FINANCING INDIA'S 100 GW SOLAR TARGET

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Executive Summary

India has revised its solar targets under the National Solar Mission (NSM) from 20 GW by 2022 to 100 GW over the same period. This report looks at the financing implications of that target.

The total capital required to fund the 100 GW target is estimated to be around INR 550,000 cr. (USD 85 bn.)[1]. Out of which the equity component is estimated to be INR 165,000 cr. (USD 25 bn.) and the total debt requirement is INR 385,000 cr. (USD 60 bn.).

There are three aspects to financing this target – **equity, debt** and **Power Purchase Agreements** (PPAs). The inability of India's power utilities to purchase 'expensive' solar power is the weakest link in the financing chain.

There isn't a dearth for **equity**. Several prominent developers have committed to capacities far exceeding the government's goals at the Government's flagship Renewable Energy Investment Summit (REInvest) that took place in February 2015. The cumulative interest for developing solar energy projects in India exceeds 171 GW.

Raising **debt** remains a moderate challenge. Publically and privately owned Indian banks committed to finance around 70 GW of renewable energy projects at REInvest. Meanwhile, the participation of foreign banks in the Indian solar sector has been limited and 85% of all loans raised so far have come from Indian banks.

Most importantly, a majority of Indian banks have already reached limits to lend to power projects as prescribed by the Reserve Bank of India (RBI). Most of these projects are thermal projects that are in the red due to unavailability of domestic coal and steep hike in cost of imported coal.

There is a significant build-up on Non Performing Assets (NPA) on the bank's books from other conventional power projects. Power projects form nearly 16% of all stressed assets in the banking sector. This severely

[1] An exchange rate of 1 USD = 65 INR has been assumed throughout this report

restricts the banks' ability to issue fresh loans to solar power projects. A couple of initiatives by the Reserve Bank of India such as classifying renewable energy as a priority lending sector and introducing interest rate subvention can alleviate some of these problems – but cannot fundamentally change the root cause.

Meanwhile, YES Bank has announced green bonds in an attempt to raise public money to fund renewable energy projects. These bonds have been received extremely well and been over subscribed by 7.2 times. Despite this, there are genuine concerns on the availability of debt, especially non-recourse debt.

The major challenge though, is presented by the poor financial health of the country's publically owned distribution companies (DISCOMs). The ability of the DISCOMs to fund the purchase of 'expensive' solar power remains the **single biggest challenge for the success of India's solar program**. This report estimates that a total subsidy of INR 10,000 cr. (USD 1.5 bn.) is required to bridge the viability gap in order to fund the purchase of the 'expensive' solar power.

The poor financial health of these companies can be attributed to the copious amount of subsidies disbursed to the agricultural sector, lack of stringent metering of energy and monopoly due to state patronage. The ideal solution is to end the monopoly of the state DISCOMs, which would result in rational power tariffs and improve the financial health of these companies. However, this is also the most unlikely solution due to the political nature of farmer power subsidies. The easier interim solution would be for an intermediary agency like the Solar Energy Corporation of India (SECI) or a Central Public Sector Unit (CPSU) like the NTPC Vidyut Vikas Nigam (NVVN) to act as a power trader and repackage power to pass it on to DISCOMs. This would protect the interests of the investors and make the PPAs far more bankable. A long-term solution could be to use using direct cash transfers to disburse power subsidies. This will prevent state DISCOMs from taking these financial losses on their accounting books.

So far the only budget allocation that can help finance the purchase of expensive solar power is the National Clean Energy Fund (NCEF), which has a corpus of 16,388 crore

(USD 2.73 bn)[2]. The NCEF is funded by a cess on coal mined in India. Although the government has doubled the coal cess from INR 100 per tonne to 200 per tonne in the FY 2015-16 budget, this may not be adequate since the NCEF is not solar specific; it would have to fund other clean energy and environment programs in the country.

Considering the rising Average Pooled Purchase Cost (APPC) for DISCOMs and the rapidly falling solar prices in the Indian market, utility scale solar could reach grid parity as early as 2018-19. This could be the saving grace and reduce the need for subsidies and cushion the impact on DISCOMs.

I trust that this report helps initiate a data driven dialogue between policy makers, bankers, developers and interested stakeholders as India calibrates its path towards the 100 GW solar goal.

Akhilesh Magal

[2] Ministry of New and Renewable Energy. 'National Clean Energy Fund'. 06th August 2015. http://bit.ly/1fJELy0

Tough Targets

India's 100 GW solar target is unprecedented. In the next seven years, India will have to annually add roughly 15 GW to achieve the target. In contrast, India has historically added less than 1 GW a year (figure 1).

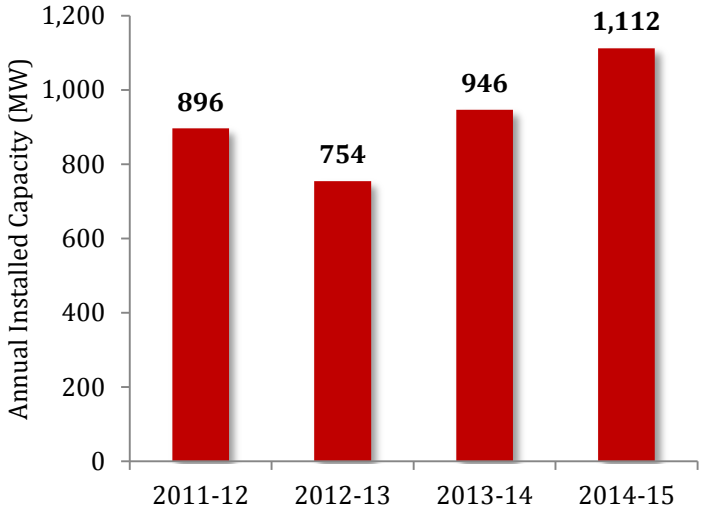


Figure 1: Year on year capacity addition of solar PV in India[3]

This is a 15-fold increase. No other country has ever attempted such a massive scale up of solar capacity. China, in comparison, has set itself a target of adding 15 GW every year[4].

The target is split in two ways,

a) 40 GW of rooftop solar projects
b) 60 GW of ground mounted utility scale projects

[3] Data from MNRE
[4] Global Data. 'China Will Lead Global Solar Installations by Adding 17.6 Gigawatts in 2015'. 09 June 2015. http://bit.ly/1NHovfS

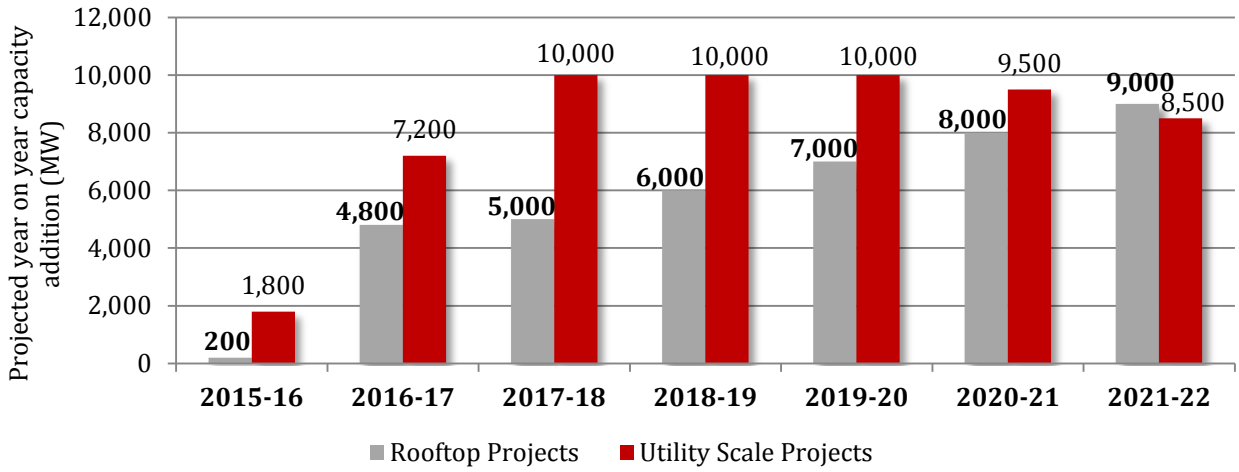
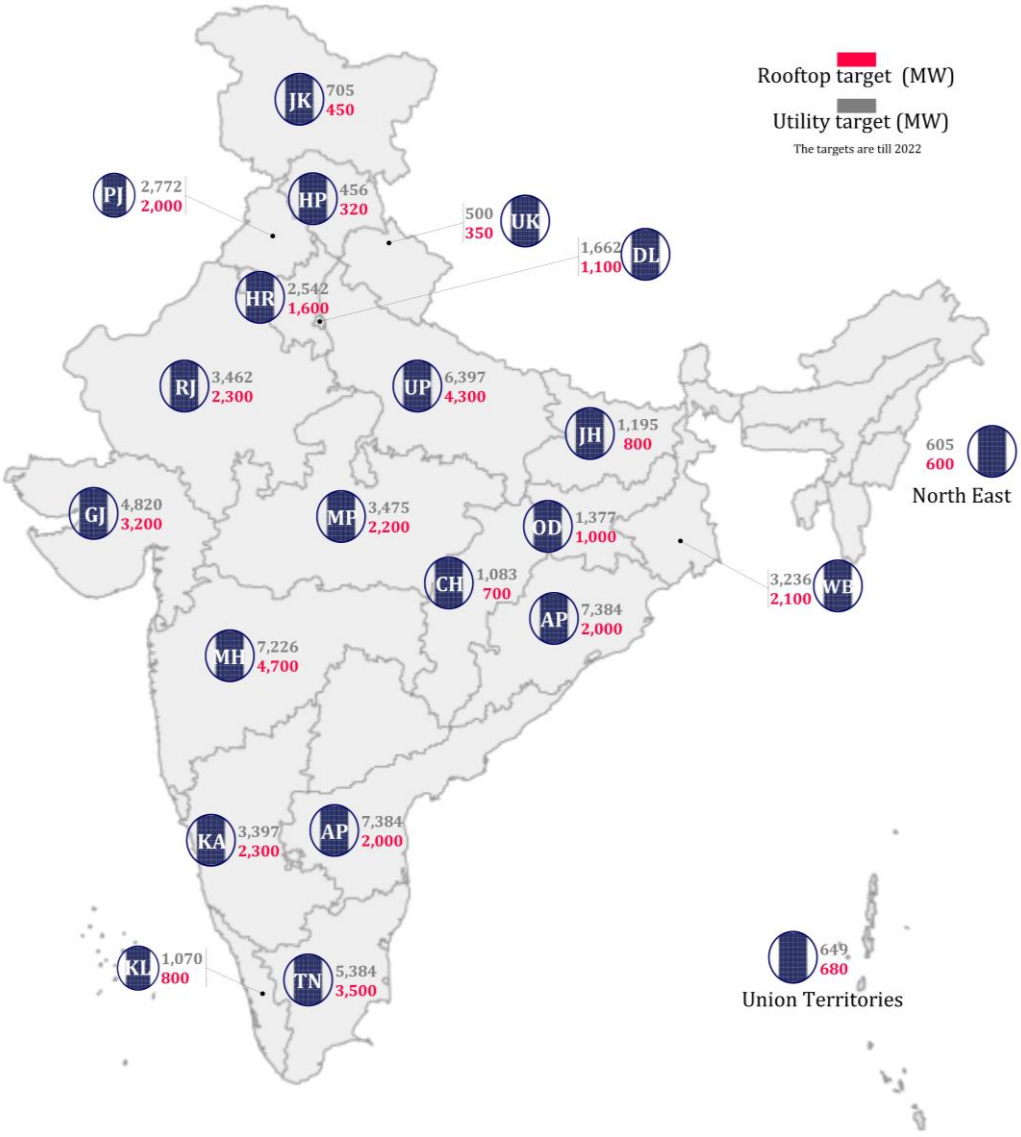


Figure 2: Projected year on year capacity addition – utility scale and rooftop scale[5]

Although utility scale projects make up a large part of this target, it is planned that rooftop projects shall exceed utility projects by 2022 (figure 2). This makes sense, as the impact of centralized solar projects on the grid would be harder to manage once the penetration of solar PV on the grid increases[6].

What is less clear is the split up of these targets across different schemes announced by the government. The Government has already apportioned the 100 GW target to different states (see MAP below)

[5] Data from MNRE.
[6] Akhilesh Magal, Tobias Engelmeier, George Mathew, Ashwin Gambhir, Shantanu Dixit, Anil Kulkarni, B.G.Fernandes, Ranjit Deshmukh. 'Grid Integration of Distributed Solar Photovoltaics (PV) in India'. July 2014. http://bit.ly/1L2bagp



Rooftop Solar Projects

The MNRE has allocated the target of 40 GW according to the state's Renewable Purchase Obligation (RPO).

Targets bring clarity to the investor community, provided they are realizable. For instance, Uttar Pradesh has been assigned a target of 4,300 MW. Given UP's power deficit, high theft and lower per capita income, it is highly unlikely that these targets would be met. Targets should rather be a reflection on the drivers for rooftop solar. The primary reason why consumers would want to shift to solar is to save on their electricity bills. Consequently, the states with the highest tariffs must be the best markets. Rooftop solar should make sense is

states such as Maharashtra, Delhi, Tamil Nadu and Karnataka[7].

Utility Scale Projects

The 60 GW target under utility scale projects are split as follows.

Utility Scale Projects (all figures in MW)					
Ongoing programs and past achievements	SECI	State allocations	PSU	Farmer and unemployed youth scheme	Private IPP
10,000	5000	20,000	10,000	10,000	5,000
60,000 MW					

Table 1: Revised targets of 60 GW under the National Solar Mission (NSM)[8]

There are a few key observations on these targets:

- Private companies' can participate in a total of 30 GW of projects i.e. half the planned capacity. This is under - NSM Phase II Batch II & III (5,000 MW), Private IPP (5,000 MW) and under state allocations (20,000 MW) i.e. a total of 30,000 MW. Going by the investment commitments made during MNRE's flagship conference, REInvest, private companies are willing to do much more. Out of the total solar commitment of 171 GW, 90% is from private developers and only about 20 GW from publically owned companies of India[9].
- A majority of this target is allocated to states. This means that the onus would be on India's state distribution companies to purchase solar power. Unless backed by the Central Government, given the poor financial health of these DISCOMs, these projects could be non-starters – or would not attract

[7] BRIDGE TO INDIA. India Solar Handbook June 2015. Page 18. http://bit.ly/1L2c78q
[8] Government of India. Ministry of New and Renewable Energy. New Solar Power Policy. http://bit.ly/1inq9qd
[9] These commitments were made during the **RE-Invest, 2nd Renewable Energy Global Investors Meet & Expo** conference held in New Delhi, India between 18th – 20th February 2015. The complete list of commitments can be found here: http://bit.ly/1EurZ2i

serious players. As a consequence quality of the plants may suffer.

- The farmer and unemployed scheme, while good in spirit, may be a channel for unscrupulous people masquerading as farmers to 'grab' projects. Certifying unemployed youth and farmers can be very difficult and leaves room for corruption.
- Overall, there is very little clarity on how these different schemes fit with the overall targets that have been assigned to states (table 1). The funding mechanisms (who funds the state targets?) are also unclear.

Ample Equity

The total investment required to meet the 100 GW target is estimated at INR 550,000 cr. (USD 85 bn.). Accordingly, the equity requirement between now and 2022 is estimated at 1.6 lakh Cr. (USD 25 bn).

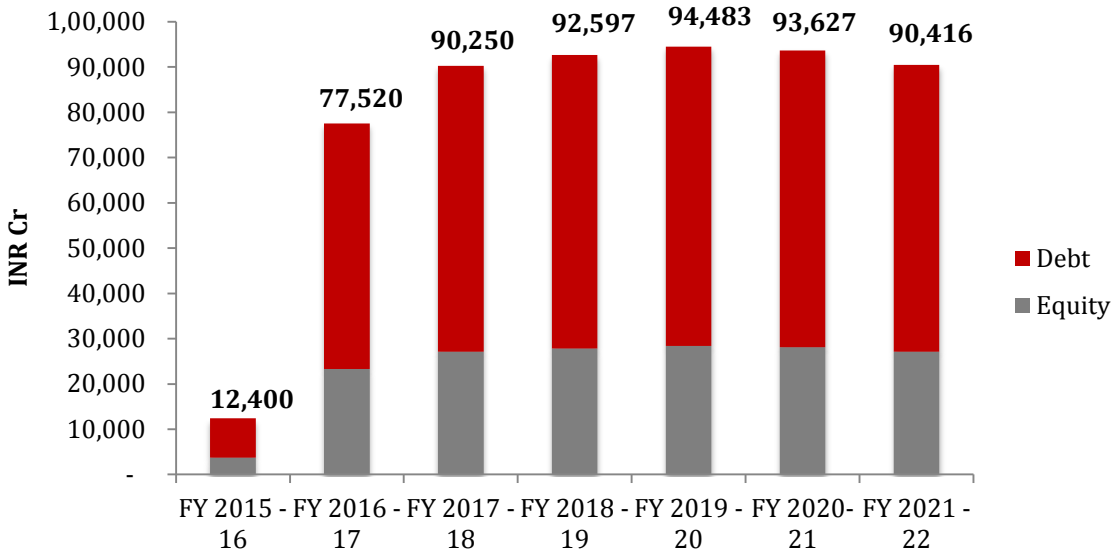


Figure 3: Total debt and equity required to support the 100 GW target

The key assumptions in arriving at the number are:

Debt : Equity ratio	Unit	70:30
Cost of rooftop scale system (2015)	INR/kW	80,000
Cost of utility scale system (2015)	INR Cr./MW	6
Annual decline of capital cost	%	5

Table 2: Assumptions for capital requirement

The key question here is that, **"Is there adequate equity to fund these projects?"**

Going by the current investment climate in India, the appetite for equity investment in solar energy projects is much higher than 100 GW. Private and public companies made an overall investment commitment of 271 GW. 80% of these commitments (171 GW) were towards

solar PV projects[10]. This goes to show that equity should not be a constraint in India meeting the 100 GW goal.

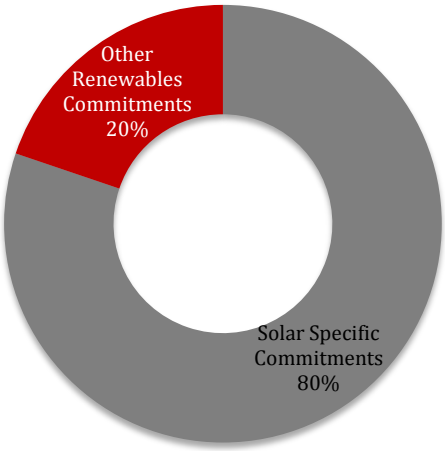


Figure 4: Split of the 271 GW investment commitments made during RE-Invest 2015

The Government should apportion a greater part of the 60 GW target to private company participation in order to harness both foreign and domestic equity.

[10] These commitments were made during the **RE-Invest, 2nd Renewable Energy Global Investors Meet & Expo** conference held in New Delhi, India between 18th – 20th February 2015. The complete list of commitments can be found here: http://bit.ly/1EurZ2i

Deficient Debt

The total debt required is estimated at INR 385,000 cr. (USD 60 bn.) (see figure 1). Private and public lenders in India have committed to finance 70 GW worth of renewable energy projects. A large portion of this is likely to be taken up by solar and wind energy projects. Further, these commitments may not translate to actual advances to projects, which is a function of the promoters financial capability and the strength of the PPA.

The Indian market has seen most of the solar PV projects being funded by debt raised from Indian banks. The participation of foreign banks has remained limited (some estimates suggest 15% of all projects commissioned in India). Despite the loans being raised from foreign banks, it tends to be a part debt with an Indian counterpart[11].

A key constraint in lending to solar power projects is that most Indian banks are over exposed to the power sector. The Reserve Bank of India (RBI) prescribes sectorial lending limits that constraints lending to the power sector. Most of these projects are now being classified as stressed assets or are having their loans recast. According to India's central bank, the Reserve Bank of India, the power sector (both generation and distribution) contributed to 16.1% of stressed advances of all Indian commercial banks. Indian banks have restructured a total of INR 530 bn. (USD 8.8 bn.) of loans to the power sector[12].

Solar as a priority lending sector

Indian banks are restricted to lend only 10-15% of all their advances to the infrastructure sector as per the RBI's prudential lending norms. This translates to about 4% for the power sector as a whole. Most public and private banks in India have already reached the ceiling lending limits from funding large coal power projects[13]. This had left banks with very little room to fund renewable energy projects. In April 2015, the RBI announced that renewable energy projects would fall

[11] BRIDGE TO INDIA. Telephonic Interview. August 2015.
[12] Reserve Bank of India. Financial Stability Report. June 2015. http://bit.ly/1IOlClw
[13] Climate Policy Initiative. Meeting India's Renewable Energy Targets: The Financing Challenge. Page 12. November 2012. http://bit.ly/1EXaFTy

under the priority sector[14]. What this means is that, banks would have to set aside 40% of all advances to sectors that the RBI determines as being 'priority' to India's growth – renewable energy projects being one of them. Renewable energy projects would no longer be restricted to the 4% ceiling limit.

Unfortunately, the RBI has also set a maximum cap of INR 15 Cr. (USD 2.3 mn.) per borrower. This translates to a solar system capacity of just over 3 MW. Given that the minimum project sizes in India is around 25 MW[15], this limit is woefully inadequate and would shut-off larger developers from accessing these funds. The industry has already requested the RBI to increase this limit to INR 500 cr. (USD 77 mn.)[16].

[14] Reserve Bank of India. Priority Sector Lending - Targets and Classification. April 23rd 2015. http://bit.ly/1EX9HXt

[15] The minimum project size under SECI tender for 250 MW at Charanka Solar Park, Gujarat is 25 MW. Tender Number SECI/JNNSM/P-2/B-3/RfS/GJ/082015. 31st August 2015

[16] The Economic Times. Clean energy industry hails inclusion of renewables in priority sector lending; progressive move says Suzlon. April 24th 2015. Accessed on: September 10, 2015. http://bit.ly/1EXcQ9L

The Green Bond Market

An interesting development has been the issue of Green Bonds in the market. YES bank, one of the mid sized banks in India (market capitalization of INR 29,682 Cr) has issued two rounds of green bonds. The first round was issued in February 2015 and the bank raised 7,200 crore (USD 1.2 bn.) against an issuance of INR 1,000 Cr. (USD 0.16 bn)[17].

The bank issued a second round of bonds worth INR 315 Cr. (USD 50 mn.) in August 2015 to the International Finance Corporation (IFC). This comes in the wake of Yes Bank committing funding for 5,000 MW of solar power projects during the RE-Invest Conference conducted in February 2015.

The Government owned Indian Renewable Energy Development Agency (IREDA) was perhaps the first to issue a bond for renewable energy projects. It issued bonds worth INR 500 Cr (USD 83 mn.) in February 2014 and has since then issued bonds worth 2,207 Cr. (USD 367 mn.)[18]. The Export-import Bank of India also earlier in March 2015 issued green bonds worth USD 500 mn. This was India's first dollar denominated green bonds. This too was over-subscribed nearly 3.2 times. Being an Export-Import bank, this corpus of funds is not likely to be used to fund solar projects in India[19].

[17] YES Bank. 'YES BANK Places INR 315 Crore (USD 50 MM equivalent) of Green Infrastructure Bond With International Finance Corporation, Washington'. August 5th 2015. http://bit.ly/1EypLPI
[18] IREDA. 'Resource Mobilization as on 31.3.2015'.http://bit.ly/1KZTkpS
[19] Exim Bank India. Press Releases. Exim Bank Raises US $ 500 Million 5 Year Tenor Reg S Green Bond At a Coupon 2.75% p.a. March 24th 2015. http://bit.ly/1Kcx4bK

Lending Institution	Bond Value	Interest Rate / Coupon Rate (%)	Tenure (years)	Issuing Currency
IREDA	INR 500 cr. (USD 77 mn.)	8.16 8.55 8.55	10 15 20	INR
EXIM Bank of India	USD 500 mn	2.75%	5	USD
YES Bank	Round 1| INR 7,200 cr. (USD 1.2 bn.) Round 2| INR 315 cr. (USD 50 mn.)	8.85% 6.45%	10 5	EUR

Table 3: Overview of Green Bonds in India

Penurious PPAs

An equally important aspect of financing is the ability of the off-takers i.e. DISCOMs to purchase power. According to a recent report released by the Ministry of Power, Government of India, only 7 out of 40 utilities surveyed are rated in the category of A+ / A ('Very High / High Operational and Financial Performance Capability')[20]. The remaining 33 rated utilities had cost coverage ratio of less than 0.90[21], which indicates that these utilities not earning enough to meet their expenses. The cumulative losses from all DISCOMs in India are estimated to be around INR 200,000 cr. (USD 30 bn.)[22].

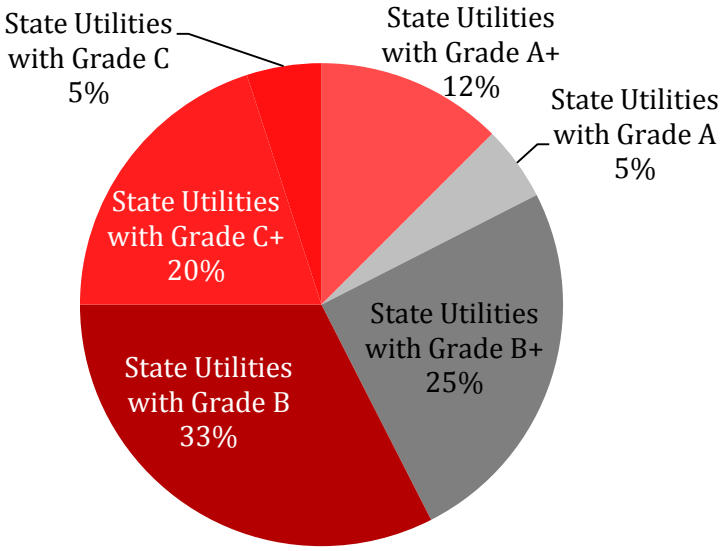


Figure 5: Ratings of DISCOMs in India (for a full description of the grading's, refer to the report)[23]

[20] Ministry of Power. 'State Distribution Utilities Third Annual integrated Rating'. http://bit.ly/1EO8UbH
[21] Coverage ratio is a ratio of total revenues / total expenditure for any given financial year. Ideally, this ratio should be greater than 1.0
[22] TERI. Crisis in India's Electricity Distribution Sector: Time to Reboot for a Viable Future. January 2015. http://bit.ly/1KLy5ho
[23] Ministry of Power. 'State Distribution Utilities Third Annual integrated Rating'. http://bit.ly/1EO8UbH

A common benchmark that utilities use to evaluate the cost effectiveness of solar power versus traditional power is the Average Pooled Purchase Cost (APPC). The APPC is essentially the weighted average of the price of power that a DISCOM buys from different sources. Since renewable energy has not traditionally contributed significantly to the energy mix, this metric does not (yet) include purchase from expensive sources of power. It is important to note that short-term power purchases (day ahead) from the exchange are also not included in this metric, although DISCOMs are increasingly moving to short-term power purchases for the want of access to stable long-term reserves. This has effectively meant that the APPC no longer reflects the true weighted cost of power. It tends to be slightly lower than the actual cost of power.

When utilities make decisions to purchase power from different sources of energy, they benchmark it against the APPC. Solar energy – from both rooftop and utility scale systems – is still much more expensive than the APPC. This coupled with the poor financial health make DISCOMs hesitant to purchase expensive solar power.

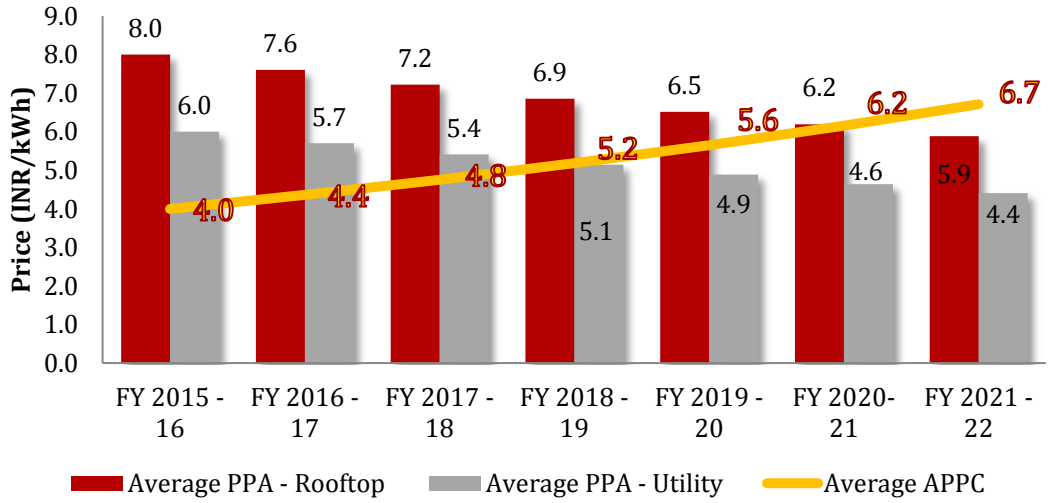


Figure 6: Projected development of APPC and solar tariffs in India FY 2015-16 to FY 2021-22

Figure 6 depicts this trend. However, with APPC increasing rapidly at 9% per year (all India average), and solar prices rapidly nose-diving, grid parity with APPC isn't too far away. The calculations show that

by FY 2018-19, solar power purchased from utility scale plants should be at parity with APPC. Solar power from rooftop plants should reach parity by FY 2021-22. The cumulative subsidy required in order to fund the purchase of solar power until FY 2021-22 would amount to just over 10,000 cr. (USD 1.5 bn.).

Key Assumptions

Assumption	Value
Average solar tariff – Utility Projects (2015)	INR 6.00/kWh
Average solar tariff – Rooftop Projects (2015)	INR 8.00/kWh
Average APPC (2015)	INR 4.00/kWh
Average annual decline in solar tariffs	5%
Average annual increase in APPC	9%[24]

Table 4: Overview of assumption for analysis presented in figure 6

This figure is still quite large and DISCOMs may not be able to absorb the additional expense. Until then, one option is for the Central Government to bridge the gap. The National Clean Energy Fund (NCEF) was established in 2010 precisely for this purpose. The fund, though, is not solar specific and is used to fund many initiatives. The fund is populated by a tax on coal mined in India. The cess has been progressively increased from INR 50 per ton of coal mined in 2010[25] to INR 200 per ton of coal mined in 2015[26]. The fund has a corpus of INR 16,388 Cr (USD 2.5 bn.) as on August 6th 2015[27].

Figure 7 shows the NCEF receives approximately INR 10,000 cr. (USD 1.5 bn.) from the coal cess (see table 5). The orange bar shows the cumulative subsidy that needs to be disbursed every year to bridge the viability gap (difference between the solar PPA tariff and the APPC). The subsidy increases rapidly as projects are cumulatively added on a yearly basis and starts to taper off as grid parity (with APPC) is reached by FY 2018-19 (figure 6).

[24] Compiled using data from Page 12 of http://bit.ly/1O2O9Zv and Page IX of http://bit.ly/1O2OgEn
[25] Ministry of Finance, Government of India. Budget 2010-11, Speech of Pranab Mukherjee, Minister of Finance. February 26th 2010. Clause 154. http://bit.ly/1Mg9UaU
[26] LiveMint. Union Budget 2015: Full text of finance minister's speech. Clause 123. http://bit.ly/1MgaO7n
[27] Government of India. Ministry of New and Renewable Energy. Clean Energy Fund. http://bit.ly/1fJELy0

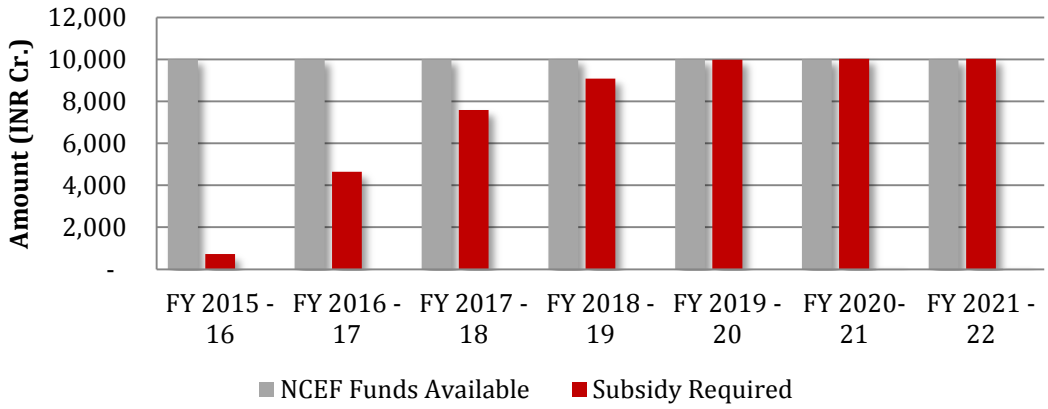


Figure 7: Comparison of NCEF funds available with the total subsidy required to bridge the grid parity gap (see in conjunction with figure 6 above)

Coal production in India has gradually increased and is now expected to increase much faster due to the allocation of coal blocks from the recently concluded auctions (see table 5). However, for the purpose of this report, we have assumed a uniform annual output of 500 million metric tones as a "base case scenario".

FY 12	FY 13	FY 14	FY 15
435.84	452.21	462.42	494.24

Table 5: Annual Coal Production in million metric tones[28]

The MNRE has allocated 20,000 MW to states (see table 1) that means that the state DISCOMs take on the burden to finance the expensive solar PPAs. It would rather be prudent for the Central Government to use an intermediary such as SECI or NVVN to act as a trader and back these PPAs using funds from the National Clean Energy fund.

28 Business Standard. Coal Output on a High but demand dries up. September 7th 2015. http://bit.ly/1L21IJT

Key Takeaways

- India would require a total of 550,000 cr. (USD 85 bn.) to fund the capital expenditure for the 100 GW plan.
- The Government should announce a firm plan on how it intends to achieve the 100 GW target. How would the state wise targets apportioned by the MNRE be met? How would SECI and NVVN come into the picture? What is the future of the NSM Phase 3? Currently allocations are happening on an ad-hoc basis and there appears to be no clarity to the public on how these allocations fit into the larger framework of the 100 GW goal.
- Given the overwhelming interest among private developers and investors to invest in solar in India, the Government should allocate a greater portion of the targets to the private sector. Public sector companies such as the railways, oil marketing companies and even defense establishment need not invest into non-core business to enable India achieve the 100 GW target.
- Equity is not a concern. There appears to be overwhelming interest to invest in solar energy projects in India.
- Debt is a constraint in India, primarily because most banks have reached ceiling limits to lend to the power sector. The recent move by the RBI to include renewable energy into the priority sector does not help the sector because of the inadequate ceiling limit of INR 15 cr. (USD 2.3 mn.) per project.
- The weakest link in the chain is the ability of the DISCOMs to purchase 'expensive' solar power. Only seven of India's DISCOMs are financially sound. The cumulative losses among all DISCOMs in India stands at INR 200,000 cr. (USD 90 bn.)
- The total subsidy required until 2022 in order to bridge the gap between 'expensive' solar power and the APPC is estimated to be INR 10,000 cr. (USD 1.5 bn.). The NCEF could meet this subsidy requirement, however, it must be kept in mind that the NCEF funds other renewable energy and environmental programs in India. The Government might need to secure other sources to bridge the gap.

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Author

Akhilesh Magal is the Head Advisor – Solar Energy at GERMI. He is an environment engineer from Carnegie Mellon University and is an expert on solar policies and grid integration of renewable energy. His interests include renewable energy policies, regulations and markets with a focus on how these metrics can enable business in India. He can be reached at akhilesh.m@germi.res.in