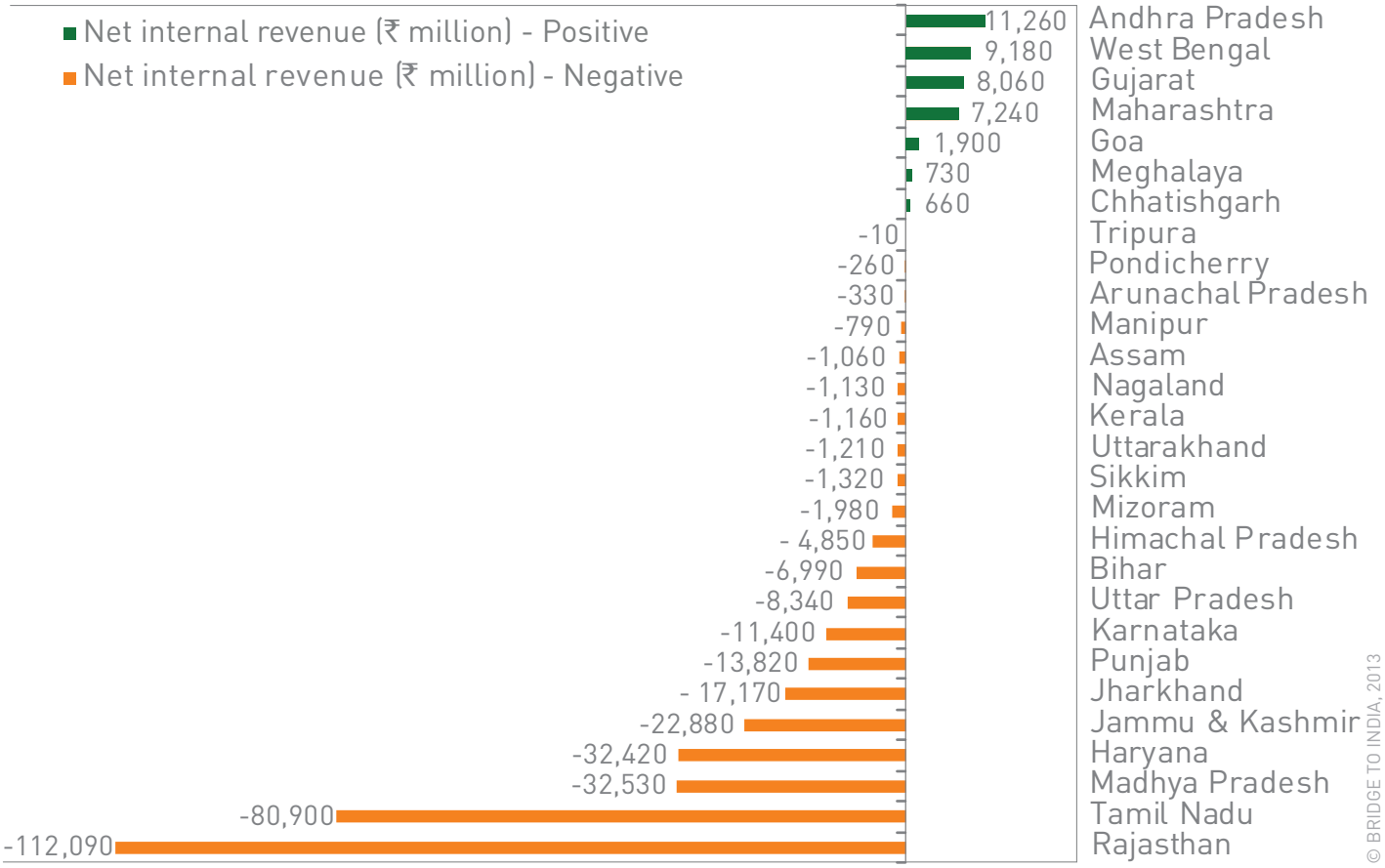
For private PPAs, each off-taker will have to be judged on a case-to-case basis. This will initially push up the transaction costs. If power is sold on site (captive model) rather than through the grid, the dependency on the buyer will be very high. This is a significant risk. On the other hand, many private entities are in significantly better financial shape than most state utilities. Also, a strong, underlying commercial logic to buying solar power can be a better safeguard against payment default than the mere political will behind a solar policy, which might quickly fade, if the financial strain on the government (central or state, as the case may be) becomes too much. This is a lesson that has been learned from European markets, such as Spain or the Czech Republic.

Mitigation strategy

Project selection should be done only after undertaking an in-depth assessment of the off-taker. For state policy-backed PPAs that are usually signed with the state distribution companies (DISCOMS), it is important to assess the financial health of the counterparty.

Each Indian state has a State Electricity Board (SEB), representing the state's power generation, transmission and distribution companies.

Figure 1: State-wise net internal revenues for 2009-10 (in ₹ Million)



Source: Annual Report 2011-12 on The Working of State Power Utilities & Electricity Departments – Planning Commission of India

Source: BRIDGE TO INDIA

Figure 2: Structure of a typical State Electricity Board

Source: BRIDGE TO INDIA

The distribution utilities' cumulative losses rose to ₹ 1.9 trillion (€ 29 billion/$ 38 billion) in FY-2011 from ₹ 1.22 trillion (€ 18 billion/$ 24 billion) in the year before. This puts their PPAs at risk.

Tamil Nadu received an interest for just 499 MW out of the 1,000 MW offered in January 2013 under its solar policy, primarily due to the poor financial health of its PPA signing entity (TANGEDCO).

Typically, DISCOMS are heavy loss makers. Data on the financial health of individual DISCOMS (can be more than one per state) is not easily comparable. For that reason, the Planning Commission of India shows the losses or profits made on the level of the SEBs. They give a good indication of the finances of the electricity sector in a state and thus the financial ability of the states PPA signing authority to honor PPA payments.

A majority of the SEBs have negative net internal revenues and the situation is becoming worse. The distribution utilities' cumulative losses rose to ₹ 1.9 trillion (€ 29 billion/$ 38 billion) in FY-2011 from ₹ 1.22 trillion (€ 18 billion/$ 24 billion) in the year before[9]. This puts their PPAs at risk. In the past, states have been bailed out by the Government of India in an irregular manner. Now, the central government has offered to bail them out systematically for perhaps the last time through a debt restructuring. In return, states are asked to raise tariffs on a regular basis to put their power industry on a stable economic footing. However, it is expected that many states will not even go ahead with the restructuring as political compulsions might not allow them to increase tariffs as proposed under the restructuring mechanism.

The sound financial health of the Gujarat PPA signing entity, Gujarat Urja Vikas Nigam Limited (GUVNL), which is responsible for the generation, transmission, and distribution of electricity in the state, has gone a long way in creating interest amongst investors and lenders in solar projects in the state. Andhra Pradesh also received a decent response owing to the relatively better health of DISCOMs. On the other hand, Tamil Nadu received an interest for just 499 MW out of the 1,000 MW offered in January 2013 under its solar policy, primarily due to the poor financial health of its PPA signing entity (TANGEDCO). Debt financing for these projects will likely happen on a recourse basis.

A public PPA should have the following features to be bankable:

1. The term of the PPA should be longer than the debt repayment period (debt repayment period for rupee term loans is usually 8-12 years).
2. The off-taker should commit to buying all the solar power produced. The total power production should be governed by Capacity Utilization Factor (CUF)[10] or Performance Ratio (PR)[11] limits[12].
3. Payment security should be

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[9] Article: State power boards seek extension of reform programme deadline - Mint
[10] Capacity Utilization Factor(CUF) =Energy measured (kWh) / (365 x 24 x installed capacity of the plant)
[11] Performance Ratio (PR) of a plant for a period of time =Energy measured(kWh)/(Irradiance(kWh/m2) on the panel x Active area of PV module(m2) x PV module efficiency)
[12] The CUF and PR measures ensure that the plant is only producing the power it is supposed to and there is no excess capacity or any excess supply of power through other sources of energy.

Payment security should be ensured through a revolving monthly letter of credit (LOC). However, such a LOC is only useful for ensuring short term payment security and the overall PPA structure should preferably be backed by a dedicated fund.

A strong 'Plan B' for an alternative off-taker is a significant advantage. Having alternatives becomes significantly easier, if the project is grid connected (i.e. is not captive).

ensured through a revolving monthly letter of credit (LOC). However, such a LOC is only useful for ensuring short term payment security and the overall PPA structure should preferably be backed by a dedicated fund, especially if the PPA signing authority is a loss making entity.

4. The tariff mentioned in the PPA, should be approved by the state electricity regulatory commission (SERC)[13].
5. A course of action for a default by either the power producer or the off-taker should be clearly outlined.
6. The litigating authority to resolve any issues should be fixed for cases where the SERC may not be the litigating authority.
7. During any litigation, payment should typically not be held up. The power producer or the procurer can be asked to submit bank guarantees in lieu of payments being made during the litigation period. The procedure for this should be specified in the PPA itself.

For private PPAs, developers will need to ensure the bankability of each off-taker by conducting a due diligence (assets, liquidity, business prospects, etc.). For public companies, information is publically available. For private limited companies, one can either ask the company to provide attested copies of previous financial statements and verify them using the services provided by the Ministry of Corporate Affairs (MCA), to access the publically available statements by paying a minimal processing fee. Typically it would be advisable to sign private PPAs with large and financially sound companies or institutions. In addition, an escrow account or letter of credit covering a reasonable payment period will help.

If the power is sold under a private PPA, on-site under a captive model,a clause to sell the plant under pre-defined terms in case the contract is to be terminated before the end of the PPA or a build operate own transfer (BOOT) model can reduce the risk. (For such plants, also other risks related to right of way, lease of land, liquidation preferences of the land/building vs. liquidation preferences of the power plant, etc. have to be addressed.)

In general, the more dependent customers are on the power sold, the stronger their willingness to abide by the PPA. Thus, the larger economics of the power industry in India should be considered. Key questions are: how long will the demand/supply gap continue to exist and will the price of alternative power (grid power, open access power, etc.) rise or fall?

A strong 'Plan B' for an alternative off-taker is a significant advantage. Having alternatives becomes significantly easier, if the project is grid connected (i.e. is not captive). Alternatives could be: sale of power to trading companies, other private PPA customers or DISCOMS.

A more long-term way of managing individual payment risks would be through building a portfolio of PPAs across different buyers.

2.1.2 Regulatory risks

The regulatory environment in India with respect to solar power is still in flux and is expected to remain so for at least a couple of years. Policy initiatives are not all equally transparent, financially sound and implementable.
As an example, the REC mechanism[14] at the national level and the SPO mechanism[15] in Tamil Nadu are both dependent on demand that has to be induced through implementation of

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[13] Release of funds for payment of monthly tariffs is only permissible after SERC has approved the tariffs. Moreover, such an approval by an independent body provides payment security irrespective of a change in government.
[14] Refer to the BRIDGE TO INDIA's decision brief, 'REC Mechanism – Viability of solar projects in India' to read more.
[15] Refer to BRIDGE TO INDIA's, 'Policy Brief- Tamil Nadu Solar Policy 2012' to read more.

The floor price of the RECs, i.e., ₹ 9,300/MWh till 2017, is significantly higher than the generation cost of solar power in almost all parts of the country.

Currently, it is much more economical for any obligated entity to set up a plant or buy solar power through a private PPA, rather than buying RECs even at the floor price.

the obligations. Given that each Indian state has a different approach towards implementing these obligations and a different degree of earnestness in implementing them; it is extremely difficult to ascertain the actual resulting demand for solar power or RECs.

All evidence currently suggests that the implementation of obligations is nowhere near the aimed-for levels. Moreover, the floor price of the RECs, i.e., ₹ 9,300(€ 143/$ 186)/MWh till 2017, is significantly higher than the generation cost of solar power in almost all parts of the country. This casts doubt on the future demand for RECs. Lenders are very wary of lending to projects that require REC revenue to achieve viability.

Projects that are looking for the third-party sale of power also have to deal with charges for interconnection, wheeling, transmission and cross subsidy that also vary by factors such as voltage levels, location and off-taker. The financial impact of these charges can vary from ₹ 0.50 (€ 0.007/$ 0.01)/kWh to ₹ 2.00 (€ 0.03/$ 0.04)/kWh, depending on the project[16]. Ascertaining the exact quantum of these charges can be a challenge as most regulations regarding them are framed with large conventional power plants in mind.

Mitigation strategy

Project selection should be based on an in-depth understanding of themarket conditions and clarity on policy or regulation. An investor should understand the following issues before making an investment decision:

1. The high price of RECs is only valid till 2017. According to BRIDGE TO INDIA, the floor price of RECs beyond that could be as low as ₹ 2,000 (€ 30.8/$ 40)/MWh[17].
2. There is uncertainty regarding thelong term demand for solar RECs as it depends largely upon the enforcement of RPOs.
3. State DISCOMS that are the primary source of demand have huge losses on their balance sheets and without any penalties, have little reason to buy the more expensive solar power or RECs.
4. Currently, it is much more economical for any obligated entity to set up a plant or buy solar power through a private PPA, rather than buying RECs even at the floor price. The floor price is only valid until 2017, post which it will likely fall significantly, whereas plant lifetime and most PPA periods are upwards of 15 years.
5. Many developers are convinced that the REC mechanism can provide considerable upside to their projects, thereby, making them viable. However, lenders are not comfortable with lending to such projects. Due to this, a large number of projects have not been able to come out of their planning stage.

For any projects under the REC, developers should try to maximize the realization of revenue through the tariff in the PPA. Ideally, the revenues from the PPA should be able to serve interests and repayment of the loan. Lenders might be comfortable with a bankable private PPA at a viable tariff using additional revenues from the REC mechanism only as an upside.

At the time of planning, one should also have maximum clarity on the requirement of permits and applicability of cross subsidy, wheeling, transmission and power banking charges. A developer would need to scrutinize the publicly available regulatory documents and then work closely with the state DISCOM, SERC and the connecting substation to ascertain such charges at the time of project planning.

[16] Refer to 'The Project Development Handbook' decision brief by BRIDGE TO INDIA.
[17] Refer to the 'REC mechanism: Viability of Solar Projects in India' decision brief by BRIDGE TO INDIA

The error margin in DNI data considered at the time of planning has been cited as one of the key reason by some developers who have cancelled their CSP projects under phase one of the NSM.

Ground based measuring stations have only recently been installed under the Center for Wind Energy Technology (C-WET), an initiative by the MNRE.

2.2 RISKS RELATED TO LONG-TERM PLANT QUALITY AND POWER GENERATION

2.2.1 Resource data risk

Irradiation data from most sources available in India is based almost entirely only on satellite data. According to industry sources, the margin of error for specific locations could be as high as 10% for some commonly used global satellite based data traditional sources such as NASA-SSE and WRDC.

Meteonorm is a combination of satellite and ground based data. In places where irradiation measurement is not available for an area of 200km around the selected location, it uses satellite information. If the nearest site is more than 30km away, a mixture of ground and satellite information is used. However, the satellite covers a period of just three years (2003-2005) and there are less than 15 locations in India for which Meteonorm uses ground data and this data too cannot be considered as high quality.

Most satellite data available only covers 10 years as compared to the 20+ years in mature markets. According to Acira Solar, a technical consulting company based in India, satellite based irradiation sources use monthly averages of Linke Turbidity function and have no credible methodology to correct this based on ground measurements. Also, traditional Satellite based data usually has a low resolution, i.e., the data will appear constant over large areas. This can be as high as 30-40 kms for some sources. In fact, the error margin in direct normal irradiation (DNI) data considered at the time of planning has been cited as one of the key reason by some developers who have cancelled their concentrated solar power (CSP) projects under phase one of the NSM.

Comparing global horizontal irradiation data for a single location using different data sources

Charanka solar park /Source	Lat 23.9078401, Long 71.2029348
Meteonorm	1952 kWh/m^2/year
Nasa	1884 kWh/m^2/year
3-Tier	1940 kWh/m^2/year
SolarGIS	2008 kWh/m^2/year

Source: BRIDGE TO INDIA

Ground based measuring stations have only recently been installed under the Center for Wind Energy Technology (C-WET), an initiative by the Ministry of New and Renewable Energy (MNRE). Therefore, there is very little ground measured irradiation data available in the country till date. A network of 51 Solar Radiation Resource Assessment (SRRA) stations have been installed in the first phase and the real-time data is now available from these stations.[18] However, the timeframe for historical data collection till date is still very short. Equally, the actual generation data of operational plants is only available for just over a year. As a result, it is still difficult to reliably predict the performance of projects. The uncertainty of performance predictions is a risk for lenders and they would cover this risk by charging a higher rate of interest and assuming a discount on the projected generation, when determining the viability of a project.

Mitigation strategy

It is important to quantify the uncertainty in performance prediction models. For solar projects, irradiation can be a key source of uncertainty. Majority of financial institutions

[18] Solar Radiation Resource Assessment (SRRA) – C-WET

require a solar resource risk assessment report by an independent consultant. The report should describe the Exceedance probability[19] at 90% confidence, or "P90". Some institutions are even more cautious and require P95, P98, or even P99. This has prompted the industry to obtain TMY based not only on P50 but also P90.

Higher the uncertainty in solar resource data, the higher will be the difference between P50 and P90 values. High uncertainty results in lower values of the P90 solar resource estimate. The evaluation of uncertainty in solar data is therefore critical.

Ideally, irradiation data for more than 10 years should be considered for accurate prediction models. For India, such data is available from SolarGIS and 3TIER.

Ideally, irradiation data for more than 10 years should be considered for accurate prediction models. For India, such data is available from SolarGIS and 3TIER. As the data from SolarGIS and 3TIER is available in real-time, it can be combined with ground-measured data. Such a process results in a 10+ years dataset with accuracy of a ground sensor. This is the best way to mitigate risk in solar resource assessment.

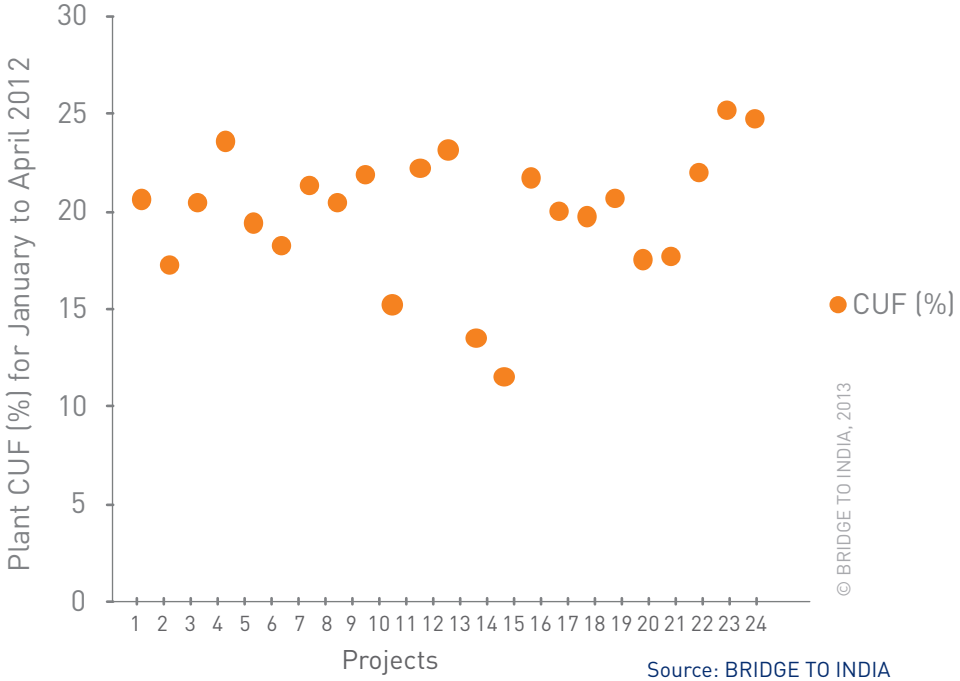
Field data on module failure rates and performance degradation rates in India is limited.

2.2.2 Technology risks with regard to quality and performance

Indian lenders in particular are wary about technology risks as funding solar projects is new for them and many are still uncomfortable with the technology. Many players in the module industry, especially those in newer thin film technologies such as CdTe and CIGS, have lesser on-ground experience than a typical module and plant lifecycle (25+ years). Hence, project developers often cannot refer to long-term generation data of their chosen module. Field data on module failure rates and performance degradation rates in India is also limited. Under such circumstances, a selection of modules, inverters, BOS components and construction practices that do not meet adequate internationally prevalent quality standards such as IEC 60364, IEC 61557 and IEC 61730, would put the bankability of a project at risk.

Available performance data from solar projects under the NSM and

Figure 3: CUF based on plant data from Gujarat (January to April 2012)



Source: BRIDGE TO INDIA

[19] Exceedence probability is usually calculated in terms such as P50/P75/P90. Here, a "PXX" denotes the annual energy production level that is reached with a probability of XX%. Hence, P95 means that there is a chance of 5% that the P95 level will not be reached. P50 of course is the base case, as there is a 50:50 chance it will be exceeded.

Regular breakdowns due to faults in BOS components can not only increase the recurring costs on maintenance of structures, electrical equipment and wiring, but can also result in significant losses in power generation over the plant lifetime.

Many project developers in India split EPC contracts and some also take on a part of the EPC responsibility themselves to save costs. In such a scenario, no single EPC would be able to provide performance guarantees for the plant as a whole.

Gujarat Solar Policy shows that there is a significant variance in terms of energy yield (kWh/KWp), PR or CUF levels of projects located in similar irradiation locations. A preliminary review of the power production data in Gujarat from January to April 2012 by BRIDGE TO INDIA[20] shows that in spite of being in similar irradiation and temperature conditions, while most of the plants have a CUF of around 20%, some plants have achieved a CUF as high as 25% while a few are as low as 14%. These CUF numbers have been calculated based on the energy injected into the grid.

This goes to show that many projects are performing lower than expected. Generation data for projects under the NSM in Rajasthan shows similar variations in project performances[21]. This variation is primarily due to component selection, engineering and construction.

In India's extremely competitive PV landscape, cost reduction is a major point of concern for developers to be able to offer winning tariffs. However, this needs to be managed in a comprehensive manner. Just using the right modules and inverters but simply reducing the overall plant cost, can take the emphasis away from using the right balance of system (BOS) components and sound construction. Regular breakdowns due to faults in BOS components can not only increase the recurring costs on maintenance of structures, electrical equipment and wiring, but can also result in significant losses in power generation over the plant lifetime. Those plants with a below average CUF will struggle to be profitable.

The technical capability and financial health of project developers, EPC companies, module suppliers, inverter suppliers and O&M contractors are also of significance to the lender. A large part of the bankability rests on the track record and guarantees these suppliers bring to the table. In times of market consolidation and insolvencies (such as now), it is especially important to check the financial health of the suppliers as their insolvency can leave critical equipment without a proper guarantee cover.

Many project developers in India split EPC contracts and some also take on a part of the EPC responsibility themselves to save costs. In such a scenario, no single EPC would be able to provide performance guarantees for the plant as a whole. This reduces the bankability of the project.

Mitigation strategy

Most of the technical risks can be mitigated through selection of the right EPC partner or, if the contract is split, by sound technology selection at the time of project planning. Identifying a capable O&M contractor (sometimes the EPC) during the plant operation is also essential. Lenders usually have a preferred-suppliers-list that is used to determine the bankability of the projects. Globally, c-Si cell/module technology has a market share of about 85% as it is the most mature technology and has a proven track record. Purely from a technology point of view, lenders are more comfortable with c-Si as the risk profile for the technology is lower. However, in India, more than half of the installed PV projects have used thin-film modules. There have been several regulatory, commercial and technical factors such as domestic content requirement, export finance and presumably better power production in hot climates, which have influenced this shift. This has given Indian lenders significant exposure to thin-film technology.

It is preferable to select EPC contractors with significant experience of executing projects in India and internationally. Technical aspects of the plan and designs provided by the EPC contractors should be carefully reviewed by experts at the

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[20] Refer to the July 2012 edition of the INDIA SOLAR COMPASS to read more
[21] MNRE - net exported power for the month of December 2012

developer's end or by third party technical consultants such as Lahmeyer International, SGS and TUV Rheinland.

Adherence to international quality and safety standards can ensure plant quality and performance over time. Some of the international standards for utility-scale, grid-connected solar PV projects are as follows:

International standards for utility-scale, grid-connected solar PV projects

Equipment	Standards (Applicable IEC/equivalent BIS standard)		Standard description
PV modules	c-Si PV modules	IEC 61215 / IS 14268	Design qualification and type approval
	Thin film PV modules	IEC 61646	
	CPV modules & assemblies	IEC 62108	
	IEC 61730 – 1		PV module safety qualification (construction)
	IEC 61730 – 2		PV module safety qualification (testing)
	IEC 61701		Salt mist corrosion test for PV modules
Power conditioner units (PCUs)/ Inverters	IEC 61683, IEC 60068 2 (6,21,27,3,7,78)		Efficiency measurements
Cables	IEC 60189, IS5 694 / IS 1554, IS/IEC 69947		General tests and measuring methods for PVC insulated cables used for working voltages up to and including 1100 V-DC, UV resistance for outdoor installations
Switches / Circuit Breakers / Connectors	IS/IEC 60947 part I, II, III EN 50521		General requirements for connectors safety
Junction Boxes / Enclosures	IP 65 (for outdoor use) / IP 21 (for indoor use), IEC 62208		General requirements
Solar PV system design	IEC 62124		PV standalone system design verification
Other electrical equipment	IEC 60364 – 5 – 52 : 2001		Selection and erection of electrical equipment and wiring systems
Safety equipment	EN 62305 -4: 2005		Protection against lightning
Commissioning and inspection	IEC/EN 62446:2010		Grid connected photovoltaic system- Minimum requirement for system, commissioning and inspection
Performance Ratio measurement	IEC 61724		Photovoltaic system performance monitoring- Guidelines for measurement and data exchange

It would be wise to negotiate terms for the EPC provider to furnish a performance guarantee for at least the first two years of the plant operation.

Some projects such as CCCL Infrastructures Ltd., Camelot Enterprises Pvt. Ltd. and Karnataka Power Corporation Ltd. under batch one of phase one of the NSM lost up to ₹ 100m (€ 1.54m, $ 2m) due to delays to their 5 MW projects.

The solar manufacturing industry is going through a consolidation phase and many module manufacturers are expected to either shut down or be acquired. A supplier's financial due diligence based on balance sheets, operating profit/loss, debt, shipments, etc. should be carried out and previous settlement of claims and the mechanisms used by the suppliers to cover guarantees and warrantees should be checked and compared.

Most projects in India have not insisted on performance guarantees from the EPC provider as it comes at an additional cost. Internationally, such guarantees are structured in such a way that the EPC pays a penalty to the plant owner, if the plant performance ratio of the plant is lower than a certain pre-decided limit (typically starting from around 85% and accounting for degradation thereafter).

This, to a large extent, is not possible in India as almost all EPC contracts are split up to save costs and EPC companies do not command enough margins to be able to cover such risks. However, it would be wise to negotiate terms for the EPC provider to furnish a performance guarantee for at least the first two years of the plant operation, especially for the comfort of the lenders. It is also suitable to appoint the EPC contractor as the O&M contractor. This will allow all guarantees to be covered by a single entity.

Third-party insurance from international companies such as Solarif and Solar Insure for output generation can also be considered. This comes at a cost and such insurances are so far not popular in India. However, getting an insurance post the project commissioning can be of help while restructuring the debt to improve terms.

2.3 SHORT-TERM, PROJECT EXECUTION RISKS

2.3.1 Permitting and construction risks

There is no comprehensive list for permits and clearances required to construct a solar power plant in India as they vary by location and off-take. The process of acquiring the necessary permits and clearances can be complicated and time consuming and can cause unexpected delays[22]. For example, a 125 MW project by Mahagenco in Maharashtra has been delayed by well over a year due to issues related to land use. The penalty for delays in most policy-based projects is extremely high and can have a significantly negative financial impact, sometimes making projects completely unviable. Some projects such as CCCL Infrastructures Ltd., Camelot Enterprises Pvt. Ltd. and Karnataka Power Corporation Ltd. under batch one of phase one of the NSM lost up to ₹ 100m (€ 1.54m, $ 2m) due to delays to their 5 MW projects.

Timely acquisition of land can be another key hurdle. Land in India usually has multiple owners and the records are often not well maintained. There have been several instances where disputes over the ownership of land have started on the verge of its acquisition. The disputesthen are resolved through litigation or through an out-of-court-settlement. In such cases, many developers prefer to shift the plant location to avoid potential delays in land acquisition. For example, most projects under batch one of phase one of the NSM did not actually get built at the location proposed at the time of bidding.

In the past, many project developers have waited until the last moment to place orders in the hope of getting

[22] To read more about permits and clearances, refer to 'The Project Development Handbook' by BRIDGE TO INDIA

Many project developers have waited until the last moment to place orders in the hope of getting the best prices. This has not been a successful strategy for most developers as in many cases it resulted in losses due to delays and fines.

Consultation and approval from the relevant forest authority may be required to ensure that the land is not reserved by the forest department.

the best prices in a market where equipment costs have been falling steeply. This has not been a successful strategy for most developers as in many cases it resulted in losses due to delays and fines, when they could not successfully close purchase conversations on time. In Gujarat for example, for some projects, a large part of the delay was due to the developers waiting till the last moment to place orders, in order to avail the maximum benefit of the falling module prices. Plans to construct plants at the last moment where thwarted by excessive monsoon rains in 2011. The situation was made worse by a shortage of labor two months before the commissioning deadline due to the festival season of Diwali.

Mitigation strategy

The easiest way to get all the permits and clearances in place is to set up a project in a government-backed solar park, where these are usually taken care of a priori. Since there is no comprehensive list of clearances required for projects being set up outside an official solar park, it is a developer's responsibility to work with different government offices to obtain all the necessary documents. Apart from working with the MNRE and the state renewable departments, developers also need to work with the following departments, to ensure that all the requirements are being met[23]:

1. District land and revenue department (Tehsil): All documentation related to land purchase, hold and lease related documentation is done by this district level department. Clearance for an approach road, allotment of government land and conversion of land for industrial use are also the responsibilities of the land and revenue department.
2. District advisory committee (Deputy Commissioner/Collector/ District Magistrate): A clearance may be required from the district collector confirming that the project would not have an adverse impact on its surroundings.
3. Planning department: The project will normally require prior approval from the relevant planning department of the municipal corporation at the town and district levels.
4. Archaeological department: Consultation and approval from the relevant archaeological department will confirm that the land acquired for the project is not of historical significance.
5. Fire safety authority: Consultation and approval from the relevant authority may be required with respect to fire safety requirements during construction and operation of the project.
6. Forest department: Consultation and approval from the relevant forest authority may be required to ensure that the land is not reserved by the forest department. As an example, the Mahagenco project in Maharashtra was delayed because of the forest department's claim on the land designated for the plant.
7. Pollution control board: Consent from the local pollution control board may be required with respect to wastewater management and noise emission control, particularly during the construction phase of the project.
8. Irrigation department: In addition to confirming that land is not subject to any relevant reservation, consultation with the irrigation department may ensure water availability during construction and operation.
9. Industrial development corporation: Early consultation with such authorities at the state level may yield indirect benefits to the project, depending on various initiatives taken up by local governments for industrial development. As an example, land conversion to industrial status

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[23] Reffered from the IFC Guidebook - Utility Scale Solar Power Plant

Specific approval for grid interconnection is required from the local substation of the state DISCOM. Approval may also be needed to access power from the grid during the construction phase.

Legal experts usually charge around ₹ 2,00,000 (€ 3,000/ $ 4,000) for services related to the facilitation of land acquisition.

may be cheaper for some locations where land has been earmarked for industrial development as compared to some other locations where the land is earmarked for agricultural use.

10. Local governing bodies (Panchayats): In some areas, a project may fall under the jurisdiction of governing bodies for small villages. Consultation with these local bodies is key to getting consent for the project from the local population. Their approval can facilitate work in the construction and operation phases.
11. State DISCOMS (local substation): Specific approval for grid interconnection is required from the local substation of the state DISCOM. Approval may also be needed to access power from the grid during the construction phase. This normally specifies and confirms the point and voltage level of connection. Electrical design inspection and approvals ensure safety on all electrical installations. The approvals are likely to be mandatory requirements of the public works department of the state in which the plant is built. These are required throughout the project execution life cyclefrom pre-construction to post-commissioning of the project.

To avoid legal hassles in land acquisition, a local legal expert should be hired who can ensure that all the paperwork is in order and that no issues can arise out of multiple ownership or land grab. Legal experts usually charge around ₹ 2,00,000 (€ 3,000/ $ 4,000) for services related to the facilitation of land acquisition.

Soil testing and all the necessary due diligence with regard to the availability of the interconnection point, grid capacity and grid availability should be done at the time of the site selection.

Most international EPC contractsconsist of penalties such as liquidated damages for delay and under performance. These penalties are usually expressed in terms of a percentage of the contract price.

However, EPC companies working at the prevalent rates in the Indian market would not be able to take on such liabilities. A developer should ensure that a maximum liability is accepted by the EPC contractor and that this is backed by a letter of credit (LoC) or at least a corporate guarantee in case of large EPC companies.

The EPC must manage the construction schedule efficiently so as to not cause any delays and the developer must ensure that equity disbursement is available as and when required for the timely completion of the project.

3. BORROWER'S VIEW – STRUCTURING DEBT FINANCE

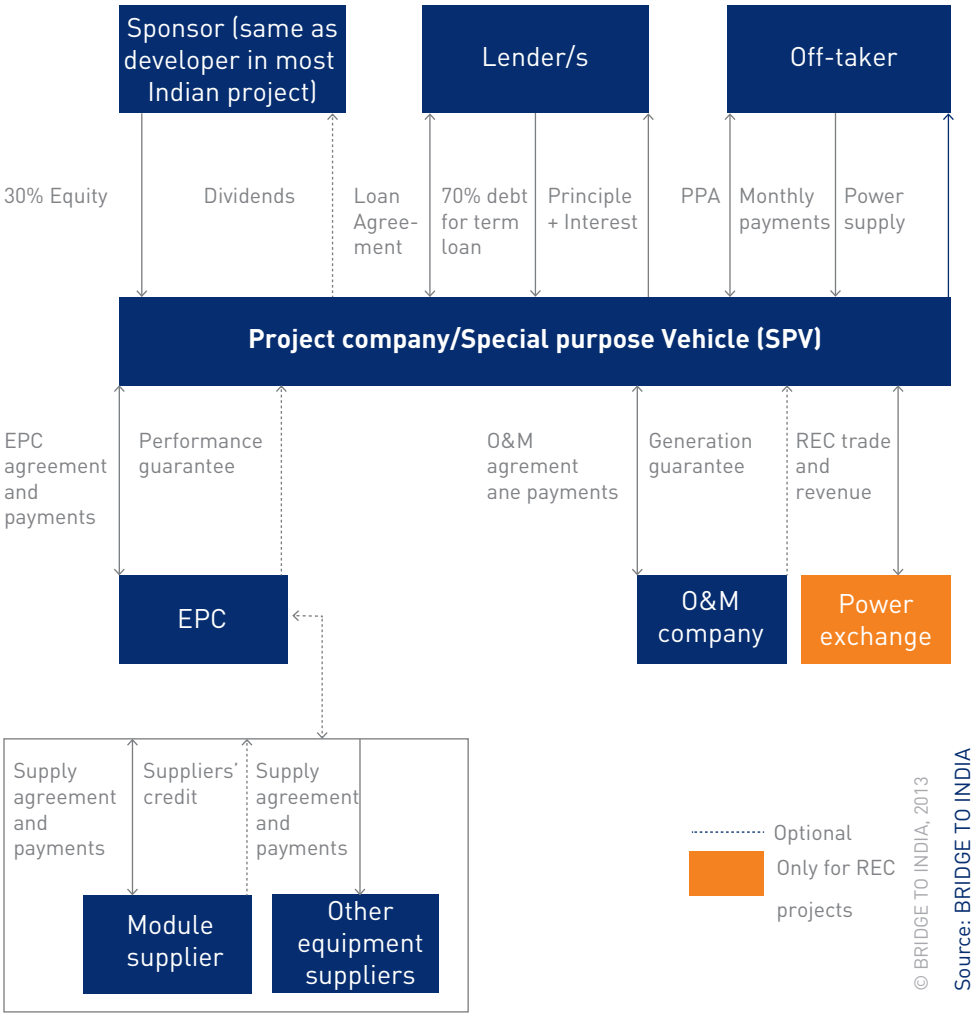
A special purpose vehicle (SPV) holds all of the project's funds, assets, contracts and obligations. Typically, the sponsor puts in 30-40% equity and the lender puts in 60-70% debt. All the cash-ins and cash-outs of the project are then managed from the SPV's cash reserve and revenue.

From the point of view of the project promoter looking for debt funding (the borrower), the challenge in India has so far been to obtain debt funding at all, and if so at reasonable terms(interest rate, moratorium, loan period, non-recourse, etc.). Also, debt had to be available in time to meet commissioning deadlines. This is often complicated by the time taken for a lender's due diligence.

3.1 A TYPICAL PROJECT FINANCING STRUCTURE IN INDIA

The project financing structure revolves around the creation of the project company. For all policy-based projects in India, this company needs to be set up under the Companies Act, 1956. It serves as a special purpose vehicle (SPV) that holds all of the project's funds, assets, contracts and obligations. Typically, the sponsor puts in 30-40% equity and the lender puts in 60-70% debt. All the cash-ins and cash-outs of the project are then managed from the SPV's cash reserve and revenue. The project cash flow needs to service construction and O&M cost, principal and debt repayment, debt service reserve account (DSRA)[24] and dividends to the sponsors.

Figure 3: Typical cash flows and contracts managed through the SPV



[24] The DSRA is usually funded up to a dynamic target balance. The target balance for the DSRA includes both the interest and principal repayment amounts. This might be set at three (3), six (6), nine (9) or twelve (12) months or may even be a fixed amount.

3.2 A TYPICAL PROJECT FINANCING TIMELINE

There are three pre-requisites for a project to be eligible for financing:

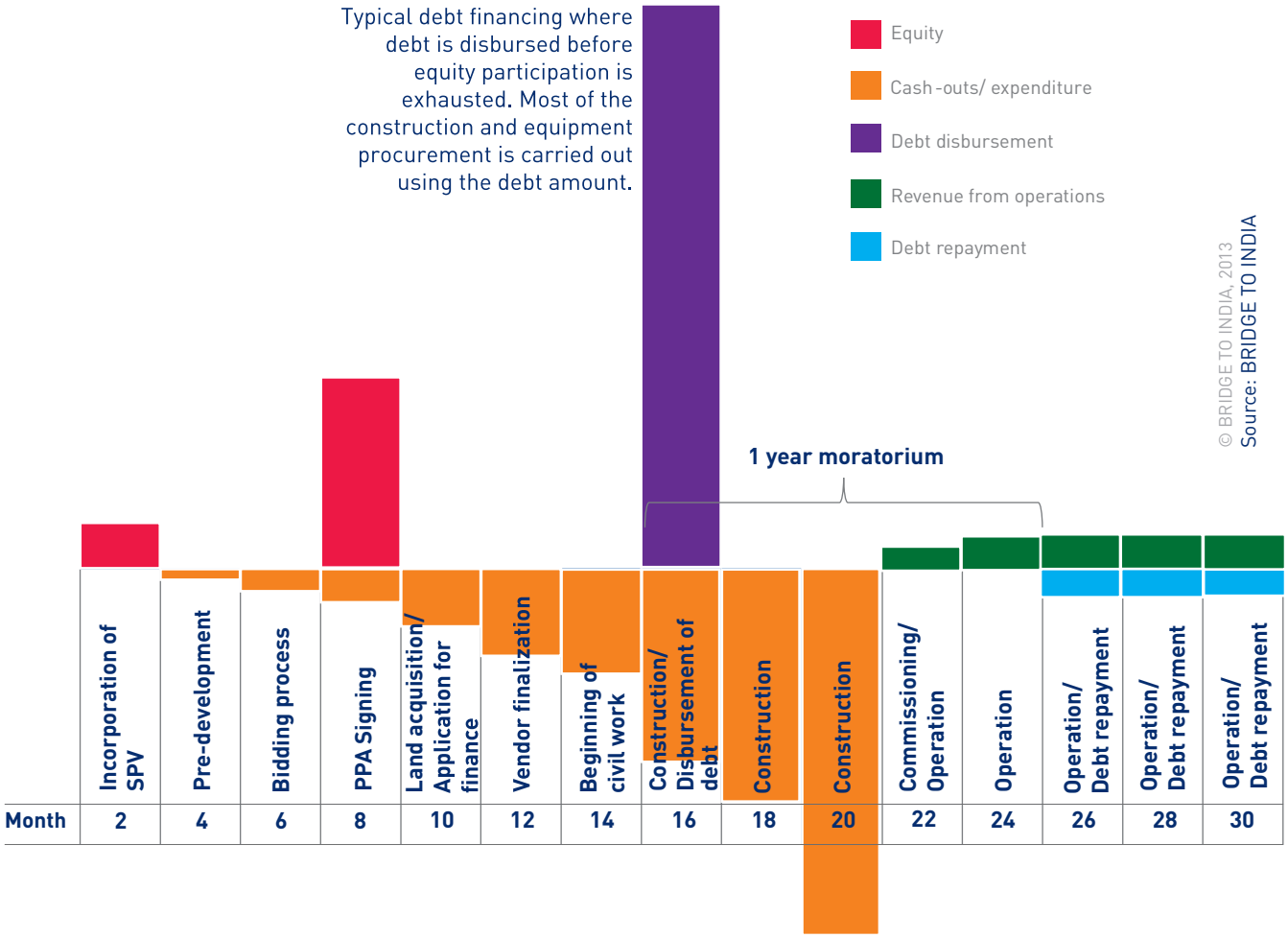
Other aspects, such as the finalization of the choice for modules, inverters and other BOS componentsand the mobilization of resources to begin the civil work at the site can run in parallel. This means that it usually takes at least five months from the signing of the PPA until the actual loan amount is disbursed to the project.

Pre-requisites for eligibility for financing of a project

Requirement	Timeline
PPA	For most projects under the policies, a pre-development and bidding process takes upto eight months. During this, developers need to discuss their projects with possible lenders to understand the interest rates that can be made available through a single source or a syndicated source (rupee loan, foreign currency loan or a combination). The interest rate will have a significant impact on the feed-in tariff that can be proposed.
Land[25]	A clear holding of land is necessary for the loan to be processed. Typically,it takes up to three months to get a free holding of the land. This can be faster if the land is in a solar park.
EPC letter of intent (LOI)	The EPC needs to have assessed the land and signed an LOI that will be submitted to the lender to begin the application process. During the course of the lending application process, the EPC will need to submit the final drawings and plans. This takes atleast another one month. The lender's counsel then scrutinizes all the documents, including the technical drawings and plans. This can take up to another one month.

Source: BRIDGE TO INDIA

Figure 4: Typical project cash flows on a timeline



Source: BRIDGE TO INDIA

[25] To read about land acquisition and prices, refer to BRIDGE TO INDIA's 'Project Development Handbook'

3.3 TYPES OF DEBT FINANCE

3.3.1 Project finance or non-recourse financing

Project finance is the long-term financing of solar projects, based on their projected cash flows rather than balance sheets of the project sponsors. Usually, a project financing structure involves a number of equity investors, known as sponsors, and a lender, a syndicate of lenders or other lending institutions that provide loans to the project. Non-recourse loans are securitized by the project assets and paid entirely from the cash flow, rather than from the general assets or creditworthiness of the project sponsors. The decision to finance is largely dependent on the risk assessment and expected cash flows of the project. Project lenders are given a right to dispose all the project assets to secure debt and are able to assume control of a project, if the project company cannot comply with the loan terms.

Most of this non-recourse financing has come from international sources of finance or investment advisory and fund syndication agencies like SBI Capital Markets.

Very few solar projects in India have been able to secure complete non-recourse financing. Most of this non-recourse financing has come from international sources of finance or investment advisory and fund syndication agencies like SBI Capital Markets.

Several solar projects in India have required refinancing as the deadlines for financial closure and project commissioning sometimes do not allow the developers to access the most suitable sources of finance.

3.3.2 Limited recourse financing

So far, lenders in India are not entirely comfortable with Indian solar projects, as there is little track record of the performance of projects in the country. Apart from other risks related to permitting, construction, operations, regulations, policies and off-takers, Indian banks, with little exposure to such projects, still consider them as a technology risk. To provide debt to such projects, lenders seek additional collateral apart from the project assets; the lender is further protected from default by the existence of a co-signer, which is typically the sponsor or the parent company with a healthy balance sheet. However, this puts the company balance sheets at risk and the burden of the project failing or under-performing falls on to the co-signer.

Almost all the projects in India so far have been developed using limited recourse financing. However, there are limitations with respect to the amount of exposure to solar projects a balance sheet can take. In addition, many promoters already have strongly leveraged balance sheets from expanding other business activities.

3.3.3 Refinancing

Refinancing takes place when a project has already received debt but decides, or needs, to replace existing debt arrangements with new ones. Several solar projects in India have required refinancing as the deadlines for financial closure and project commissioning sometimes do not allow the developers to access the most suitable sources of finance. Moreover, post construction the risk is considerably reduced, which can make better terms of loan available.

Refinancing a loan can have the following benefits:

1. To take advantage of a better interest rate.
2. To consolidate multiple loans into one loan.
3. To switch from recourse based debt to a non-recourse based debt.
4. To reduce the monthly repayment amount by increasing the term of loan.
5. To reduce or alter risk. E.g. switching from a variable-rate of interest loan to a fixed-rate of interest loan.

3.3.4 Construction finance

Mezzanine and/or bridge financing are types of short term debt financing that

Projects availing international financing typically require bridge financing as the disbursement of the debt amount can take as long as nine months in some cases.

At this early stage of the market, the typical project finance structure and the typical project finance timeline can in most cases not be followed.

are often vital to help keep projects on track with regards to timelines. They can help smaller developers solve liquidity issues. The available liquidity can be used to negotiate better terms of purchase. For example, a module supplier may be willing to quote a lower price if a large part of the payment is being made in advance. Bridge financing is especially relevant, if there is a shortage of liquidity for the procurement of components or construction and the lender providing the term loan is expected to take a long time to conclude the due diligence and/or disburse the complete amount of the project debt. Bridge financing from financial institutions is typically more expensive than a term loan.

Projects availing international financing typically require bridge financing as the disbursement of the debt amount can take as long as nine months in some cases. For Indian projects, this has mostly been available through suppliers' credit,backed by a letter of credit/bill of exchange or through short-term construction finance from a financing institution.

3.4 ROLE OF BRIDGE FINANCE/ CONSTRUCTION FINANCE

At this early stage of the market, the typical project finance structure and the typical project finance timeline can in most cases not be followed. Below are some possible reasons fora deviation.

1. Policy determined deadlines and timeframes are too short for successfully commissioning the allocated project.This may happen because of the following reasons:
   a. The policy allows for too little time. For example, the Tamil Nadu state policy allows for 10 months for commissioning as compared to 12 to 18 months for most other policies.
   b. The capacity allocated may be distributed over multiple locations. In such a situation, a developer may require more time to construct. The due diligence from the lender's end can also take longer. Some developers will face this problem in Tamil Nadu and Andhra Pradesh.
   c. A developer may be allocated a project capacity that is larger than what the developer may be able to commission in the provided timeframe. For example, a developer may have bid for multiple projects to increase the chances of allocation but may be allocated a capacity that is larger than planned and difficult to complete, given the resources available. There was no upper limit on capacity allocation in Tamil Nadu and there was an upper limit of 200 MW per developer in Andhra Pradesh.
2. There is a delay in land acquisition, EPC selection or vendor finalization that may lead to a delay in the final term loan disbursement.
3. Disbursement of the borrowing amount is scheduled to take longer than the typical disbursement. For example, foreign currency borrowing (FCB) in some cases can take up to nine months for disbursement as their due diligence period may be longer.
4. Excess liquidity is required to get better terms of purchase on plant equipment. For example, a module or inverter supplier may be willing to provide attractive purchase terms for an advance payment.
5. Better terms of debt with respect to interest rates can be achieved if the debt is disbursed after plant commissioning (as the risk of a commissioned project is significantly lower than a project under development or under construction).

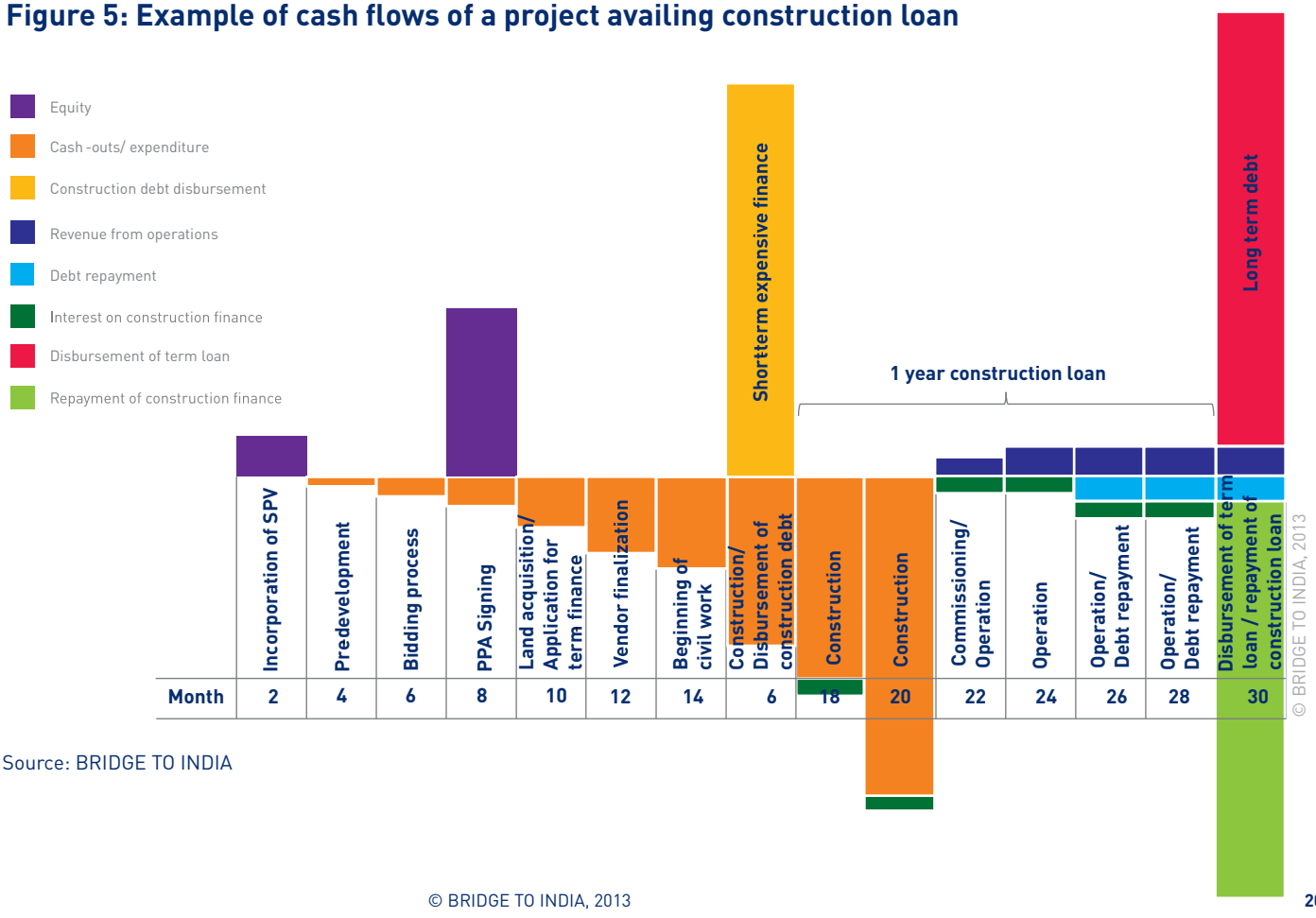
In all of the above cases, a source of short term funding is required before the disbursement of the term loan. Bridge financing for the construction

Supplier's credit is usually given by module manufacturers whose components are worth around 40% of the total project cost. As supplier's credit is treated as a short term debt, it is usually used to lower the upfront equity requirement of the project.

period has proved to be a key tool to keep a large number of Indian projects on track with regards to timelines. Construction finance can be of the following types:

1. **Equity** - A developer may put in equity to meet the requirement of funds.This is the quickest and easiest option. However, not all the developers have sufficient cash and even those who do, might prefer using a short-term debt instrument.
2. **Pre-financing by EPC companies** – Pre-financing by EPC companies is prevalent in Europe and the US, but has hardly been used in India. Even in these regions, construction finance is provided only by certain EPCs that are large in size and for certain customers where the risk is considered low. In India, it is extremely rare for an EPC to provide pre-financing for construction. This is primarily due to the low margins for EPCs in India.
3. **Bridge finance from a financial institution** – Bridge financing is usually available from most lenders at a higher interest rate. The differential is usually of about 100 basis points. Disbursement is much quicker. The developer needs to be in possession of land and a Letter Of Intent from the EPC companyto be considered for bridge financing by an institution. In such a situation, the EPC needs to take an additional risk of spending resources on design and planning, before they know that the project debt has been closed.
4. **Supplier's credit** – Supplier's credit is not a debt instrument but is used to ease the cash flow strains during the construction period. It is usually given by module manufacturers whose components are worth around 40% of the total project cost. As supplier's credit is treated as a short term debt, it is usually used to lower the upfront equity requirement of the project. Due to the oversupply of modules in the market, some form of suppliers'credit has been made

Figure 5: Example of cash flows of a project availing construction loan



Source: BRIDGE TO INDIA

available by almost all module suppliers in India. Such a credit is usually made available at interest rates of around 8%, backed by a letter of credit.

3.5 SOURCES OF DEBT FINANCE

There are various sources for debt finance available in the Indian solar market. They vary with respect to speed, cost (interest rate), lending criteria, risk perception and motivation. Finding the right source of debt financing is one of the key competitive advantages in an increasingly commoditized solar market.

3.5.1 Indian commercial banks

The majority of solar projects in India have been financed by Indian commercial banks. Some of the first banks to finance solar projects in India have been the Bank of Baroda, Axis Bank, ICICI Bank, State Bank of India, IDBI Bank and Yes Bank. Almost all of the disbursed loans in India so far have been backed by the promoters' balance sheets. Banks provide long-term project debt, which might be syndicated by combining multiple banks and/or other sources of finance. As discussed in detail in Chapter 2 of this report, Indian banks are still wary of financing solar projects on a non-recourse basis. However, after the successful financial closure of a number of projects under phase one of the NSM and projects under the Gujarat solar policy, the banks are garnering more confidence in the solar projects backed by preferential FiTs under a PPA structure. This is a reason for healthy skepticism amongst the lenders. But, a change in government policy through the introduction of VGF under the NSM might act as a set back for the banks that are becoming more confident. A concern is the excessive exposure of many Indian banks to the infrastructure sector at large.

Some of the first banks to finance solar projects in India have been the Bank of Baroda, Axis Bank, ICICI Bank, State Bank of India, IDBI Bank and Yes Bank.

3.5.2 Non-banking financial companies

Non-bank financial companies (NBFCs) are financial institutions that provide banking services without meeting the legal definition of a bank, i.e. they do not hold a banking license. There are more than 34,000 NBFCs operating in India but not all of themare willing to finance solar projects as their industry focus varies. Some of the prominent NBFCs that are open to financing solar projects include: L&T Infrastructure Finance Company (subsidiary of L&T Financing Holdings), Power Finance Corporation (PFC), Mahindra Finance, IDFC, IL&FS and SBI Capital Markets.

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The procedure, interest rates and expectations with regards to IRR and DSCR for NBFCs is similar to that of the Indian banks. The tenure of loans is usually longer - NBFCs focusing on

Financing details for Indian commercial banks

Prominent banks financing the sector	Interest rates	Debt-equity ratio	Loan tenure	DSCR expectation	Time-line
SBI, ICICI Bank, Axis Bank, Yes Bank, IDBI Bank	10.25% (RBI Base)[26] + 2.75 - 4.25% (Margin) =13-14.5%	30:70	9 – 12 years	Approx. 1.40	3 months

Source: BRIDGE TO INDIA

[26] The base rate is as of 25th January 2013 and subject to change. In most likelihood, the rates are to be revised downward from here.

IDFC holds an equity stake in a prominent developer, Green Infra, it has also been involved with at least 18 projects with a cumulative capacity of 100 MW.

Among Indian investment banks, SBI Capital Markets (SBICAPS) has been a prominent player in financing solar projects.

infrastructure offer loans for up to 15 years. The time until the disbursement of debt through some NBFCs tends to be shorter than those of the banks, as the scrutiny and disbursement procedure is more focused and streamlined for power projects.

NBFCs can be of the following types:

Infrastructure funds

Infrastructure funds are specialized NBFCs focusing on infrastructure investments. It is useful to categorize them separately as most of them are actively involved with solar investments in India. They often provide both equity and debt to companies for building their project pipelines. Among Indian infrastructure funds, IDFC has so far been the most prominent in the solar sector. While IDFC holds an equity stake in a prominent developer, Green Infra, it has also been involved with at least 18 projects with a cumulative capacity of 100 MW. Some of the developers that IDFC has assisted include Mahindra Solar, SunEdison, Kiran Energy, GMR Solar, AES Solar and Videocon Solar. Some other prominent infrastructure funds in India include SBI Macquarie, IL&FS and Taurus Infrastructure Fund.

Dedicated power sector financing

The Power Finance Corporation and Rural Electrification Corporation are the two leading public finance companies dedicated to India's power sector. Both are financing solar projects in India. PFC is India's largest state-run lender to electricity utilities. The company is also India's largest NBFC. PFC is known to have already provided debt of more than ₹ 2 billion (€ 300m/$ 400m) to different renewable energy projects and intends to further sanction around ₹ 1.5 billion (€ 230m/$ 300m). The company has also started a subsidiary, Power Finance Green Energy Ltd., in July 2012 to broaden its exposure to renewable energy projects. The subsidiary is expected to begin operations by March 2013 and plans to offer a discount of 50 basis points on interest rates to renewable projects.

Investment banks

Investment banks typically syndicate debt from multiple sources and make it available to the borrower under a single contract. Among Indian investment banks, SBI Capital Markets (SBICAPS) has been a prominent player in financing solar projects. In most instances, foreign banks that are not comfortable with lending to a developer directly may be open to lending to such Indian investment banks for a portfolio of similar projects. This debt is then passed on to the developers with a margin and a hedging charge. The actual lending to the developer takes place based on RBI guidelines. SBICAPS has been involved with the financing of projects developed by Tata Power Co., Kiran Energy, Sunborne, Alex Astral and Acme Tele Power. Other investment banks operating in India include the Bank of America, Barclays Capital, BNP Paribas, Lazard, Credit Suisse, etc.

Financing details for NBFCs

Prominent NBFCs financing the sector	Interest rates	Debt – equity ratio	Loan tenure	DSCR expecta-tion	Timeline
L&T Infrastructure Finance Company, PFC, SBICAPS, IL&FS Financial Services, Mahindra Finance	10.25% (RBI Base) or + 2.00% – 2.75% (Margin) =12.25-13.00%	30:70	9 – 15 years	Approx 1.35	2-3 months

Source: BRIDGE TO INDIA

3.5.3 Export Credit Agencies/Investment insurance agencies

The US EXIM bank has been the most active ECA in the Indian solar market. According to a statement in July 2012 by the bank, it has approved financing worth ₹ 16.5 billion (€ 250m/$ 330m).

An export credit agency (ECA) or investment insurance agency is usually a government-backed institution that supports exporters of a given country by reducing the cost of risk/debt associated with cross-border transactions. The financing can take the form of direct debt support and/or credit insurance and guarantees. A primary objective of ECAs is to further the exports (modules, inverters, EPC) from the host country for solar projects in India. Export credit agencies use three methods to provide funds to an importing entity:

1. Direct lending - This is the simplest structure, whereby the loan is conditional upon the purchase of goods or services from businesses in the country of the ECA.

and/or

2. Financial intermediary loans - The export–import bank lends funds to a financial intermediary, such as a commercial bank, that in turn loans the funds to the importing entity.

and/or

3. Interest rate equalization - A commercial lender provides a loan to the importing entity at below market interest rates, and in turn receives compensation from the export–import bank for the difference between the below-market rate and the commercial rate.

To qualify for US EXIM financing, the project developer must import modules and in some cases other equipment from the US.

The US EXIM bank has been the most active ECA in the Indian solar market. According to a statement in July 2012 by the bank, it has approved financing worth ₹ 16.5 billion (€ 250m/$ 330m). It is known to have approved financing for at least a 130 MW of solar PV and 100 MW of CSP in India. These projects belong to developers like Acme Telepower, Azure Power, Mahindra Solar, Reliance, Punj Lloyd, Tatith Solar Energy and Universal Solar Systems.

Despite being a popular option for finance, borrowing from the US EXIM bank poses certain limitations for projects. The total consideration of project cost for debt can only be a maximum of 30% over and above the cost of imports from the US. As this financing option is usually based on module imports and prices for modules account for only around 40% of the total project cost, the developer will need to club a US EXIM loan with another source of finance, thereby potentially increasing the cost of procuring debt. The timelines for financial closure for projects under different policies in India range from six to eight months. Typically, the US EXIM bank can take between six to nine months to process loan requests, straining developers' execution timelines.

Developers aiming for a US EXIM loan usually have to arrange for alternative bridge financing to carry on the procurement and construction work before the disbursement of the debt amount. The long processing time is attributed mostly to the lengthy legal, technical and financial due diligence undertaken by the bank. Further, the due diligence can increase transaction costs by as much as ₹ 45m (€ 0.7m/$ 0.9m).

US EXIM financing is a viable option only for projects that are larger than 10 MW. Such projects can bear the high transaction costs. Further, to qualify for US EXIM financing, the project developer must import modules and in some cases other equipment from the US. This is different from the terms and conditions of European banks, which would finance the project even if the manufacturing facility is outside the country as long as the majority shareholding company is from the lender country. US EXIM also requires the project developer to use a US-based cargo vessel for shipping, which can be expensive.

Financing details for Export Credit Agencies

Prominent banks financing the sector	Interest rates	Debt-equity ratio	Loan tenure	DSCR expectation	Timeline
US EXIM	0.7% (LIBOR[27]) + 3.5% (350-400 BIPS[28]) (Margin)+ 6.5% (Hedging) **= 10.7%**	Up to 80%based on value of imports	9 – 16 years	Approx. 1.45	5-6 months

Source: BRIDGE TO INDIA

JBIC has already extended a line of credit to ICICI bank to promote the financing of solar power in India and it is expected to start playing a more important role in the market in the future.

Considering a large number of Japanese module manufacturers looking to sell in India, the Japan Bank for International Cooperation (JBIC) is also looking to play a significant role in the market. JBIC has already extended a line of credit to ICICI bank to promote the financing of solar power in India and it is expected to start playing a more important role in the market in the future.

Other key export credit agencies/ export insurance agencies are: Euler Hermes Kreditversicherungs-AG (Germany), China Export & Credit Insurance Corporation (China), Nippon Export and Investment Insurance (Japan), Korea Trade Insurance Corporation (South Korea), Swiss Export Risk Insurance (Switzerland), Export Finance and Insurance Corporation (Australia), OesterreichischeKontrollbank AG (Austria), Export-Import Bank of Malaysia Berhad, (Malaysia), Export Development Canada (Canada), Hong Kong Export Credit Insurance Corporation (Hong Kong).

IFC has been actively involved in providing debt to solar projects and project development companies. It has done so for projects by developers such as Green Infra, Mahindra Solar, Azure Power and SunEdison India.

3.5.4 Development Finance Institutions

Development Funding Institutions (DFIs) are multilateral or unilateral funding agencies, which provide credit in the form of higher risk loans and loan guarantees in developing countries. DFIs have a mandate to provide finance to the private sector for investments that promote development and many DFIs actively provide financing for solar energy. DFIs sometimes use the same tools as ECAs to carry out their loan disbursement, i.e., through direct lending, financial intermediary loans and interest rate equalization. The main DFIs active in the Indian solar market are the Asian Development Bank (ADB), the International Finance Corporation (IFC), Overseas Private Investment Corporation (OPIC), Germany's KreditanstaltfuerWiederaufbau (KfW) and DEG andthe Indian Renewable Energy Development Agency (IREDA).

IFC, a member of the World Bank Group, is one of the most actively involved DFIs in India. Apart from providing advisory services to state governments and investing in companies at a corporate level, IFC has been actively involved in providing debt to solar projects and project development companies. It has done so for projects by developers such as Green Infra, Mahindra Solar, Azure Power and SunEdison India.

ADB is also actively involved in financing solar in India. It provides financing support under the India Solar Generation Guarantee Facility (ISGGF), under its Asia Solar Energy Initiative (ASEI) to promote the development of solar energy in developing member countries. Apart from providing debt as per ADB's LIBOR-based lending facility towards solar transmission infrastructure in Gujarat, ADB also considers direct financing and/ or guarantees for projects greater

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[27] London Inter Bank Offered Rate
[28] Base points 1/100

ADB aims to support 3 GW of solar power capacity in developing member countries by May 2013.

IREDA has received a ₹ 13 billion (€ 200m/ $ 260m) line of credit from KfW for a broad mandate of promoting renewable power in India but has not been particularly active in financing utility scale solar projects till date.

than 25 MW. Reliance Power's 100 MW CSP plant has been partially financed with both debt and equity participation by ADB. Under ISGGF, ADB provides partial credit guarantees (PCGs) available to local and foreign commercial banks that finance private sector solar power plants in the country. This guarantee covers up to 50% of the payment default risk on bank loans made to project developers. Currently, two commercial banks have been approved by ADB as eligible partner banks: L&T Infrastructure Finance Company Limited (India) and the NorddeutscheLandesbank (abbreviated Nord/LB, Germany). ADB aims to support 3 GW of solar power capacity in developing member countries by May 2013.

The Overseas Private Investment Corporation (OPIC) is the U.S. government's development finance institution. OPIC aims to support solar in India by providing investors with financing, guarantees, political risk insurance, and support for private equity investment funds. OPIC claims that it has committed ₹ 55 billion (€ 0.8 billion/$ 1.1 billion) to the renewables sector globally last year and nearly one-quarter of ithad been earmarked for India. However, it does not seem that a significant part of it has actually made it to India yet. OPIC is known to have been involved in financing of projects by Azure Power and Sun Edison in the country.

Germany's KfW and DEG are also looking at the Indian solar market. In their respective first deals, KfWis involved in lending to a 125 MW project by Mahagenco in Maharashtra and DEG has provided ₹ 680m (€ 11m/$ 13.6m) risk capital in the form of Compulsory Convertible Debentures (CCDs) to Azure Power.

The Indian Renewable Energy Development Agency (IREDA) is a development funding institution but operates as a NBFC under the administrative control of MNRE for providing term loans for renewable energy and energy efficiency projects. IREDA has received a ₹ 13 billion (€ 200m/$ 260m) line of credit from KfW for a broad mandate of promoting renewable power in India but has not been particularly active in financing utility scale solar projects till date. IREDA also provides loans to other banks at interest rates as low as 2-5% so as to incentivize them to finance renewable projects.

Other key DFIs include: Japan International Cooperation Agency (JICA), U.K Department for International Development Cooperation (DFID), Netherlands Development Finance Company (FMO), the European Bank for Reconstruction and Development (EBRD), the European Investmet Bank (EIB) and the Islamic Development Bank (IsDB).

Financing details for Development Finance Institutions

Prominent banks financing the sector	Interest rates	Debt-equity ratio	Loan tenure	DSCR expect-ation	Time-line
IFC, OPIC, ADB, DEG	**OPIC** 2.5% (US Treasury rate) + 2.5 -3% (Margin/ 200 BIPS) + 6.5% (Hedging) = 11.5-12%	25:75	9 – 16 years	Approx. 1.45	6-7 months
	Some other DFIs 0.7% (LIBOR[29]) + 3.5% (Margin - 350-400 BIPS[30]) + 6.5% (Hedging) = 10.7%				

Source: BRIDGE TO INDIA

[29] London Inter Bank Offered Rate
[30] Base points 1/100

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4. OTHER TOOLS FOR DEBT FINANCING

4.1 CURRENCY HEDGING

Difference in total interest paid per MW during the course of a 10 year loan due to 1% decrease in interest rate can be as large as ₹ 3.5m ($ 70,000/ € 54,000).

From a borrower's perspective, the key concern while looking for debt finance is the interest rate. Difference in total interest paid per MW during the course of a 10 year loan due to 1% decrease in interest rate can be as large as ₹ 3.5m ($ 70,000/€ 54,000). They can look at the lending sources in two broad categories: Rupee term loan (RTL) and external commercial borrowing (ECB). A rupee term loan will have a base rate as determined by the RBI and the margin charged by the lender. ECBs can have varying base rates as determined under LIBOR, EURIBOR, US Treasury or other country specific base rates. These are typically lower than the RTL interest rates.

In a bid to receive better terms of debt, many developers such as Azure Power, Acme Telepower, Green Infra, Punj Lloyd, Reliance, SunBorne and Sun Edison have opted for US dollar based loans from institutions such as EXIM, OPIC and IFC.

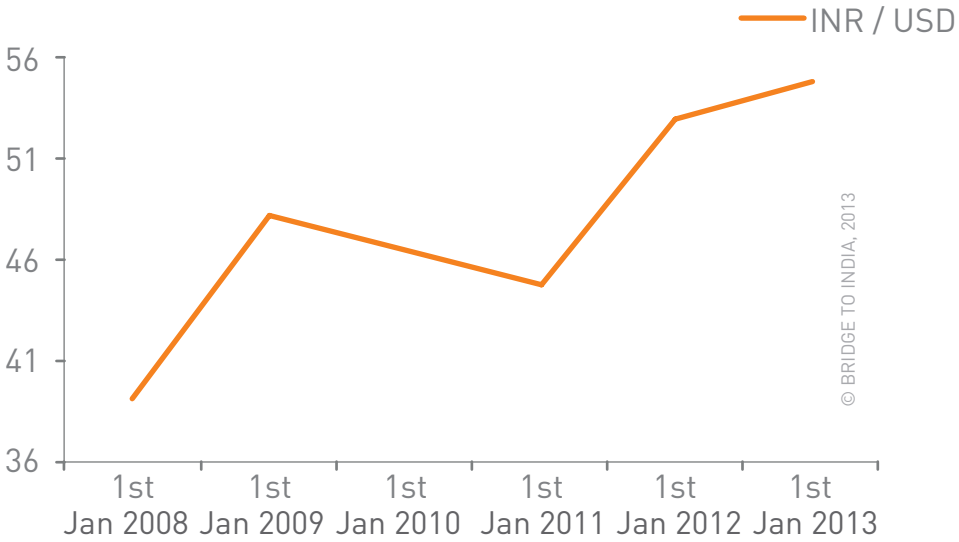
The revenue from the projects is in Indian rupees but the repayment for international borrowing would be in US dollars. For such borrowings, any fluctuation in the exchange rate of the Indian rupee to the US dollar can cause significant losses (or profit) to the developer. Factors like a high current account deficit in India, policy stagnation, low capital in-flows and strengthening of the US dollar in the wake of the Euro zone crisis have led to the depreciation of the Indian rupee by 24% since January 2011.

The slide of the rupee to record lows will have a negative impact on the balance sheets of the developers that have relied on un-hedged or partly hedged overseas borrowing for projects under batch one of phase one of the NSM and projects under phase one and two of the Gujarat Solar Policy. The principal and interest payments are to be made in the currency of the loan and the revenue is in the weakening Indian rupee. This nullifies the cost advantage they enjoyed through a lower cost of capital. Developers looking to avail finance in any international currency often hedge againstsuch currency risk. Most ECAs mandate a currency hedge for at least the first few years of the debt service term.

Most ECAs mandate a currency hedge for at least the first few years of the debt service term.

Hedging strategies might vary from player to player. Some developers have other business interests that are involved in the export of goods from India. Such developers can get

Figure 6- Five year valuation of the Indian rupee against the US dollar



Source: BRIDGE TO INDIA

Even most international financing sources would like to involve a local lender as a part of the lending agreement. In such a situation there is a need for debt syndication.

a natural hedge against currency fluctuations. However, based on industry interviews, we think that the exposure from ECBs should be either limited to around 40% or protected through hedging. Many developers have played to the rhetoric that the rupee is at its all-time low and fully hedging an ECB might not be the best strategy for them.But again, the 'all-time low' rhetoric was there since the rupee touched ₹ 50/$ and from there we have seen a further 10% downturn to ₹ 55/$.

4.2 DEBT SYNDICATION

In many cases, lenders are not willing to take on the complete risk of the project themselves. This is particularly true in case of non-recourse financing. Even most international financing sources would like to involve a local lender as a part of the lending agreement. In such a situation there is a need for debt syndication.
A debt is often broken down into several tranches (segments) of different loans. The aim of structuring the project's debt is to seek the optimum finance conditions for each of these tranches in the light of the requirements of the project. A syndicated loan is one that is provided by a group of lenders and is structured, arranged, and administered by one or several commercial banks or investment banks known as arrangers.

Typically, investment banks such as SBICAPS syndicate the loan from multiple sources and bring it together under one agreement. A significant number of projects in India are known to have opted for debt from a consortium of lenders. For example, at least ACME Telepower, SunBorne, Azure Power and Welspun are known to have opted for project debt from a consortium of lenders.

5. FINANCING DOCUMENTATION

For a developer, it is important to understand the process and documentation requirements of a lender.

Corporate finance applications typically are ~100 pages, whereas project finance applications can reach 200-300 pages.

Typical required information about the borrower includes:

1. Description of the borrower and related or commonly-owned companies (with financial information)
2. Qualifications of the buyer with respect to the PV or energy sector
3. Three years of audited financial statements of the promoting company
4. A recent credit report
5. A recent creditor bank reference
6. Available debt ratings

Typical terms for balance-sheet backed financing are:

Note: These terms are for the borrower and related or commonly-owned companies

1. Three years of audited financial statements
2. Positive operating profit over last two years
3. Positive net income over last two years
4. Positive cash flow from operations (latest year)
5. EBITDA/DSCR- greater than 150%
6. Total liabilities/total net worth - less than 175%
7. Bank exposure/total net worth - less than 40%

Project plans should include:

1. PPA documentation
2. Permitting and regulatory approval list with status of each
3. Engineering, Procurement and Construction (EPC) plan
4. Interconnection/evacuation plan
5. Operation and maintenance (O&M) plan
6. Project financing plan
7. Detailed list of estimated project costs including soft costs
8. Pro-forma financial model with projected annual financial statements for term of debt
9. Currency risk abatement plan
10. Project schedule

Typical project details required:

1. PPA contract
2. Detailed technical designs
3. Detailed technical feasibility studies (related to design of project)
4. EPC contract
5. Description of EPC's experience with this type of project
6. Evidence of compliance with quality and safety standards
7. Environmental assessment/study, if needed
8. Environmental management plans for construction and operation, if needed
9. O&M contract
10. Description of O&M provider's experience with this type of project
11. Land-control documentation (e.g. land-lease contract)
12. Interconnection/evacuation contract
13. Acquisition list
14. Supply contracts for all significant components
15. Shareholder agreement for the SPV, if applicable
16. Draft with status or final copies of all other contracts, permits, licenses and approvals related to the project.

6. OUTLOOK

The availability of debt finance for solar projects has improved over the past two years. For projects under phase two of the NSM and in Andhra Pradesh, debt finance is expected to be more readily available than before. However, it is expected that developers will continue to face issues in securing finance for projects in Tamil Nadu and Rajasthan primarily due to the poor long term payment security in the states. In the short to medium term, debt is likely to be mostly recourse based.

Developers in India have relied on various forms of bridge financing structures to solve their liquidity issues. This is expected to continue in the short term. In the medium term, developers are expected to seek more diverse options, especially outside India, for financing their projects. As the lenders do not necessarily prefer complicated financing structures, the trend for bridge financing is expected to reverse in the long term. The deadlines for project commissioning are expected to become more uniform and the execution timeline is expected to reduce due to a streamlining of project development processes. This will make financial structuring for debt much simpler.

Many projects in India have been constructed below the required standards because of the lack of experience at the developers' end, short and stiff deadlines and an extremely price competitive landscape. Some lenders who have lent to projects so far might have to bear the brunt of payment defaults as some such projects could fail.

Developers in India realize that they cannot continue to accumulate recourse based debt to grow their project portfolios. The developers that do not have an Indian parent company and cannot leverage assets and balance sheets to accumulate debt should look to find alternative means to access non-recourse finance to achieve their planned portfolio growth. In the short to medium term, lenders will continue to be wary of providing non-recourse debt to solar projects. However, project development companies such as Azure Power, Mahindra Solar, SunBorne, Sun Edison and Astonfield among others have already managed to arrange non-recourse finance from international and in some cases even Indian lenders. Going forward, only developers that continue to be able to access non-recourse debt financing will be able to grow.

7. GUEST ARTICLE

GeoModel SOLAR

GeoModel Solar is the developer and operator of the SolarGIS database. We help our clients reduce uncertainty in solar energy investments by delivering bankable solar resource data and reports required in planning, financing and operation of solar power plants. Our company brings 13 years of experience in solar energy, and has delivered bankable assessment of solar resource and PV electricity yield for more than 260 projects in 5 continents. In 2011, by introducing SolarGIS in India we achieved an important milestone towards reducing uncertainty of solar resource estimates in India.

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7.1 WHAT MAKES A SOLAR RESOURCE ESTIMATE BANKABLE?

The last 2 years in the Indian solar industry have been a learning phase. One of the lessons learned has been the importance of having a bankable solar resource assessment. Below we describe the best practices to follow in order to ensure that banks do not have doubts about solar resource potential at a project site.

Long time record (minimum 10 years): Variation in global radiation in India can be as high as 10% from year to year. Only 1-2 years of ground measurements are not enough for proper climate characterization. The general rule is to use solar radiation data that covers continuously a period of at least 10 years. The most important for India are the recent years, as increasing air pollution in the last two decades has likely affected solar resource. SolarGIS data is available for any location in India for a period of more than 14 years (1999 until today).

High spatial and temporal resolution: Detailed data is required to accurately represent local climatic features. The industry standard is to use data with level of spatial detail 4 km x 4km or better. SolarGIS data represents a spatial resolution of 250 m x 250 m and 30-minute measurement frequency.

Many consultants still use monthly data or synthetic hourly data for PV energy simulation. However, to obtain a bankable estimate of energy potential, hourly (or more detailed) time series data is required. Use of hourly TMY (Typical Meteorological Year) data is also acceptable provided inter-annual variability is calculated from a multi-year time series dataset.

Low uncertainty proven by validation: It is important that the data source is proven to be accurate by independent experts. Many data providers claim to offer solar data with low uncertainty. However, SolarGIS is the only data source that has been independently validated with high-quality ground measurements from India that are available in public domain (from C-WET). Other international data comparison studies also position SolarGIS as the most accurate database on the market.

Use of ground-measured data: Recent improvements in satellite-derived data brought about by us have made the use of ground-measured data irrelevant for small PV projects (size approx. < 5 MW). For large projects it can be useful to have 12+ months of local measurements to reduce uncertainty by 1-3%. However, if ground measurements are used, it must be quality controlled by an expert to ensure that there are no errors in the data. In India, where there is high air pollution, ground sensors must be cleaned optimally every day in order to obtain a reliable verification dataset.

Continuity of data: SolarGIS database is updated every day, thus the recent data can be used for evaluation of a PV project performance after 1 or 2 years of operation. Advantage is that the same source of solar data can be used for longterm prediction and later for verification of the actual power production.

7.2 BANKABILITY OF SOLAR PROJECTS – THE NEED TO LOOK BEYOND FINANCIAL METRICS

Over the last 10 years, since the German market opened the doors for FiT based investments for photovoltaic projects, many interesting variants have been globally adopted. Some of the models like capital subsidies for identified projects in the UK were not very successful and some FiT models without any upper limit on capacities, such as the one adopted in Spain led to runaway installations which in the end resulted in curtailment of the market.

Learning from history, the FiT driven investment opportunities that India framed as part of phase one of the NSM was successful in preventing uncontrolled capacity addition, limited exchequer burden and rationalized project return on investment through bidding, still providing enough impetus for the PV industry to gain a foothold in India and grow.

Taking a cue from the NSM phase 1, various state governments have also launched their own solar policies, albeit with certain variants in the modus operandi of licensing and awarding project development rights, with mixed success rates evidenced.

Two years down the road, since the inception of grid connect solar support programs and 1.2 GW later, one can look at the success of the NSM as the full half of the glass. The other half can be considered as the projects conceived which could not take off owing to lack of financing or were commissioned but are underperforming owing to quality, engineering, construction or choice of materials issues.

The need of the hour is hence to look at function over mere form. To look at the quality of the performance of solar plants and bring in certain measures to ensure that project financing and investments are linked to ensuring that the asset performs to its peak capacity throughout its life.

Bankability of solar projects in certain mature solar markets like Europe are linked not just to project IRR, DCSR and financial risks but also to product and engineering quality of the asset. Interest rate and terms of financing vary based on the assessed "quality" of the asset build. The need of the hour in Indian solar business is also to bring in similar metrics of assessing project financing viability.

Owing to the diverse spread of equity financers and related expectations, one of the practical ways of ensuring project asset and build quality is to link this to debt financing.

- As part of the assessment of project debt financing, in addition to traditional risk and reward assessment, the following needs to be considered as additional "quality" metrics linked to project bankability and terms of debt financing
- Technology selection, its field performance and longevity of usage
- Design methodology and processes adopted, benchmarked against upcoming standards
- Major components used and its 'bankability' from past experience and actual field performance
- Contractor track record for projects installed; actual performance of these projects versus committed ones
- A standardized methodology for Performance Ratio or uptime guarantees

If bankability of products, project build and design is considered as a metric in debt financing assessments going forward, the solar installations in our sunny but energy starved nation will continue to bask in the glory of their performance for decades to come.

We can then truly have the cake and can eat it too.

8. ANNEXURE

GLOSSARY OF TERMS

ASEI - Asia Solar Energy Initiative

ADB - Asian Development Bank

ARC - Asset Recovery Company

BOS - Balance of System

BOOT - Build Operate Own Transfer

CdTe - Cadmium Telluride

CUF - Capacity Utilization Factor

C-WET - Center for Wind Energy Technology

CCD - Compulsory Convertible Debentures

CSP - Concentrated Solar Power

CIGS - Copper Indium Gallium Selenide

c-Si - Crystalline Silicon

DRT - Debt Recovery Tribunals

DSCR - Debt Service Coverage Ratio

DSRA - Debt Service Reserve Account

DFI - Development Funding Institution

DNI - Direct Normal Irradiation

EBITDA - Earnings Before Interest, Taxes, Depreciation, and Amortization

EPC - Engineering, Procurement and Construction

EBRD - European Bank for Reconstruction and Development

EIB - European Investment Bank

ECA - Export Credit Agency

ECB - External Commercial Borrowing

FiT - Feed-in Tariff

FCB - Foreign Currency Borrowing

GUVNL - Gujarat Urja Vikas Nigam Limited

ISGGF - India Solar Generation Guarantee Facility

IREDA - Indian Renewable Energy Development Agency

IDFC - Infrastructure Development Finance Company

IL&FS - Infrastructure Leasing and Financial Services Limited

IRR - Internal Rate of Return

IEC - International Electrotechnical Commission

IFC - International Finance Corporation

IsDB - Islamic Development Bank

JBIC - Japan Bank for International Cooperation

JICA - Japan International Cooperation Agency

KfW - Kreditanstalt fuer Wiederaufbau

L&T - Larsen and Toubro

LoC - Letter of Credit

LOI - Letter of Intent

MCA - Ministry of Corporate Affairs

MNRE - Ministry of New and Renewable Energy

NASA-SSE - National Aeronautics and Space Administration - Surface Meteorology and Solar Energy

NSM - National Solar Mission

NBFC - Non-banking Financial Company

Nord/LB - Norddeutsche Landesbank

NVVN - NTPC Vidyut Vyapar Nigam

O&M - Operations and Maintenance

OPIC - Overseas Private Investment Corporation

PR - Performance Ratio

PFC - Power Finance Corporation

PPA - Power Purchasing agreement

REC - Renewable Energy Certificate

RPO - Renewable Purchase Obligation

RTL - Rupee Term Loan

SPO - Solar Purchase Obligation

SRRA - Solar Radiation Resource Assessment

SPV - Special Purpose Vehicle

SBI - State Bank of India

SBICAPS - State Bank of India Capital Markets

DISCOMS - State Distribution companies

SEB - State Electricity boards

SERC - State Electricity Regulatory Commission

TANDEGCO - Tamil Nadu Generation and Distribution Corporation

US EXIM Bank - The Export-Import Bank of United States

DFID - U.K Department for International Development Cooperation

VGF - Viability Gap Funding

WRDC - World Radiation Data Centre

BRIDGE TO INDIA

HOW BRIDGE TO INDIA CAN SUPPORT YOU

BRIDGE TO INDIA provides services along the project development value chain. Our approach to project development is to make projects 'profitable' and 'bankable'.

Our unique combination of adapting an international quality and local-knowledge makes us the right partners for executing your solar projects.

Source: BRIDGE TO INDIA

IDENTIFICATION	DEVELOPMENT	CONSTRUCTION & OPERATION
Site identification & assessment	Project registration	Site supervision
Techno-commercial feasibility studies	Bid strategy preparation	Quality management
Detailed Project Report (DPR) preparation	Land securitization	Stakeholder management
	Power Purchase Agreement (PPA) facilitation	Cost controlling and reporting
	Management of permits and approvals	
	Renewable Energy Certificates (REC) consulting	
	Technology evaluation & selection	
	EPC tendering and selection	
	Project structuring and documentation	

If you would like to discuss our project development services, please contact:

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MORE THAN

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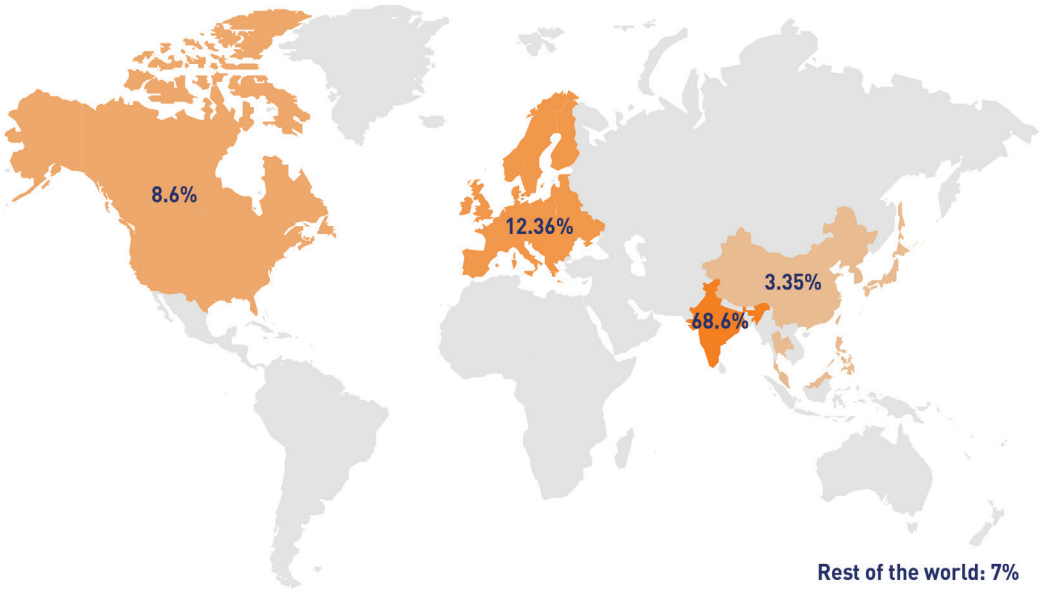

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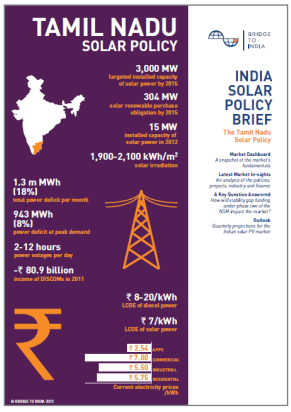

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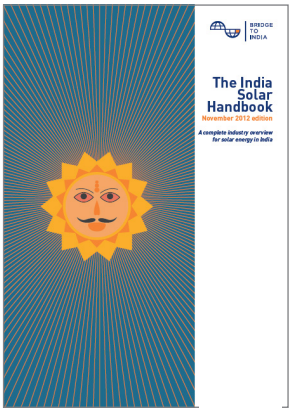

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