Deutsche Bank
Markets Research

Industry

India 2020: Utilities & Renewables

Date
19 July 2015

Asia
India

Utilities
Utilities

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F.I.T.T. for investors

Make way for the Sun

India solar power investments could surpass that of coal

India has made an exceptional commitment to solar energy by raising its 2022 target five-fold to 100GW and its Renewable Energy target to 175GW. The government has announced an unprecedented policy push and states are providing the necessary infrastructure. Annual investments in solar could surpass investment in coal by 2019-20, with USD 35bn committed by global players. For local IPPs, solar has to be an inherent part of their expansion strategy, as RE obligations become strictly enforceable and cost of coal power increases. NTPC, Adani and RPWR are ahead in this development cycle which adds 10-15% to our current valuations. NTPC is our top pick.

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We raise our solar power forecast by 240%

Global majors have committed USD 35bn+ to the Indian solar sector. By 2020, annual solar power capacity additions and investments could surpass those in coal power projects. We are raising our solar power forecasts by 240% to 34GW by 2020. This is on the back of strong commissioning (4.5GW), even stronger pipeline - under construction (~5.1GW), and new projects (~15GW). By then, renewables could account for a significant 20% of power capacities in India, per our forecast. Private sector interest is decisively moving towards solar from coal power, and we foresee numerous opportunities of fund-raising, yieldco structuring and M&A activity.

RE can reach 20% of capacity but we see challenges to higher penetration

(1) Transmission constraints and integration of diurnal power into the grid are risks, without peak-load management capability. Solar absorption in Rajasthan could see challenges like wind in Tamil Nadu, given policy target of 25GW solar vs. peak-demand of 11GW. (2) A further risk is the enforcement of RE purchase obligations (RPOs) given weak finances of state distribution cos, and hence large-scale absorption of solar could be a concern (INR 170bn additional burden by 2020E). (3) Other issues include financing, land acquisition, limited domestic manufacturing, and returns/reliability of baseline data.

Impact on the thermal power producers

Solar could have a significant impact on day power rates, given that generation peaks between 9am and 6pm. In turn, this could reduce the coal requirement by ~8% or 70mnt by 2020E, largely impacting the highest cost of power, i.e., imported coal – leading to large savings (~USD 17bn/pa).

Companies to play the theme (see pp 26-34 for global and unlisted players)

Indian IPPs have started adopting a solar growth strategy, given competitive pricing which may restrict conventional power growth. Additionally, cost competitiveness is at risk, as the possibility of further cess cannot be ruled out to fund RE subsidies. Utilities- NTPC, Reliance and Adani - are early adopters and making large-scale commitments – resulting in ~5% incremental growth and 10-15% impact on target price. PV manufacturers and EPC service providers will also see benefits, although the majority of PV cells are likely to be imported given the small scale of domestic PV industry.

Our valuation framework is based on DCF and P/B; risks

We value the regulated models on P/B (on Gordon Growth) and IPPs on the NPV of projects. Key risks are lower-than-expected domestic coal supplies, execution delays and lower/higher-than-expected merchant tariffs.

Top picks

NTPC Limited (NTPC.BO),INR135.15	Buy

Source: Deutsche Bank

Companies Featured

NTPC Limited (NTPC.BO),INR135.15			Buy
	2015A	2016E	2017E
P/E (x)	13.5	11.6	10.3
Price/book (x)	1.30	1.26	1.18

CESC Ltd (CESC.BO),INR591.00			Hold
	2015A	2016E	2017E
P/E (x)	43.4	22.6	10.6
Price/book (x)	1.33	1.23	1.10

Adani Power (ADAN.BO),INR30.00			Hold
	2015A	2016E	2017E
P/E (x)	–	–	29.41
Price/book (x)	2.4	1.5	1.5

Reliance Power (RPOL.BO),INR46.35			Hold
	2015A	2016E	2017E
P/E (x)	20.62	8.21	6.60
Price/book (x)	0.8	0.6	0.5

Tata Power (TTPW.BO),INR76.05			Buy
	2015A	2016E	2017E
P/E (x)	46.83	19.50	18.87
Price/book (x)	1.5	1.4	1.3

Power Grid Corporation (PGRD.BO),INR141.00			Hold
	2015A	2016E	2017E
P/E (x)	14.10	13.13	11.16
Price/book (x)	2.0	1.7	1.5

NHPC (NHPC.BO),INR19.10			Hold
	2014A	2015E	2016E
P/E (x)	9.98	9.02	7.94
Price/book (x)	0.7	0.7	0.7

Source: Deutsche Bank

Deutsche Bank AG/Hong Kong

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Executive summary

Government is generating a lot of excitement over solar power in India. At the recent REInvest Global Summit, companies committed to 166GW solar power, and 216GW for Renewable Energy (RE) projects. India could become one of the largest RE producers in the world, with an increase in its target from 20GW to an ambitious 100GW by 2022 – similar to China's target of 100GW by 2020. State administrations are providing the necessary framework and infrastructure to achieve this goal, attracting interest from not just domestic corporate houses but also global players – ranging from utilities to RE majors and PEs. Solar fundamentals are becoming compelling in India, and investments are bound to grow dramatically, in our view. But there are numerous challenges which still need to be addressed.

The new rising sector – solar power

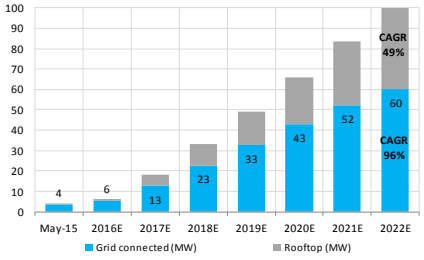
1) **Solar targets raised:** India's government has increased its solar target five-fold to 100GW by 2022.

2) **Cost decline is driving investments:** IPPs and investors tend to dislike a subsidy-based model, for fear of withdrawal. With capital cost plunging from INR 180m/MW (USD 3m) in 2009 to nearly INR 65m/MW (USD 1m) vs. replacement cost of coal at USD 1.2 m/MW, grid parity is in sight and utilities/investors will focus on commercial viability. Going ahead, with anticipated improvement in technology and increased supply of panels from China/Europe, capital costs could stabilize at lower levels.

3) **Tariffs have been driven lower and are now near parity:** Solar tariffs have dropped 60% over last four years, from INR 14.90/kWh in 2010 to almost INR 5.75/kWh in 2015 – almost at parity with other conventional power sources. Market expectations are that solar equipment prices could drop a further 30-40% largely due to technological/efficiency improvement.

4) **Solar fetches reasonable ROEs:** We estimate a 19% average ROE for the lifetime of the project, though initial year ROEs will be low. We caution however that data/financials from operators/developers are limited. Nonetheless, data from the first round of solar installations are encouraging and provide ~20% plant load factors (PLF).

Figure 1: Solar targets upped to 100GW by 2022



Source: Deutsche Bank, MNRE

Operational data from first round of solar installations are encouraging

Major impact from surge in renewables sector

1) **Solar power and RE share to increase considerably:** We are revising our solar power forecast by 240% to 34GW by 2020, from a mere 14GW earlier. We expect the RE share in power capacity to increase from 13% currently to 20% over the next five years.

2) **Solar capex could well overtake that of coal:** Given the momentum in solar power capacity addition and slowing new coal project additions, we expect solar capex to overtake that of coal by FY19, and capacity addition to overtake coal in FY20, if not earlier.

3) **Solar value chain to benefit:** Domestic players are unlikely to see much benefit as the majority of PV cells are likely to be imported, given the small scale of domestic PV manufacturers (only 1.2GW/pa, with the largest, IndoSolar, at 450MW/pa), and therefore, lack of cost competitiveness.

4) **Coal dependence to reduce ~8% by 2020:** If 5GW of solar capacity addition p.a. is achieved from FY16-FY20, coal dependence could reduce by 8% or ~70mt. This could lead to significant saving of costs for ultimate purchasers of power, helping in cutting down costly coal imports (USD 17-18bn/pa), and reduce the carbon footprint.

Companies positioned to benefit from the Indian solar power boom

1) **Stock implications:** Due to the scattered nature of development, solar power is being adopted by number of companies, whether listed, unlisted, PE-backed, or utility-backed. NTPC, Reliance Power and Adani Group are early adopters and making large-scale commitments. Given the shorter timelines for execution (vs. coal), capacity growth could vary significantly over the medium term vs. the projections.

2) **NTPC best placed –** NTPC has taken the advanced action of setting a goal of 10GW of solar in five years. We believe its capex and regulated equity will increase by 30% and 10-12% over three years, respectively, leading to 20%+ EBITDA and regulated BV CAGR for the company.

3) **Global picks –** Our five global solar plays, which have made commitments to participate in Indian solar power boom are:

   First Solar (TP $68, Buy) has over 700MW of PV solar plants in India, and has committed to develop 5GW by 2019.

   Trina Solar (TP $15, Buy) has ~10% market share in India on supply of PV modules, and it has partnered with Welspun Energy to build 2GW PV facility, as well as proposed 12.5MW capacity as a developer.

   SunEdison (TP $40, Buy) will build a solar factory in India along with Adani Group, and has commitment to develop 15.2GW of RE.

   SMA (TP €30, Buy) is one of the largest developers and manufacturers of PV inverters. SMA Solar India supplied to the largest PV project 40 MW in Rajasthan, and is developing India's first PV diesel hybrid system.

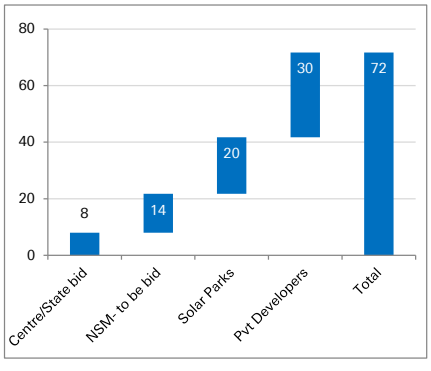
   GCL-Poly Energy (TP HK$2, Buy) is the world's largest polysilicon and solar wafer manufacturer from China. Its parent company has signed a strategic cooperation agreement with Adani Group on green energy.

Figure 2: Global commitments in India

Company	Target price	Reco	India commitment
First Solar	$68	Buy	5 GW solar capacity by 2019
Trina Solar	$15	Buy	2GW PV facility with Welspun, and 12.5MW Solar capacity
Sun Edison	$40	Buy	PV Solar facility with Adani group, and 10GW Solar capacity
SMA	€ 30	Buy	Supplied invertors to largest PV project and developing PV diesel hybrid
GCL-Poly Energy	HK$2	Buy	Strategic cooperation agreement with Adani group

Source: Deutsche Bank

Figure 3: Utility-scale solar energy projects under consideration



Source: Deutsche Bank estimates, MNRE, Industry data

Unprecedented policy support for solar

1) **Strong policy push from Central Govt:** The central government has adopted a National Solar Mission Scheme – under which various models of 'pooling solar with coal', viability gap funding (VGF), dollar bid and subsidy based mechanism will be offered. Over and above, there are various promotion schemes of Renewable Purchase Obligations, RE certificates trading, accelerated depreciation, tax-break incentives and priority lending status.

2) **States' response is encouraging too:** States have announced their policy targets (and solar parks), in line with the central government's agenda. Many states, including Rajasthan (25GW), Andhra Pradesh (5GW), Telangana (5GW), Maharashtra (7.5GW), Tamil Nadu (3GW) and Karnataka (2GW) have followed with large targets.

3) **Landmark changes by regulators:** In a recent judgment (May'2015), the Supreme Court upheld a regulatory order to mandate RPO for captive power, and industry open access users. Power ministry has also proposed major amendments to the tariff policy in April 2015. It is raising solar RPO targets from 3% to 8% by Mar'19, and stipulating 10% mandatory RE capacity for future coal/lignite projects to meet RE Generation Obligation.

Risks to the solar juggernaut

1) **Grid integration and transmission constraints**: Transmission constraints and the integration of diurnal power (i.e., solar) into the grid, without backup support from gas/pumped-hydro, constitute a risk. Solar absorption in Rajasthan could see challenges like wind in Tamil Nadu, given limited grid capacity and the policy target of 25GW solar vs. peak demand of 11GW (indicating the risk of power oversupply and hence, low utilization rates for developers).

2) **Enforcement of RPOs** given the poor finances of state distribution companies could be a risk. The ability of distribution companies to pay for costly RE, and hence large-scale absorption of solar, could be a concern.

3) **Other issues** include financing, land acquisition, limited domestic manufacturing, and returns/reliability of data.

Figure 4: Matrix of solar power players

Company name	Developer	EPC	PV Mfg
Acme Solar			x
Adani Power		x	x
Azure Power			x
BHEL			
Coal India		x	x
Euro Multivision Ltd.	x	x	
First Solar			x
Greenko		x	x
Indosolar Ltd	x	x	
JA solar	x		
L&T	x		x
Lanco		x	
Mahindra Solar			x
Moser Baer			
Mytrah			x
NTPC		x	x
Orient Green		x	x
Reliance Power		x	x
ReNew Power		x	x
SunEdison			x
Tata Power			
Titan Energy	x	x	
Vikram Solar	x	x	
Websol Energy System Limited	x	x	
Welspun			x
XL Energy Ltd.	x	x	

Source: Deutsche Bank, company data; x- denotes not present

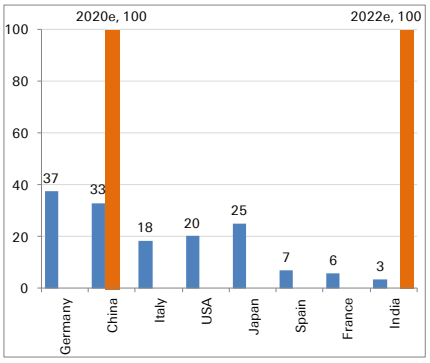
Can India achieve 100GW of solar by 2022?

India is planning to add 100GW solar power capacity by 2022. Technically this is achievable – if administrators are willing to put enough support behind it. Realistically, challenges of weak financials of distribution companies and grid constraints need to be addressed. Hence, our forecasts consider 34GW solar power capacities in India by 2020. The intent is in place, but a comprehensive strategy is still needed to achieve this large number in order to avoid an IPP-type failure wherein other value-chain (coal, railways and distribution companies) were not geared up. However, we still believe the scale of solar power development could surprise the power industry and drive big capex for long-term investor interest.

From a global perspective, China is targeting 100GW capacity by 2020, from 28GW installed capacity as of December 2014. China failed to meet its solar target for 2014, installing only about 10.5GW against an initial plan of 14GW, but is looking to install 17.8GW for 2015.

Cumulatively, India has installed ~3.8GW of solar power capacity (as of 31 March 2015 and ~4.5GW by June'15 end), most of which (~2GW) was installed in the last two years. We see long-term potential and favorable regulatory shifts as helping to accelerate growth in the sector. Recent announcements from Global majors' like SunEdison/Softbank coupled with local policy announcements support our view that India is beginning to ramp installations and could become one of the top markets in the world. In the short term, India will likely add 3-5GW per annum (5-9% of global market) from the existing 1GW market size. It is expected to continue to grow at a healthy pace, but may still not be sufficient to achieve the 100GW target by 2022.

Figure 5: Global Solar installed capacities as of 2014 (GW)



Source: Deutsche Bank, Bloomberg Finance LP

USD 35bn+ investments planned by global investors

The Government of India (GoI)'s unprecedented push has already attracted a number of large investors. Japanese multinational **SoftBank, Bharti Enterprises** and Taiwan's technology manufacturer **Foxconn Technology** have announced a USD 20bn joint venture to develop solar energy plants across the country. **SunEdison,** the US-based renewable energy giant, intends to invest USD 15bn by 2022. It will put USD 2bn into a JV with Adani Group to manufacture photo voltaic (PV) modules. China's **Trina Solar** has unveiled plans to invest USD 500m in a plant to make panels with **Welspun Energy**.

Cost parity in sight; advantage goes to solar on LCOE

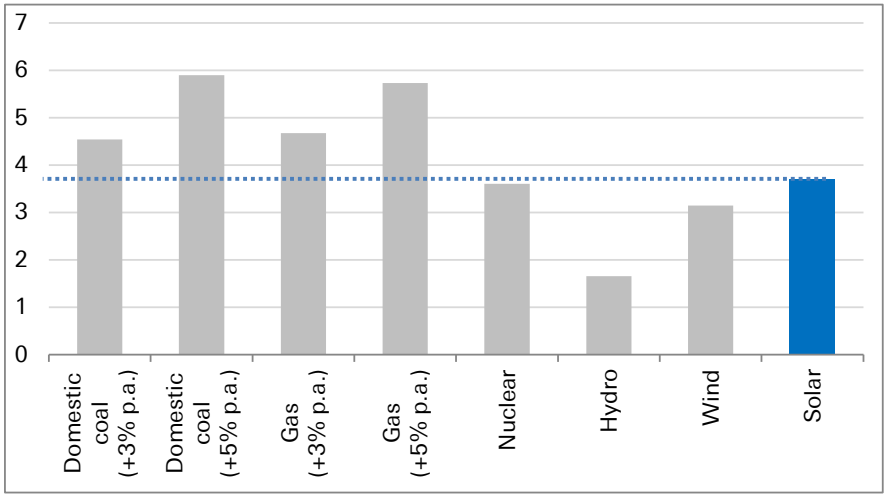
Most sweeping change has been the drop in costs

The government has reintroduced accelerated depreciation and eased duty structures and is providing viability gap (VGF) and infra development funding. Although incentives make the deal sweeter, the most sweeping change has been the drop in costs, which has enhanced project viability. On Life-cycle Cost of Energy (LCOE), solar is competitive vs. thermal power, although it looks 30% more expensive initially.

However, the dilemma is that if there are large investments in RE, the price of fossil fuels could remain subdued, keeping their attractiveness intact.

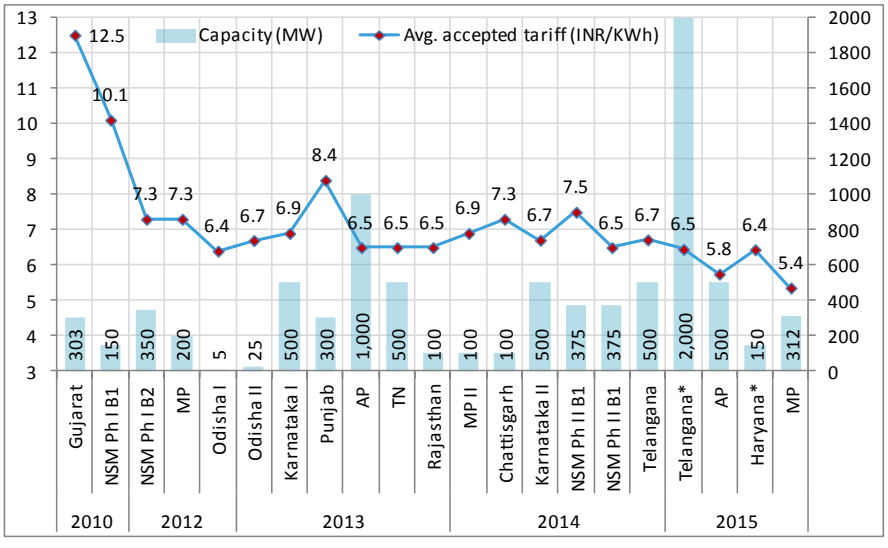
On LCOE, solar is competitive vs. thermal power, although it looks 30% more expensive initially

Figure 6: LCOE of energy sources in India highlights attractiveness of solar



Source: Deutsche Bank estimates

Figure 7: Tariffs down 55% since 2010



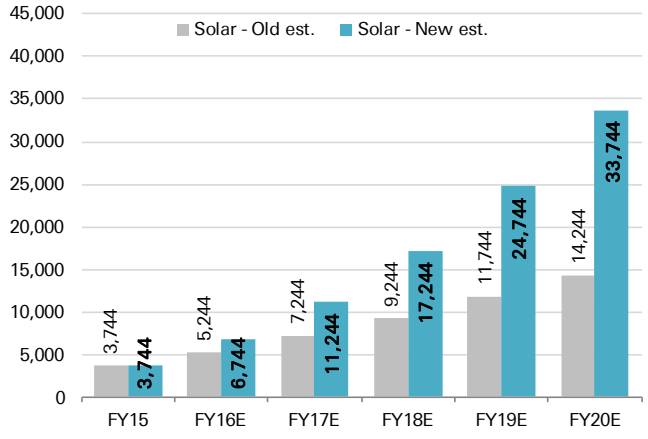
*Source: Deutsche Bank, CERC, State ERC, media reports; * Ceiling price as bid results are not yet out*

Solar power additions could surpass those for coal power

Renewable Energy now forms a significant portion of total installed capacity in the country – we forecast 20% RE from 13% currently over the next five years. By 2020, solar power capacity additions and investments could surpass those for coal-based power projects.

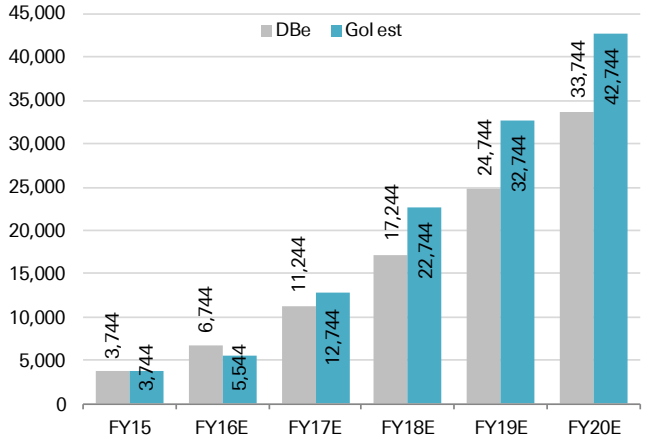
By 2020, solar power capacity additions and investments could surpass those for coal power, if not earlier

Figure 8: Solar capacity forecast upped (MW)



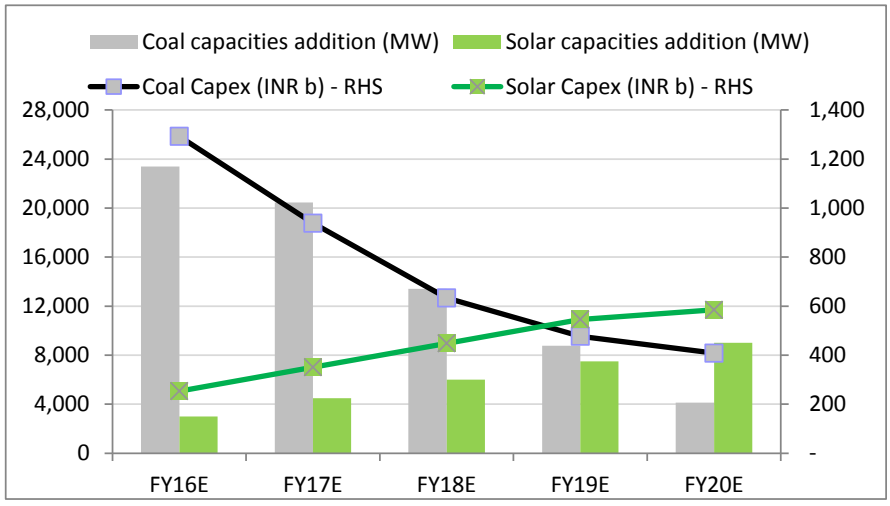
Source: Deutsche Bank, CEA, MNRE

Figure 9: GoI targets vs. our estimates (MW)



Source: Deutsche Bank, CEA, MNRE

Figure 11: Solar capex and capacities could overtake coal



Source: Deutsche Bank estimates

Figure 10: Solar & Coal – Capex and capacity estimates comparison

	FY15	FY20E	FY16-20e addition
Coal capacities (GW)	165	235	70
Solar capacities (GW)	4	34	30
Coal Capex (INR b)	1,293	408	3,749
Solar Capex (INR b)	254	585	2,184

Source: Deutsche Bank estimates

Stock implications

Due to the fragmented nature of development, solar power is being adopted by a number of companies, whether listed, unlisted, PE-backed, or utility-backed. The interest level is tremendous and we foresee numerous fund-raising, Yieldco structuring and M&A opportunities.

NTPC has highest leverage to solar shift amongst developers

Utility companies have started adopting Renewable Energy growth strategies, given a) the competitive pricing structure for solar can restrict conventional power growth if utilities do not embrace RE; b) to meet RE generation obligations; c) the government is using conventional power sources to fund renewable energy subsidies – environment cess of INR 200/t is in place and could further increase; and d) to reduce their carbon footprint.

Powergrid will garner ~14% additional capex to build RE corridor

NTPC, Reliance Power and Adani are early adopters and making large-scale commitments. NTPC has taken the advanced action of meeting its goal of 10GW solar power in five years, and will represent ~10% its total generating capacity- due to fairly early stage of development. We believe its capex and regulated equity will increase by 30% and 10-12% over three years, respectively, leading to 20%+ EBITDA and regulated BV CAGR. While we assume a gradual increase in capacity (2.5GW in three years) given the short gestation period, if the company commissions 5GW, it would provide a good 4-5% additional earnings, BV growth and bump-up in the target price.

Figure 12: NTPC, Reliance Power could be early beneficiaries

Company	Capacity FY16e (MW)	Base Case				Bull Case				Company RE Target 2016-2022	Bull-case assumption v/s target
		RE addition FY16-18E	EBITDA CAGR FY15-18E	BV CAGR FY15-18e	TP (INR/sh)	RE addition FY16-18E	EBITDA CAGR FY15-18E	BV CAGR FY15-18e	TP (INR/sh)		
NTPC	45,904	2,550	21%	22%	173	5,000	24%	24%	186	10,000	50%
Tata Power	8,726	547	11%	5%	90	1,047	12%	5%	94	1,745	60%
- Tata Power PV mfg	250										
Adani Power*	10,440	40	11%	5%	30	690	15%	8%	36	*10,000	7%
Reliance Power	5,945	140	20%	8%	42	640	24%	10%	48	6,000	11%
NHPC	6,366	50	1%	6%	22					NA	NA
CESC	2,455	9	21%	11%	635					NA	NA
JSW Energy	3,140	0	0%	13%	125					NA	NA
JPVL	5,500	0	20%	7%	10					NA	NA
Powergrid (INR bn assets)	1,483	180@								NA	NA

Source: Deutsche Bank estimates;
** Not clear if the RE development vehicle will be Adani Power or Adani Enterprises || @Green Energy Grid investments*

Solar shift could reduce coal dependence by ~8%

We believe that the Renewable Energy targets set out by the Ministry of Power are too ambitious, with ~15-16GW capacity addition per annum. We modeled for 30GW solar power capacity addition in our base power demand-supply model till 2020. With this, India could cut coal dependence by 8% or ~70mt by 2020. This could represent a large saving of costs, helping to cut down costly imports (total imports USD 17-18bn/pa), as well as bring about a major reduction in the carbon footprint.

Solar value-chain to benefit

Equipment manufacturers and EPC service providers will also see benefits from the substantial investments in solar power. However, the majority of PV cells are likely to be imported given the small scale of domestic PV manufacturers, and therefore, their lack of cost competitiveness. Additionally, the US took India to the WTO against domestic manufacturing clause in initial government tenders. The companies vying for business in each of the categories in India are:

- Module suppliers – SunEdison, First Solar, Trina, Yingli, Tata Power Solar, BHEL, IndoSolar, etc.
- EPC service providers – SunEdison, Moserbaer Solar, L&T, Tata Power Solar, Welspun, Azure Power, Acme Solar, and Mahindra Solar.
- Electrical equipment manufacturers – ABB, Siemens, SMA, Schneider Electric, etc.

India power sector coverage valuations

Figure 13: India power utility sector coverage valuations

Stock	Rating	Target Price	CMP	Upside/ (Down-side)	M Cap (USD b)	P/E (x)		P/BV (x)		ROE (%)	
		(INR/sh)	(INR/sh)	%		FY16E	FY17E	FY16E	FY17E	FY16E	FY17E
NTPC	Buy	173	135	28%	17.3	11.4x	10.2x	1.2x	1.2x	11	12
Power Grid	Hold	160	140	15%	11.6	13.1x	11.1x	1.6x	1.5x	14	14
NHPC	Hold	22.0	19.1	15%	3.3	7.9x	8.4x	0.7x	0.6x	9	8
Average-Regulated					**28.9**	**12.2x**	**10.6x**	**1.4x**	**1.3x**	**12**	**13**
Adani Power	Hold	30	29	2%	1.3	-74.5x	28.2x	1.5x	1.4x	(2)	5
JSW Energy	Buy	125	102	23%	2.6	11.6x	11.4x	2.0x	1.7x	17	15
Tata Power	Buy	90	76	19%	3.1	18.7x	18.1x	1.4x	1.4x	8	8
JPVL	Buy	10.0	7.0	42%	0.3	2.8x	6.3x	0.3x	0.3x	11	5
Reliance Power	Hold	42	46	-8%	2.0	8.0x	6.4x	0.6x	0.5x	7	8
CESC	Hold	635	571	11%	1.2	21.8x	10.2x	1.2x	1.1x	5	10
Average-Private IPPs					**10.6**	**12.6x**	**10.5x**	**1.1x**	**1.0x**	**10**	**9**
Average-Indian Utilities					**39.4**	**12.4x**	**10.6x**	**1.3x**	**1.2x**	**11**	**11**

Source: Deutsche Bank; Prices as on 16 July, 2015

Global solar players' returns and valuations

Figure 14: Global solar players' return and valuation comparison

	Recom	TP	P/E			P/B			ROE		
			2015	2016	2017	2015	2016	2017	2015	2016	2017
Upstream companies											
Solarworld AG	Buy	20.0	n.a.	20.3	n.a.	1.0	0.9	n.a.	-8	5	n.a.
SunPower	Buy	43.0	27.9	14.4	n.a.	2.0	1.7	n.a.	4	11	n.a.
First Solar	Buy	68.0	14.7	19.0	n.a.	0.9	0.9	n.a.	6	5	n.a.
Trina Solar	Buy	15.0	10.8	7.2	n.a.	0.8	0.7	n.a.	9	12	n.a.
Yingli Green Energy	Hold	1.5	n.a.	6.7	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Sunedison	Buy	40.0	n.a.	246.2	n.a.	19.1	18.7	n.a.	-51	8	n.a.
Canadian Solar	n/a	n/a	8.8	6.0	7.1	1.6	1.2	n.a.	23	25	11
SolarCity	n/a	n/a	n.a.	n.a.	n.a.	5.7	5.3	3.4	-77	415	39
Hangzhou First PV	n/a	n/a	39.2	31.0	n.a.	4.6	4.1	n.a.	12	14	n.a.
Hareon Solar	n/a	n/a	17.9	14.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Xinyi Solar	n/a	n/a	14.0	10.3	8.5	3.3	2.6	2.2	28	29	29
Shanghai Aerospace	n/a	n/a	30.8	21.7	20.5	3.2	2.8	2.4	9	13	13
Jiangsu Sunrain	n/a	n/a	16.7	17.0	16.6	n.a.	n.a.	n.a.	9	11	12
Jiangsu Zongyi	n/a	n/a	28.5	22.4	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Jiangsu Akcome	n/a	n/a	26.2	13.9	9.2	2.2	1.9	1.4	8	14	14
EGing Photovoltaic	n/a	n/a	35.8	18.8	n.a.	3.7	3.2	n.a.	11	18	n.a.
Median			**22.1**	**17.0**	**9.2**	**2.7**	**2.3**	**2.3**	**9**	**13**	**14**
Downstream companies											
Wacker Chemie AG	Buy	125.0	37.9	17.8	14.6	2.4	2.1	1.9	6	13	14
GCL-Poly	Buy	2.0	11.5	9.0	9.8	1.2	1.1	1.0	10	12	10
Tianjin Zhonghuan	n/a	n/a	132.2	73.1	n.a.	5.7	5.3	n.a.	4	7	n.a.
Beijing Jingyuntong	n/a	n/a	41.7	24.4	16.3	3.6	3.2	2.7	8	13	17
Median			**39.8**	**21.1**	**14.6**	**3.0**	**2.6**	**1.9**	**7**	**12**	**14**
Inverters											
SMA	Buy	30.0	n.a.	31.8	24.4	2.0	1.9	1.8	-2	6	8
Enphase Energy	Hold	14.0	17.0	7.5	n.a.	4,361.2	2,756.8	n.a.	6	24	n.a.
Solaredge technologies	Buy	35.0	65.6	28.9	13.8	6.9	5.4	3.8	26	23	36
Sungrow Power	n/a	n/a	31.5	22.1	15.8	5.9	4.7	3.6	18	20	22
Zhejiang Jingsheng	n/a	n/a	138.5	66.9	143.9	12.6	11.6	10.8	6	9	8
Xi'an LONGi Silicon	n/a	n/a	31.7	21.0	15.7	4.1	3.5	3.0	15	19	21
Median			**31.7**	**25.5**	**15.8**	**6.4**	**5.1**	**3.6**	**10**	**20**	**21**
Yield Cos											
Nextera Energy	Buy	113.0	18.5	17.3	16.6	2.1	2.0	1.9	12	12	12
NRG Yield	Buy	31.0	16.0	15.9	28.5	0.8	0.7	0.8	2	5	3
Terraform power	Buy	50.0	162.9	44.1	38.6	3.4	2.7	3.2	2	3	7
Abengoa yield	n/a	n/a	25.3	19.8	13.5	1.3	1.4	1.4	5	6	7
Median			**21.9**	**18.6**	**22.5**	**1.7**	**1.7**	**1.7**	**3**	**6**	**7**

Source: Deutsche Bank estimates, Bloomberg Finance LP estimates for n/a rated stocks; Prices as of 17 July, 2015

The new rising sector – solar power

Excitement brewing over Indian solar power

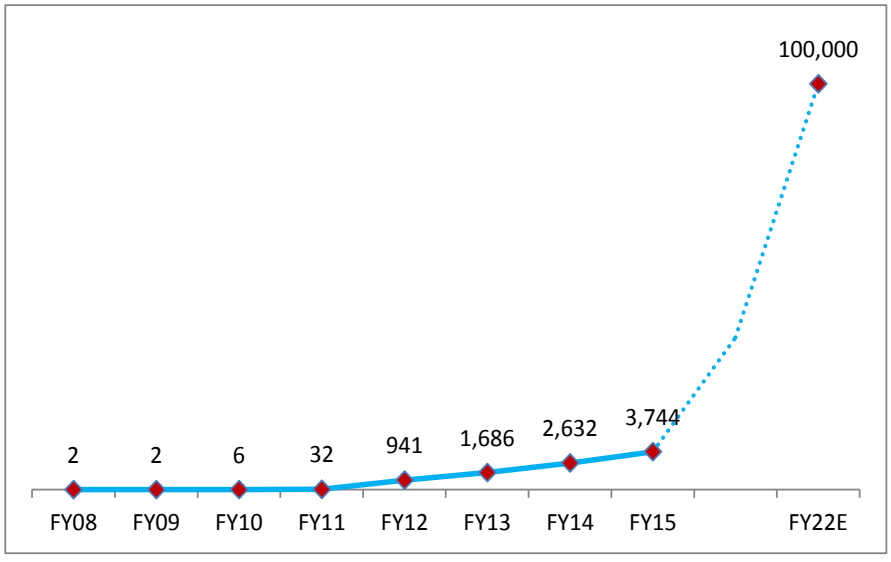
Indian Cabinet approved increasing the country's solar target five-fold to 100GW by 2022

The government has been able to generate a lot of excitement over solar power generation and investments in India. The global conference organized by the GoI drew 166GW in commitments for solar power development, and overall 216GW for Renewable Energy. This is in contrast to the ~32GW installed capacities as of March 2015 (3.8GW in solar). More recently, Prime Minister Narendra Modi-led Indian Cabinet approved increasing the country's solar target five-fold to 100GW, up from 20GW, by 2022. If it is able to meet this ambitious target, India will become amongst the largest Renewable Energy producers in the world, surpassing several developed countries.

The total investment in setting up 100GW solar energy will be around INR 6,000bn (USD 100bn). In the first phase, the Government of India is providing INR 150.5bn (USD 20bn) as a capital subsidy to promote solar capacity addition in the country.

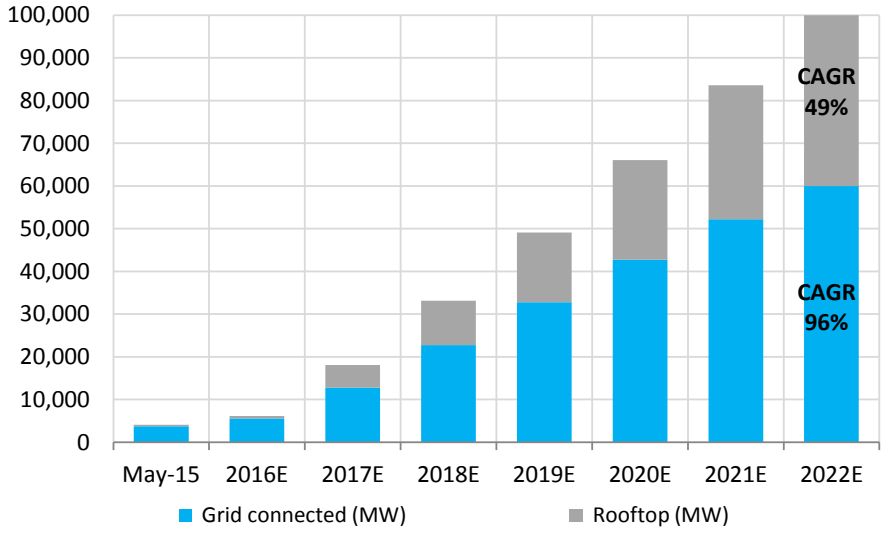
The new solar capacity will be split between residential and large-scale solar projects, with some 40GW expected to be generated from rooftop installations and the remaining 60GW coming from larger grid-connected projects, such as solar parks.

Figure 15: Solar power development in India and targets (MW)



Source: Deutsche Bank, MNRE

Figure 16: Existing capacity and evolution of government target by 2022



Source: Deutsche Bank, MNRE

Attracting global attention

Global utilities, RE majors, PE players and Indian corporate houses are queuing up for solar power

The REInvest conference in February 2015, organized by the Government of India, evinced huge interest and established the seriousness with which the world is looking at the India RE opportunity.

- In June 2015, SoftBank said it will form a JV with Bharti Enterprises and Foxconn Technologies to invest USD 20bn in green energy (largely solar) over the next 10 years in India. It will consider making solar panels locally with Taiwan's Foxconn.

- French energy major ENGIE, earlier known as GDF Suez, announced the acquisition of a majority stake in Mumbai-based solar power producer Kiran Energy Solar Power for an enterprise value of INR 12bn, from three private equity investors. Kiran Energy was founded by KPMG's former Head of IB and has an aggregate operating capacity of 85MW.

- International utilities or companies backed by international utilities such as EDF (along with ACME), Fortum and Sembcorp (Green Infra) have made significant commitments and investments in India.

- Trina Solar of China has unveiled plans for a USD 500m plant, and US-based SunEdison is investing up to USD 4bn in a manufacturing facility. Both are tying up with Indian power firms to build the plants.

- Dedicated international RE developers such as SunEdison, First Solar, SolaireDirect, 8 Minute Energy and Focal Energy are also keen on maximizing on the Indian solar power opportunity.

- Private equity (PE)-backed Indian renewable IPPs like Welspun, Azure Power and Renew Power are, moreover, participating in the solar power initiatives.

Separately, Indian majors are also putting their weight behind the GoI's ambitious target. For details, see Figure 78: Green Energy Commitments given at RE-Invest Summit in Feb 2015." These majors include:

- Indian corporate groups such as Aditya Birla, Reliance, Adani, Mahindra and Essel Infra.
- Public sector developers such as NTPC, NHPC and ONGC.

Solar is gaining favor globally

India will install more solar projects this year than Germany

Globally, 2014 saw a record 95GW of new wind and solar, and the International Energy Agency (IEA) expects renewables to account for 25% of power generation in 2018, up from 20% in 2011. India will install more solar projects this year than Germany. In 2014, non-hydro renewables accounted for almost half (48%) of net new power capacity. This was the third year in a row the figure was above 40%. Solar, in particular, is hitting its stride and has grown an average of almost 30% a year for the past decade.

The economics of renewables are improving. In 2011, when annual global investment in renewables peaked at USD 279bn, 70GW were installed. In 2014, almost 40% more (95GW) was installed, though investment was slightly lower at USD 270bn. RE is getting cheaper. Moreover, most regulatory supports, such as portfolio standards, tax credits, and feed-in tariffs, remain in place. These do protect the sector to some degree, but the larger story is that of fast-increasing competitiveness.

The technology is also improving. New solar technologies could allow solar cells to be rolled out via 3-D printer and applied anywhere. Perhaps most important, storage is getting better and cheaper, and investment in the area is rising.

In India, capacity addition is picking up exponentially

"By next year, solar installations will overtake those for wind by several-fold"

"By next year, solar installations will overtake those for wind by several-fold," says Tarun Kapoor, a joint secretary in the Ministry of Power.

India started with a humble base of 32MW in FY11, and has now achieved a reasonably large 3,744MW in FY15. Solar installations are on course to exceed 2,500-3,000MW in the year though 31 March 2016, topping the 2,400MW target for wind, according to interviews with officials from India's ministry of new and renewable energy.

Figure 17: Renewable power capacity addition

In MW	2011-12		2012-13		Accelerated Depreciation and GBI expired	2013-14		Accelerated Depreciation re-instated for 3 years	2014-15		Total Capacity
	Target	Actual	Target	Actual		Target	Actual		Target	Actual	31.03.2015
Wind power	2,400	3,197	2,500	1,699		2,500	512		2,000	2,312	23,444
Solar power	200	905	800	754		1,100	75		1,100	1,112	3,744
Small hydro	350	353	350	237		300	54		250	252	4,055
Total	**2,950**	**4,455**	**3,650**	**2,690**		**3,900**	**641**		**3,350**	**3,676**	**31,243**
Others- Biomass		340		429			521		420	414	4,418
Grand Total		**4,795**		**3,119**			**1,162**		**3,770**	**4,090**	**35,777**

Source: Deutsche Bank, MNRE

RE potential is just 4% utilized in India

Large targets still represent a small fraction of India's potential

India is bestowed with a significant amount of wind due to its large coast line and abundant radiation due to its tropical belt. India has harnessed wind and hydro energy to a good extent but still has further room for substantial progress. However, it also has enormous opportunities to exploit sun radiation (with 5-7KWh/m2) from among the most sunny sites in the world, especially Rajasthan, Gujarat, Andhra Pradesh, etc. The Modi government has realized this potential, thereby increasing the solar target five-fold to 100GW (from 20GW) by 2022, which is still a small fraction (~15%) of India's potential

Figure 18: Solar has huge potential if grid parity is achieved

in MW	Installed capacities	Potential	% utilized
Wind Power	23,444	102,772	23%
Solar power	3,744	748,990	0%
Small hydro	4,055	19,749	21%
Total	31,243	871,511	4%
Others- Biomass & Bagasse	4,418	22,536	20%
Grand Total	**35,777**	**894,047**	**4%**

Source: Deutsche Bank, MNRE

Cost parity is driving investments…

IPPs and investors do not like a subsidy-based model as there is always a fear that the subsidies might be withdrawn. With an almost 60-70% decline in capital costs, grid parity is in sight, and utilities/investors will focus on commercial viability. When that happens, a lot of investments will come in.

Wind is not commercially viable without preferential tariffs due to highly variable generation – but solar is relatively stable and predictable

The question is, then, why did wind investments drop in FY2013 and 2014? The primary reason for the decline was the discontinuation of accelerated depreciation, as well as generation-based incentives – accordingly, both investors and utilities were driven away from wind power investments. This leads us to our point: wind investments are still not commercially viable without preferential tariffs due to the highly variable nature of generation – but solar is relatively stable and predictable.

While capital costs for wind have inched up from INR 60-67.5m/MW, many state governments have raised tariffs from INR 4/unit to INR 5.50-6/unit. Also, thanks to technology advances, the PLF (plant load factor) of most projects is 21-23%, even in low wind density areas. This has led to an attractive post-tax equity IRR of 16-19% again, and investments are picking up.

In solar, the capital cost per MW has plunged from INR 180m (USD 3m) in 2009 to nearly ~INR 65m/MW (USD 1m). There has been a significant improvement in technology in addition to the dramatic fall in silicon prices (the key raw material used in solar panels). Going ahead, given the glut in the supply of solar panels in China/Europe and other regions, capital costs could stabilize at lower levels.

Tariff parity almost there for the consumers

Solar power could be accepted readily in South and East India given their higher power procurement tariffs – hence, Andhra Pradesh and Telangana could remain key markets. However, a large part of development is being planned in the North and West – including Gujarat, Maharashtra, Rajasthan and Madhya Pradesh – given better solar potential and a good payment track record.

Looking at the tariffs discovered in recent bids for Solar and Coal, the parity is almost there for buyers. Importantly, with increase in coal prices, solar could look cheaper in next few years.

Figure 19: Comparison of recent Solar and Coal bids

MP Solar - Jul'2015	Tariff (INR/kwh)	AP Coal - Jun'2015	Tariff (INR/kwh)	Likely Tariff after 5 years @ 4% coal cost escalation
Bid 1	5.051	Bid 1	4.27	4.58
Bid 2	5.109	Bid 2	4.35	4.74
Bid 3	5.298	Bid 3	4.49	4.70
Bid 4	5.38	Bid 4	4.69	4.92
Bid 5	5.398	Bid 5	4.83	5.06
Bid 6	5.451	Bid 6	4.83	5.05
Bid 7	5.452	Bid 7	4.98	5.17
Bid 8	5.456	Bid 8	5.25	5.66
Bid 9	5.457	Bid 9	5.39	5.80
Bid 10	5.61	Bid 10	5.6	5.86
Bid 11	5.63	Bid 11	5.72	6.03
Bid 12	5.641	Bid 12	6.31	6.99

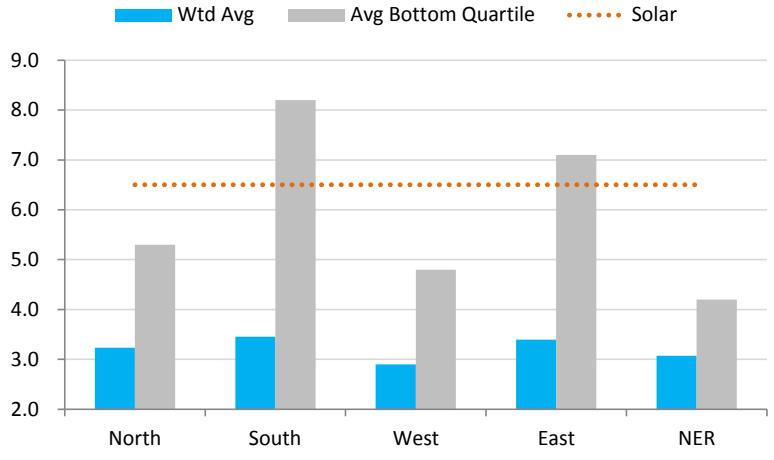
Source: Deutsche Bank, media reports

Utility/commercial-scale projects are already competitive

Commercial consumers in many major states pay the highest tariffs. Solar power is already competitive or cheaper than grid power, even without the capital subsidy in areas like South Indian states Karnataka, Tamil Nadu, Andhra Pradesh, and Telangana, and other high-industrial-tariff states like Maharashtra, Delhi, Odisha and West Bengal.

Solar power is cheaper than grid power in the high-cost states of South India and other high-industrial-tariff states

Figure 20: Comparing cost for distribution companies (INR/kWh)



Source: Deutsche Bank, CEA

Tariff parity at generation level still some time away

One of the biggest challenge solar power faces today is generation tariff parity with the grid, which means solar will need support. New solar units produce power at roughly INR 6.5 per unit. In comparison, coal-based plants produce power at INR 3 to 4 per unit. This makes solar plants unviable unless support from the government continues, either in the form of subsidies or strict implementation of Renewable Purchase Obligations.

Solar generation is still 30% costlier than coal power

We do not rule out the possibility of funding these subsidies through the implementation of a higher cess on polluting power sources, like the coal cess of INR 200/t (recently doubled in the budget for 2015).

Figure 21: Comparing parity across fuel categories

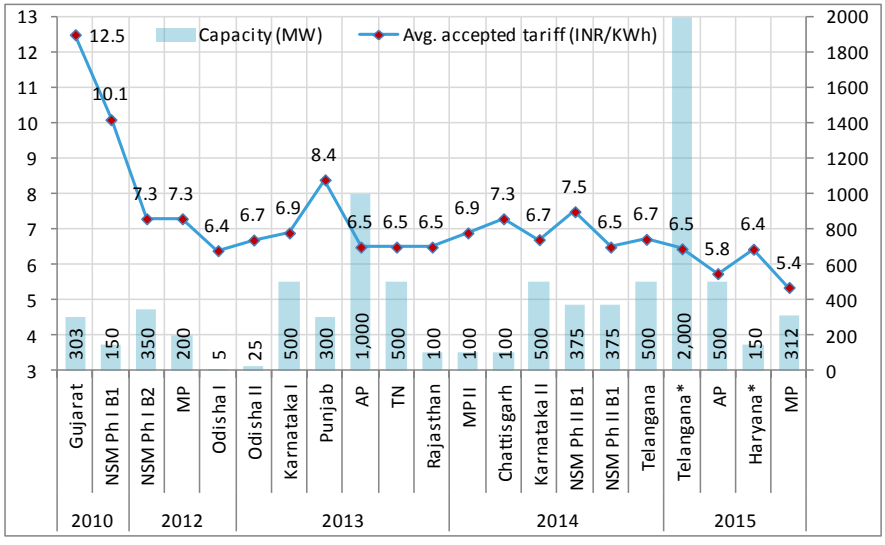
		Coal - Captive Mine	Coal - Domestic Linkage	Coal - Imported	Coal - 70:30 Domestic:Imported	Gas-domestic	Nuclear	Hydro	Wind	Solar
Total tariffs	**INR / kWh**	**3.02**	**4.05**	**5.25**	**4.54**	**5.08**	**4.72**	**5.20**	**5.33**	**6.16**
Energy Cost	INR / kWh	0.55	1.58	2.83	2.07	2.93	1.00	-	-	-
Fixed cost (inc tax and ROE)	INR / kWh	2.47	2.47	2.42	2.47	2.15	3.72	5.20	5.33	6.16
Construction period		4-5years	4-5years	4-5years	4-5years	3-4years	6-8years	6-8years	1-2years	1-2years
Project cost	INR mn/MW	70-75	70-75	70-75	70-75	50-55	100-120	85-105	65	60-65
Utilization Rate (PLF)	%	80	80	80	80	60	80	55	24	19
Units/MW	MU	7.0	7.0	7.0	7.0	5.3	7.0	4.8	2.1	1.7

Source: Deutsche Bank estimates

Decline in capital costs is driving tariffs lower…

The attractiveness of solar has largely been achieved through the use of recent competitive tariffs. Tariffs have dropped 60% over the last four years, from INR 14.90/kWh in 2010 to almost INR 5.75/kWh in 2015.

Figure 22: Tariffs discovered through central and state govt. competitive bids



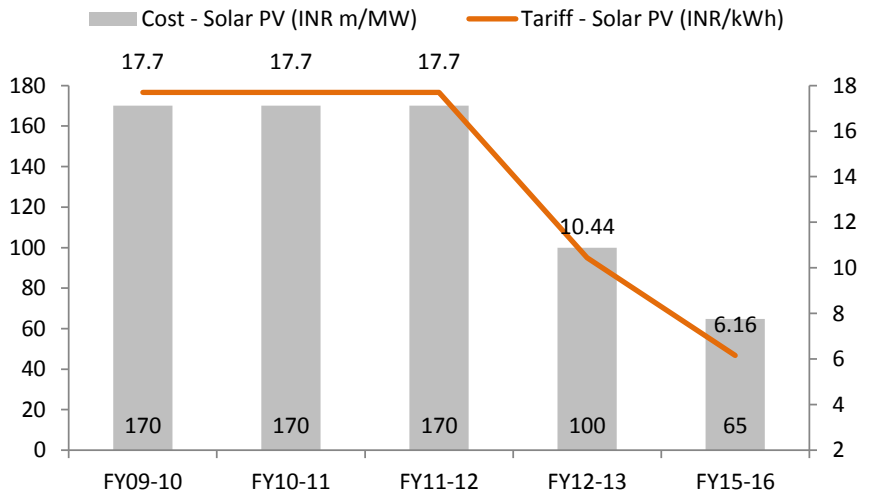
*Source: Deutsche Bank, CERC, State ERC, media reports; * Ceiling price as bid results are not yet out*

Tariffs have dropped 60% over last four years

The tariff reduction has largely been achievable due to the reduction in equipment costs and stabilization or innovations in new technology. The CERC database suggests a similar 60% decrease in capital costs, from INR 170m/MW in FY12 to INR 65m/MW, in its latest review in March 2015.

CERC database suggests a similar 60% decrease in capital costs

Figure 23: Regulator approved cost and implied tariffs



Source: Deutsche Bank, CERC

Market expectations are that equipment prices could drop a further 30-40%, largely due to technological advancements and improvement in efficiency (see details in the section on "System cost could decline"). Our analysis suggests that tariffs could be comparable to those for coal if solar equipment costs declined by another ~25%.

Market expectations are that equipment prices could drop a further 30-40%

Figure 24: Grid parity vs. capital cost – 15% decline in capital cost will make solar more attractive – Sensitivity on grid tariffs (INR/kWh)

		CUF (%)							% var
	6.16	16	17	18	19	20	21	22	from Mean
Capital Cost (INR mn/MW)	50	5.78	5.44	5.14	4.87	4.62	4.40	4.20	-23%
	55	6.30	5.93	5.60	5.31	5.04	4.80	4.58	-15%
	60	6.82	6.42	6.06	5.74	5.46	5.20	4.96	-7%
	65	7.32	6.89	6.51	6.16	5.86	5.58	5.32	0%
	70	7.86	7.40	6.99	6.62	6.29	5.99	5.72	8%
	75	8.38	7.89	7.45	7.06	6.71	6.39	6.10	16%
	80	8.90	8.38	7.91	7.50	7.12	6.78	6.48	23%
		CUF (%)							% var
	6.16	16	17	18	19	20	21	22	from Mean
Interest Cost	6%	6.67	6.28	5.93	5.62	5.34	5.08	4.85	-25%
	7%	7.00	6.59	6.22	5.89	5.60	5.33	5.09	-13%
	8%	7.32	6.89	6.51	6.16	5.86	5.58	5.32	0%
	9%	7.64	7.19	6.80	6.44	6.12	5.82	5.56	13%
	10%	7.97	7.50	7.08	6.71	6.37	6.07	5.79	25%
	11%	8.29	7.80	7.37	6.98	6.63	6.32	6.03	38%
	12%	8.62	8.11	7.66	7.25	6.89	6.56	6.27	50%

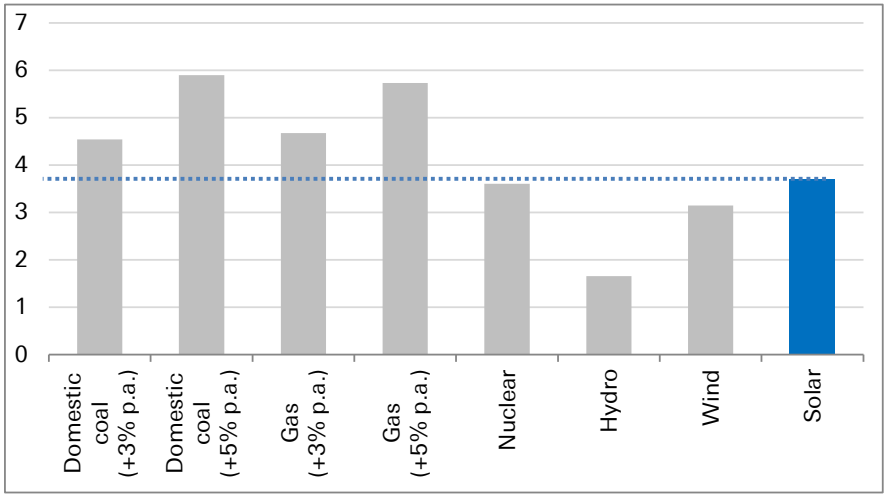
Source: Deutsche Bank estimates

…however, life-cycle cost points to parity

Wind and solar are cheap on life-cycle cost analysis

While the initial year tariff for solar looks expensive, a life-cycle cost (LCOE) analysis makes the case stronger for wind and solar power. However, the dilemma is that if there are large investments on RE, the price of fossil-fuels could remain subdued, keeping their attractiveness intact.

Figure 25: LCOE of energy sources in India highlights attractiveness of solar



Source: Deutsche Bank estimates

Disruptive power of renewables, as they achieve grid parity

Solar power scale remains relatively small, but it has potential to disrupt conventional power

For the first time in its history, in June 2014, the wholesale price of electricity in Queensland, Australia fell into negative territory – in the middle of the day – due to significant 1100MW roof-top solar power. Even as solar power's scale remains relatively small, it has the potential to disrupt conventional power due to its peak-time power capability.

The Indian power market is cost-sensitive. Regional cost curves indicate high-cost acceptability in East India, but this is less the case in other regions due to cheaper conventional power availability in the near-to-medium term. However, decentralized generation, peak-power capability and costs similar to end-user tariffs in tier-I cities could be favorable as policies support RE.

The business model for utilities depends not so much on the current generation base as on installations of new capacity. Solar could seriously threaten the latter because its growth undermines the utilities' ability to count on capturing all new demand, which historically has fuelled a large share of revenue growth.

Solar will continue to generate a small share of the overall India power supply

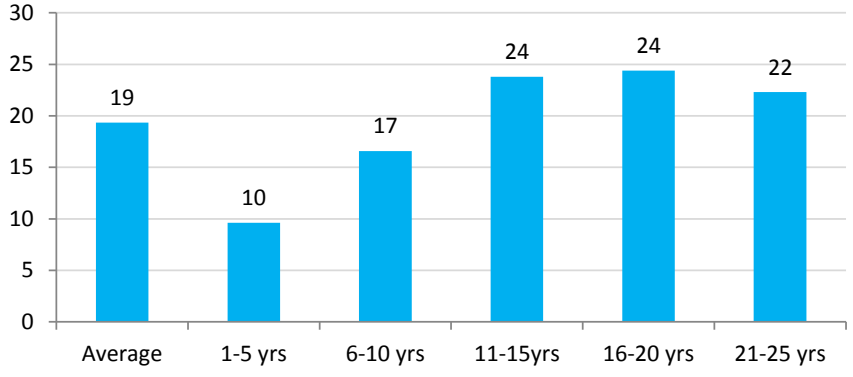
By altering the demand side of the equation, solar directly affects the amount of new capital that utilities can deploy at their predetermined return on equity. In effect, though solar will continue to generate a small share of the overall India power supply, it could well have an outsized effect on the economics of conventional utilities—and therefore on the industry's structure and future.

Solar fetches reasonable ROEs

We estimate a 19% average ROE for the lifetime of the project

While the jury is still out on solar projects' IRRs, on benchmark assumptions, we estimate a 19% average ROE for the project lifetime. Taking our cues from NTPC's 250MW Ph-I Anantpur solar project in Andhra Pradesh, the company board has approved an INR 17.8bn investment. Again, we estimate a 19% average ROE for the lifetime of the project, though we have yet to see a demonstration of on-ground data, given the investments in the sector till date have been scattered and are new, the cost of equipment is declining sharply and limited public data are available on financials. Given a flat tariff for 25 years, ROEs could be lower in the first five years with a higher interest component, but they will more than compensate in the future years; otherwise, a longer loan tenure is desirable. For detailed model, please see Figure 29.

Figure 26: ROE profile of solar project (CUF 20%, interest 8%, flat tariff 6.14)



Source: Deutsche Bank estimates

Sensitivity to the return profile is high for utilization and interest costs

Renewable projects also get the benefits of the accelerated depreciation of nearly 100% in the first year, which can help offset the full tax that the company pays on its other income. Other key parameters are equipment efficiency (PLF) and financing cost while determining the return profile.

Figure 27: Implied P/BV based on NPV @ 12.5% COE

		PLF (%)					
		17.0	18.0	19.0	20.0	21.0	22.0
Interest cost	7.0	0.93	1.10	1.27	1.43	1.60	1.77
	8.0	0.84	1.00	1.17	1.34	1.51	1.68
	9.0	0.74	0.91	1.08	1.25	1.42	1.59
	10.0	0.65	0.82	0.99	1.16	1.33	1.49
	11.0	0.56	0.73	0.89	1.06	1.23	1.40
	12.0	0.46	0.63	0.80	0.97	1.14	1.31

Source: Deutsche Bank estimates

Figure 28: Implied equity IRRs

		PLF (%)				
		18.0	19.0	20.0	21.0	22.0
Tariff (INR/kW	5.5	7.7%	9.4%	11.0%	12.7%	14.5%
	6.1	11.2%	13.1%	15.0%	17.0%	19.0%
	6.5	13.2%	15.3%	17.4%	19.5%	21.7%
	7.0	16.1%	18.3%	20.7%	23.0%	25.5%
	7.5	19.0%	21.5%	24.1%	26.7%	29.3%

Source: Deutsche Bank estimates

Figure 29: Solar Power detailed model

Key assumptions	Data	Comment	Additional data		Comment
Installed capacity (MW)	250		Depreciation Rate (SLM 10 years)	7.0%	As approved by the regulator
Months to construct	18	Between 12-20 months	Depreciation (balance 10 year period)	2.0%	As approved by the regulator
Project Life (years)	25	Standard PPA life	Salvage Value	10%	As approved by the regulator
Investment (INR bn)	17.1	As per NTPC's approved cost	Tenure of Debt (year)	15.00	As per bond period
Financing Structure (Debt/equity)	70:30	Standard in India	Tax rate for first 10 years (%)	20.0%	As approved by the regulator
Average Utilization CUF (%)	20.0	Approved by Regulators	Tax rate from 11th year onwards (%)	33.0%	As approved by the regulator
Realization (INR /kwh)	6.20	Average realizations in last 10 bids	Degradation factor	0.50%	As approved by the regulator
Interest Rate (%)	8.50	As per NTPC's recent bond yields			

Year	0	1	2	3	4	5	6	7	8	9	10	...	14	15	...	24	25
Operating metrices																	
Effective capacity (MW)		250	250	250	250	250	250	250	250	250	250		250	250		250	250
CUF (%)		20.0	19.9	19.8	19.7	19.6	19.5	19.4	19.3	19.2	19.1		18.7	18.6		17.8	17.7
Net power generation (mn kWh)		438	436	434	431	429	427	425	423	421	419		410	408		390	388
Average Tariffs (INR /kWh)		6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20		6.20	6.20		6.20	6.20
Financials (INR mn)																	
Revenue		**2,716**	**2,702**	**2,689**	**2,675**	**2,662**	**2,648**	**2,635**	**2,622**	**2,609**	**2,596**		**2,544**	**2,532**		**2,420**	**2,408**
O&M cost		200	208	216	225	234	243	253	263	274	285		333	346		493	513
Fuel cost		0	0	0	0	0	0	0	0	0	0		0	0		0	0
EBITDA		**2,516**	**2,494**	**2,472**	**2,450**	**2,428**	**2,405**	**2,382**	**2,359**	**2,335**	**2,311**		**2,211**	**2,185**		**1,927**	**1,895**
Interest		983	915	848	780	712	644	576	509	441	373		102	34		0	0
Depreciation		1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196		342	342		342	342
PBT		336	382	428	474	519	564	609	654	698	742		1,768	1,809		1,585	1,553
Tax		67	76	86	95	104	113	122	131	140	148		583	597		523	513
Tax rate %		*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*		*33%*	*33%*		*33%*	*33%*
PAT		**269**	**306**	**343**	**379**	**415**	**452**	**487**	**523**	**558**	**593**		**1,184**	**1,212**		**1,062**	**1,041**
Margin and costs analysis																	
EBITDA margin		93%	92%	92%	92%	91%	91%	90%	90%	90%	89%		87%	86%		80%	79%
Net profit margin		10%	11%	13%	14%	16%	17%	18%	20%	21%	23%		47%	48%		44%	43%
EBITDA/kWh		5.7	5.7	5.7	5.7	5.7	5.6	5.6	5.6	5.5	5.5		5.4	5.4		4.9	4.9
Net profit/kWh		0.6	0.7	0.8	0.9	1.0	1.1	1.1	1.2	1.3	1.4		2.9	3.0		2.7	2.7
ROE		**5**	**6**	**7**	**7**	**8**	**9**	**10**	**10**	**11**	**12**		**23**	**24**		**21**	**20**
Project return (INR mn)																	
Total capex	17,093																
Equity injection	5,128																
Debt balance - open	-	11,965	11,167	10,369	9,572	8,774	7,977	7,179	6,381	5,584	4,786		1,595	798		-	-
Addition/ (repayment)	11,965	(798)	(798)	(798)	(798)	(798)	(798)	(798)	(798)	(798)	(798)		(798)	(798)		-	-
Debt balance - close	11,965	11,167	10,369	9,572	8,774	7,977	7,179	6,381	5,584	4,786	3,988		798	0		-	-
PAT		269	306	343	379	415	452	487	523	558	593		1,184	1,212		1,062	1,041
Depreciation		1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196		342	342		342	342
Chg in WC		-	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)		(2)	(2)		(2)	(2)
Debt repayment		(798)	(798)	(798)	(798)	(798)	(798)	(798)	(798)	(798)	(798)		(798)	(798)		-	-
FCFE	**(5,128)**	**668**	**702**	**739**	**776**	**812**	**848**	**884**	**920**	**955**	**990**		**726**	**754**		**1,402**	**1,381**
EIRR	**15.9%**																
Project IRR	**10.7%**																

Source: Deutsche Bank estimates

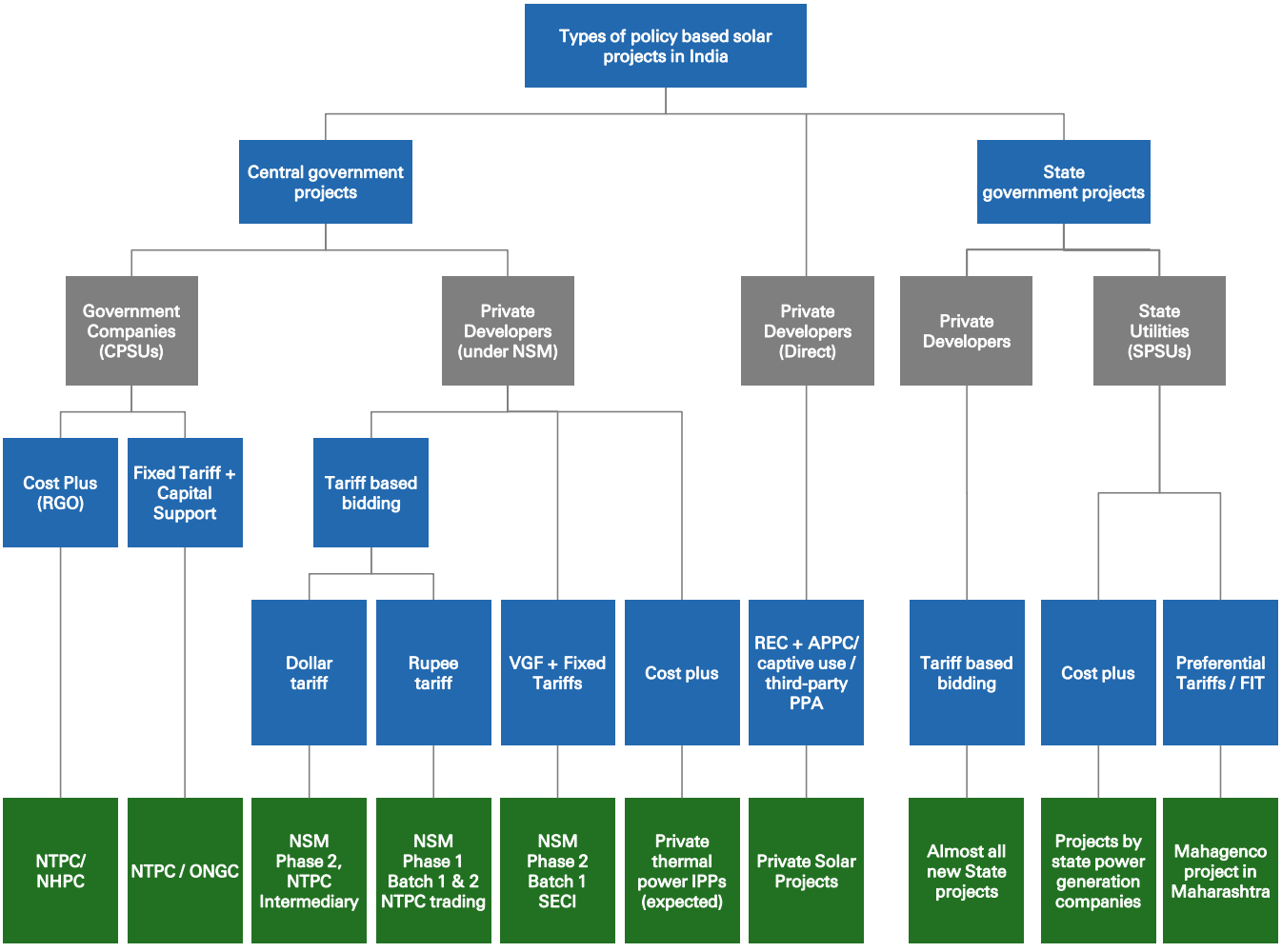
Business models in solar power

Multiple sale options—from captive group to assured tariffs

The Indian government has tested many models for solar power development, largely on the lines of conventional power projects. Feed-in tariffs (FITs) and tariff-based competitive bidding (TCB) have been the major building blocks. However, National Solar Mission (NSM) bidding has toyed with INR tariffs, dollar tariffs, fixed tariffs with subsidy, etc.

Solar plants largely have the option to choose among three sale arrangements – (1) preferential feed-in tariffs, (2) base tariffs along with the benefit of renewable energy certificates, or open access arrangement with captive group consumers and (3) tariff-based competitive bidding for NSM/state auctions. While preferential tariffs give the comfort of an assured tariff over a long-term period, open access sale arrangements essentially offer power to bulk industrial consumers at a discount to grid tariffs, which can enhance the return profile.

Figure 30: Business model and policy-driven development in solar



Source: Deutsche Bank, Industry data

Fiscal incentives enhance the return profile

- **Feed-in tariffs (FIT)** – Preferential tariffs provided by central and state regulators are based on standard 15-16% post-tax ROE.
- **Concessional transmission** – RE not only gets priority in merit order dispatch, but also gets the benefit of no allocation of inter-state transmission charges or losses. Additionally, there is a concessional cross-subsidy surcharge for intra-state transmission of solar power.
- **Renewable Purchase Obligation (RPO)** – RE target of 15% by FY2020E (of which 8% will be solar) will be the primary driver of capacity addition.
- **Renewable Energy Certificate (REC)** – RECs are issued for the projects selling power at non-preferential tariffs and which do not have RPO characteristics; RECs are traded on power exchanges at market-determined prices with floor and cap fixed by the regulator.
- **Direct tax benefit** – Ten-year tax holiday under Sec 80-IA, but Minimum Alternate Tax (MAT) will be applicable.
- **Accelerated depreciation (AD)** – A company is allowed to claim 80% AD of the investment in the very first year of commissioning, which reduces the overall tax liability. The depreciation can be claimed against income from regular business that incentivized several HNIs and companies to invest in wind assets in the past, and can follow a similar method to invest in solar, especially roof-top or dedicated captive group.
- **Priority sector lending** – The Reserve Bank of India has included RE green energy investments up to INR 150m under priority-sector lending. For individual households, the loan limit will be INR 1m for the borrower.

Unprecedented push to solar power policies

Strong government policy support

Capacity additions in India will be a combination of three demand drivers: central government-driven programs, state government solar parks and parity-driven capacity addition.

Central policies

Currently, the utility scale central government allocation plan is limited to an allocation of 20GW by 2022 under the National Solar Mission (NSM). For the first batch of 3GW, the solar power bought by central agencies (NTPC) will be bundled with thermal power generated by these central government-owned companies so that it can then be sold at a competitive cost to state power distribution companies to meet their RPO.

For the other 12GW, a combination of Interest Rate Subvention (IRS) and/or Viability Gap Funding (VGF), as required until 2019, is proposed. For this, draft guidelines have been announced for an allocation of 2GW. There is also a central government policy on the creation of solar parks for a capacity of 20GW by 2022, but that is a framework policy and action will be limited to the creation of land and power evacuation infrastructure by states, for which they will receive capital support from the central government.

States will get capital support for creation of land and power evacuation infrastructure for solar parks

Interest rate subvention

The central government is working with KfW, the Asian Development Bank (ADB) and the World Bank to provide financing support in the form of interest rate subvention for rooftop solar in India. This scheme will provide debt at a lower cost of about 8.5% in comparison to the current cost of 12-12.5%. Approximately USD 2bn has been committed by these developmental banks for the scheme.

Accelerated depreciation

The policy was re-instated last year for three years. A company can claim 80% depreciation in the first year of installation. This benefit is equivalent to 25% of the capital cost and can be claimed by profitable corporate entities but is of limited use to IPPs working on MAT rates (80IA tax benefits).

National Solar Mission – 20GW by 2022

The Government of India launched the National Solar Mission (NSM) in order to test the market and provide a framework to kick-start solar power. The government adopted reverse bidding in Phase I of the JN-NSM, which helped it to gauge the market price for the booming solar sector and for building 1GW capacities. For phase II, the government kept various combinations open, like reverse bidding, viability gap funding (VGF), interest rate subvention and AD options to build 20GW by 2022. Considering the weakened ability of discoms to buy power at a higher rate, NTPC, through its subsidiary NVVN, used a bundling approach where bidding quantity was combined with NTPC's unallocated power (coal-based), thereby reducing procurement costs for discoms in phase II, batch II, as well as providing a reasonable counterparty guarantee to solar power developers.

Figure 31: Key highlights of National Solar Mission plan

Phase/ Batch	Authority	Developers	Primary buyer	MW	Criteria	Bidding status	Comments
Phase I (2010-12)	**NTPC**	**Private cos.**	**NTPC**	**1,000**	**Tariff based bidding**		**Helped in measuring benchmark price. Output was bundled with NTPC's unallocated coal based power.**
Batch I				150		Completed	Levelised tariff of Rs.10.1/unit
				500		Completed	Solar thermal
Batch II				350		Completed	Levelised tariff of Rs.7.3/unit
Phase II (2013-17)							
Batch I	NTPC	Private cos.	NTPC	750		Completed	
				375	VGF	Completed	DCR. Levelised tariff of Rs.7.5/unit
				375	VGF	Completed	Open to all. Levelised tariff of Rs.6.5/unit
Batch II	**NTPC**	**Private cos.**	**NTPC**	**15,000**			
Tranche I	NTPC		NTPC	3,000	Tariff based bidding	Not yet	Bundling with unallocated coal based power (Ratio of 2:1) and fixed Levelised tariff
				1,000		Not yet	First solar park to be developed in Kurnool district of AP
				500		Not yet	
Tranche II	NTPC		NTPC	5,000	Later	Later	To be decided later post Tranche I experience
Tranche III	NTPC		NTPC	7,000	n/a	n/a	To be decided later. No financial support from the government
Batch III		Private cos.		2,000	VGF	Not yet	Tender will be state-specific based on demand. Estimated VGF fund - Rs.2,100cr
	SECI		SECI	250	VGF	n/a	INR 1.31cr/MW for DCR category
	SECI		SECI	1,750	VGF	n/a	INR 1cr/MW for open category
Batch IV				N/A	No details	N/A	No clarity on Batch IV
Batch V				1,300			No clarity on more capacity
	SECI	CPSUs	CPSUs	1,000	VGF	Not yet	INR 1cr/MW for DCR category, INR 50lakh/MW for open category
	SECI/ Defense ministry	Defense Ministry		300	VGF	Not yet	All DCR. VGF support of Rs.750cr.

Source: Deutsche Bank, MNRE, SECI

13GW solar parks approved; 20GW total plan

The government has identified 13GW solar parks in 15 states. These have been proposed at the state level for a planned development approach, and would be provided with necessary infrastructure like land, water and transmission evacuation, with capital support from the central government.

13GW solar parks (20 nos) identified with land in 15 states

Figure 32: Special solar power zones

Sl.No.	State	Capacity (MW)	Area of Land identified
1	Gujarat	700	1407 hectares at Vav, Distt. Banaskantha
2	Andhra Pradesh	1,500	4517 hectares at Anantpuramu, Kadapa Districts
3		1,000	2068 hectares at Kurnool District
4	Uttar Pradesh	600	1038 hectares at Jalaun, Sonbhadra, Allahabad & Mirzapur districts
5	Meghalaya	20	27 hectares at West Jaintia Hills & East Jaintia Hills districts
6	Rajasthan	680	1797.45 hectares at Bhadla Phase II
7		1,000	2000 hectares at Bhadla Phase III
8		1,000	2000 hectares at Jaisalmer Phase I
9	Madhya Pradesh	750	1400 hectares at Rewa
10		750	800 & 600 hectares at Neemuch & Agar respectively
11	Karnataka	2,000	Pavagada taluk Tumkur dist. (2429 hectares)
12	Tamil Nadu	500	568 hectare at Ramanathapuram distt.
13	Punjab	500	6167 acres at Patiala, 1786 acres at Fatehgarh Sahib, (5285 hectares)
14		500	2311 acres at Ludhiana and 2790 acres at Gurdaspur
15	Telangana	1,000	2189 hectare at Gattu, Mehboob Nagar Distt.
16	Kerala	200	4858 hectares at Paivalike, Meenja, Kinanoor, Kraindalam and Ambalathara villages of Kasargode district
17	Uttarakhand	39	77.853 hectares at Almora district
18	Arunachal Pradesh	100	2700 acres of waste land Digaru Paya region in Sonpura circle of Lohit district
19	Nagaland	60	Dimapur, Kohima and New Peren districts
20	A& N Islands	100	South Andaman
	Total	**12,999**	**20 solar parks in 15 States**

Source: Deutsche Bank, MNRE

55GW state-level policy target

States have enunciated their policy targets for solar power, in line with the central government's agenda. We believe the solar parks proposed above will be encapsulated in the policy targets. The stand-out target is the one by Rajasthan with 25GW proposed capacity (out of ~54GW plans), which looks way higher than the existing peak demand of ~11GW.

Rajasthan's proposed 25GW capacity looks way higher than existing peak demand of ~11GW

Figure 33: State-level policy target

State	Policy target (MW)	Target year	Solar Policy
Rajasthan	25,000		Yes
Maharashtra	7,500	2019	Draft
Telangana	5,000	2019	Draft
Andhra Pradesh	5,000	2019	Yes
Tamil Nadu	3,000	2015	Yes
Jharkhand	2,550		Draft
Karnataka	2,000	2022	Yes
Madhya Pradesh	1,400		Yes
Punjab	1,000	2022	Yes
Chhatisgarh	500-1000	2017	Yes
Kerala	500 (2500)	2017 (2030)	Yes
Uttarakhand	500	2017	Yes
Uttar Pradesh	500	2017	Yes
Lakshadweep	150		No
Odisha	135		Yes
Haryana	100	2017	Yes
West Bengal	100	2017	Yes
Bihar	30		Draft
Manipur	5	2019	Yes
Total	**54,970**		

Source: Deutsche Bank, MNRE, State Policy documents

Major policy-level amendments

Landmark judgment by the Supreme Court (May 2015)

In a landmark judgment announced on Wednesday, 13 May 2015, the Supreme Court upheld the Rajasthan Electricity Regulatory Commission's decision forcing the appellants to procure stipulated amounts of renewable energy or pay a surcharge on non-fulfillment of the obligation.

The judgment will have far-reaching consequences with regard to the enforcement of Renewable Purchase Obligations.

- **Stay by HC in various states may become redundant**: Till date, the enforcement of RPO regulations has been lax due to various reasons. One of the reasons has been the stay granted by various High Courts like in the case of Gujarat (recently vacated), MP and Tamil Nadu, among others. With the Supreme Court now ruling in favor of the imposition of RPO, similar cases pending in lower courts may become redundant.
- **Enable stronger enforcement**: Furthermore, the order is likely to provide support to the state electricity regulators to impose RPO regulations more forcefully and effectively.
- **Industry will be a party to RPO** – Industrial consumers using >1MW power, using captive power or availing of open access will have to meet the RPO standards set by the state regulators. Hindustan Zinc, Ambuja Cements, Grasim Industries and 14 other companies challenged RPO regulations enacted by the state regulator of Rajasthan (RERC), which were ultimately upheld by the Supreme Court. This may be taken as precedence by other state regulators to force the private sector to comply with the RPO, thereby reducing the financial burden on discoms.

State regulators to force private sector to comply with RPO, thereby reducing the financial burden on discoms

Figure 34: Solar power procurement tender issued by Vedanta Limited


vedanta

Inviting bids for supplying solar power

visit www.vgcb.co.in

Vizag General Cargo Berth Pvt. Ltd.,
REGISTERED OFFICE: SIPCOT Industrial Complex, Madurai Bypass Road, P.O.: T.V.PURAM, TUTICORIN - 628002, Tamilnadu, INDIA
CIN: U35100TN2010PTC073408

EXPRESSION OF INTEREST (EOI)

Vedanta Limited (Formerly known as Sesa Sterlite Ltd/Sesa Goa Ltd), a subsidiary of Vedanta Resources plc. is a global, diversified natural resources company with business operations in India, South Africa, Australia, Ireland, Namibia, Liberia and Sri Lanka. Vedanta is a leading producer of Oil & Gas, Zinc, Lead, Silver, Copper, Iron Ore, Aluminium and Commercial Power.

Vizag General Cargo Berth Private Limited (VGCB), a Vedanta group company operating (Mechanized coal handling terminal) General Cargo Berth (GCB) at Visakhapatnam Port Trust for coal imports

Expression of Interest is invited from well-reputed, resourceful and experienced organizations interested in supplying 5 MVA power through SOLAR PV plants.

Parties with sound credentials and relevant experience are requested to submit their expression of interest along with credentials, past experience, financial details, etc., within 7 days from the date of this advertisement, at the following address:

Associate Manager-Commercial
Vizag General Cargo Berth Pvt. Ltd.,
Administrative Building,
Eastern Stack Yard, Visakhapatnam Port Trust
Visakhapatnam-530 035, Andhra Pradesh
Mob No: 07702511163, E-mail: vgcb.eoiresponses@vedanta.co.in

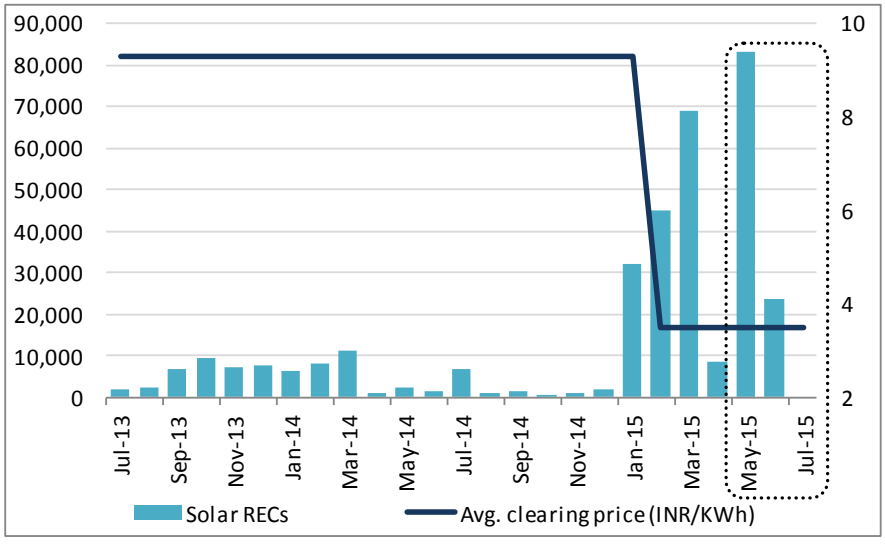
Source: Deutsche Bank, Economic Times dated 25 June 2015

Strict adherence to RPO obligations by State Regulators – order by the Appellate Tribunal (April 2015)

The Tribunal has directed the State Commissions to enforce Renewable Purchase Obligations (solar and non-solar) and invoke penal provisions in case of non-compliance. Roll-forward of targets will not be permitted. Key directions:

- **State Commissions** shall decide the RPO targets before the commencement of the Multi-Year Tariff period.
- **Distribution licensees** should have preferential tariffs for procurement of renewable energy in place before the beginning of the respective financial year.
- **Monitoring of compliance of the RPO** should be carried out periodically. State Commissions may review the RPO performance of distribution licensees after the end of each financial year and give directions accordingly.
- **Carry forward/review** should be allowed strictly as per the provisions of the Regulations, keeping in view of availability of REC. In case of default in fulfilling of RPO by obligated entity, the penal provisions as provided for in the Regulations should be exercised.
- Provisions in Regulations like the power to relax and power to remove difficulty should be exercised judiciously under exceptional circumstances, as per the law, and should not be used routinely to defeat the object and purpose of the Regulations.

Figure 35: REC trading picking up following the APTEL order



Source: Deutsche Bank, IEXindia

Decisive changes in the Tariff Policy proposed (April 2015)

The Ministry of Power came out with major amendments to the Tariff Policy in April 2015, which need to be approved by the Cabinet. Its key proposals were:

- **RPO targets raised** – The government has proposed an 8% purchase obligation (RPO) by March 2019 for solar energy, from 3% earlier.
- **RGO introduced** – 10% RE capacity is proposed to be mandatory for future coal/lignite project developers to meet Renewable Generation Obligations.

Existing developers can also choose to set up RE capacity with a regulated tariff structure, which could be beneficial for NTPC's ~INR 700bn solar capex plans at its existing project sites.

State government policies also being streamlined

Apart from the 60GW utility scale projects, the government is targeting 40GW roof-top solar projects to achieve its agenda of 100GW by 2022. State government policies will play a key role in achieving those targets.

Net metering

So far, 25 states and UTs have put in place net-metering guidelines for rooftop solar installations. This will help end-users to sell excess power back into the grid and make projects viable in case of low/no demand internally.

State policies

Tracking the state-level allocations is a little more complicated. Theoretically, they are supposed to be driven by RPOs. Depending on their outlook and demand for solar power, the states can broadly be divided into four categories.

- The first category includes states that are trying to be in line with or at least trying to meet the original RPO target of 3% of power consumption by 2019. For e.g., Madhya Pradesh, Uttar Pradesh and Punjab.
- The second category includes states where the cost of conventional power is high due to higher industrialization, the deficit is high and the availability of other sources of power is low. This is typical of most South Indian states such as Andhra Pradesh, Telangana, Karnataka and Tamil Nadu. These states can typically go beyond their roadmap for 3% of power from solar by 2019 as they can absorb all the power they can get.
- The third category includes states with ambitions backed by credible political development and a new investment agenda. In the current context, this would be applicable to states such as Rajasthan, Maharashtra and Gujarat, which have announced large targets. Currently, these states are ruled by the same political party (BJP/NDA alliance) as the central government and may have been prepped to aim for the 8% solar RPO target by 2019, which is in the process of being raised from 3%.
- The fourth category includes states that do not yet seem to have placed solar power high on their priority list. This includes states in Eastern India such as West Bengal, Bihar, Jharkhand and Odisha and also most North and Northeastern Himalayan states. However, a few states recently became associated with the solar park policy, and have been included in active development.

States making steady progress

The parity-driven market for solar is largely driven by the cost trends of conventional power and regulations in different states. Almost all new state policies encourage both open access sales of solar power through waivers in open access charges and cross-subsidies, and rooftop-based solar power through net-metering regulations. States that run a deficit and can absorb more power at higher costs tend to have more pro-solar regulations. This includes the South Indian states of Karnataka, Andhra Pradesh and Telangana, as well as Rajasthan in the west. However, states that have high power costs but may have sufficient power tend to be a little more restrictive. This includes states such as Maharashtra and Gujarat. These states may also have more pro-solar regulations in the future if the political backing for solar goes beyond announcing high targets for government-backed projects.

Figure 36: Progressive states are making a big stride forward

State	2012-13	2013-14	2014-15	Growth YoY
Rajasthan	301	667	1,128	69%
Gujarat	824	860	953	11%
Madhya Pradesh	12	130	637	390%
Maharashtra	76	150	354	136%
Punjab	0	9	239	2470%
Andhra Pradesh	77	93	228	145%
Tamil Nadu	19	32	164	416%
Karnataka	79	31	104	235%
Telangana	0	0	83	NA
Uttar Pradesh	0	0	73	NA
Total Installed Capacity	**1,388**	**2,208**	**4,000**	**81%**

Source: Deutsche Bank, MNRE

Rajasthan: Rajasthan is targeting ~25GW over the next 7-8 years through state or private enterprises or through public-private partnerships. Rajasthan, also run by the BJP and Chief Minister Vasundhara Raje Scindia, is busy attracting investment. Rajasthan has installed capacity of 1128MW, while projects of ~600MW are under implementation. Rajasthan receives maximum solar intensity in the country and has low precipitation, and there are large stretches of land available to set up projects.

Rajasthan revised its Solar Energy Policy in 2014, allowing projects to use agricultural land without land use change. This resulted in proposals and joint ventures of 32GW from corporate houses such as Adani Enterprises, Reliance Power, IL&FS, Essel Infra, Azure Power and US-based SunEdison. Rajasthan Solar Park Development, a state government subsidiary, is developing two solar parks of 1,400MW at Bhadla and 1,000MW in Jaisalmer.

Andhra Pradesh: The total installed capacity in Andhra Pradesh is 228 MW; the target is to take it to 5,000MW in the next few years (by 2019). Chandrababu Naidu, the BJP's ally in the National Democratic Alliance, was the quickest among the chief ministers to get an in-principle nod for two solar parks in Kadapa (1,500MW) and Kurnool (1,000MW) districts of Andhra Pradesh on 28 November 2014. Kadapa would be the country's largest solar park. NTPC signed an agreement with the state government to develop 1GW solar power projects in the state.

Tamil Nadu: In 2012, Tamil Nadu implemented a 3GW target by 2015. Of the 3GW target, 350MW was reserved for rooftop. In addition, the Tamil Nadu Energy Development Agency (TEDA) announced plans to set up solar rooftop projects at about 300 government buildings across the states that requested tender offers. However, the state has made little progress towards the 3GW goal and had an installed capacity of only 164 MW as of March 2015. To increase the pace of installations, Tamil Nadu's electricity regulator ordered the state's distribution utility to pay a tariff of INR7.01/kWh (USD0.11/kWh) for power from solar PV plants and INR11.03/kWh (USD0.18/kWh) to plants using solar-thermal technology (or less, depending on the treatment of depreciation benefits).

Karnataka: The state government has announced a 2GW target by 2022, which would be in addition to solar capacity coming from private project developers. Under the policy, the government would auction 1.6GW capacity for utility scale projects, while ~400MW would be added in the form of rooftop grid connected projects. The government also plans to implement a net metering policy to complement this program and provide financial incentives to households and commercial buildings.

Punjab: The Indian government recently announced plans to set up a 2GW solar power plant in the state of Punjab. Additionally, the state government is planning to set up 100MW of rooftop solar power projects on all government buildings, and to install 10,000 solar-powered irrigation pumps.

Madhya Pradesh: The state agencies are working to start 2,000MW of solar farms at Rewa, Neemuch and Agar on about 28 hectares of wasteland.

Maharashtra – On 6 June 2015, the Maharashtra Cabinet approved achieving 14.5GW of new renewable capacity in next five years, consisting of 7.5GW of solar capacity. The procurement of electricity will be done under RPO through competitive bidding.

Risks to the solar story

1) Commerciality and impact on distribution utility financials

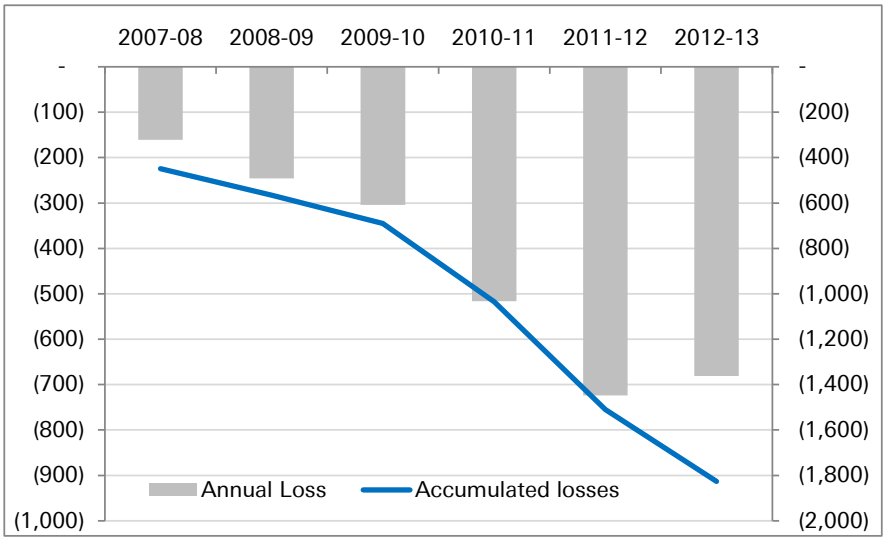
Utilities need to fund an additional ~INR 170bn on a switch to solar

For renewables there are a lot of hurdles in store. We are particularly worried by the weak financials of state discoms (SEBs), the key buyers of electricity, who are finding reasons to support cheaper conventional power. Since the cost of renewable power is currently higher, SEBs may be reluctant to turn to RE, even as various state governments have mandated them to buy a certain portion of their power from renewable sources. Many large SEBs are under-recovering cost of power due to high T&D losses, non-remunerative tariffs as well as subsidized supplies, and hence have huge accumulated losses.

Central government is looking to subsidize solar power

Though it is clean energy, questions of viability are still pertinent as solar energy costs INR 6-7/unit against the average cost of power generation of INR 4-5/unit today for conventional power. The central government is looking to subsidize this power, until the cost of solar power declines further, through various means: 1) bundling of power with 60-70% coal-based power; 2) subsidy provided through viability gap funding (VGF)-based bidding; and 3) dollarized tariffs to attract technology leaders and cheaper capital globally (we are not sure who will bear the currency risk, but bids are being planned to be hosted by NTPC/PTC).

Figure 37: Financial losses of state distribution companies (INR bn)



Source: Deutsche Bank, PFC

The cost of solar energy is closer to peak-load prices, and almost 2x higher than the base cost of power purchase for distribution utilities. Hence, utilities would need to shell out ~INR 170bn more (assuming INR 2/unit as incremental tariff) by 2020 to support solar energy. However, if conventional energy (coal) costs increase by 5% p.a., then the utilities will end up paying ~INR 110bn more for using renewable energy vis-à-vis conventional energy sources, and cost reduces if we use the lifetime costs.

How would SEBs pass-on the additional cost burden to end-consumer, when they are already under-recovering cost of power, is the pertinent question then.

- Firstly, for the industry, as per the recent Supreme Court ruling, state distribution companies will pass-on that burden to the industry to meet their individual RPO obligation (as set by the State Regulators), instead of SEBs (covered in detail in the Policy section). This is similar to the case in China, where Power Grid charges a renewable surcharge to all non-residential users to recoup their procurement of high-priced wind/solar.
- Secondly, central government is charging an environmental cess of INR 200/t on coal; which can increase to INR 300 by an executive order- allowed in 2015 Central budget.
- Thirdly, additional resources are being provided to the States through proceeds from coal mine auctions, and hence, state subsidy will also hold the key. For e.g., UP provides budgetary support for solar power purchases.

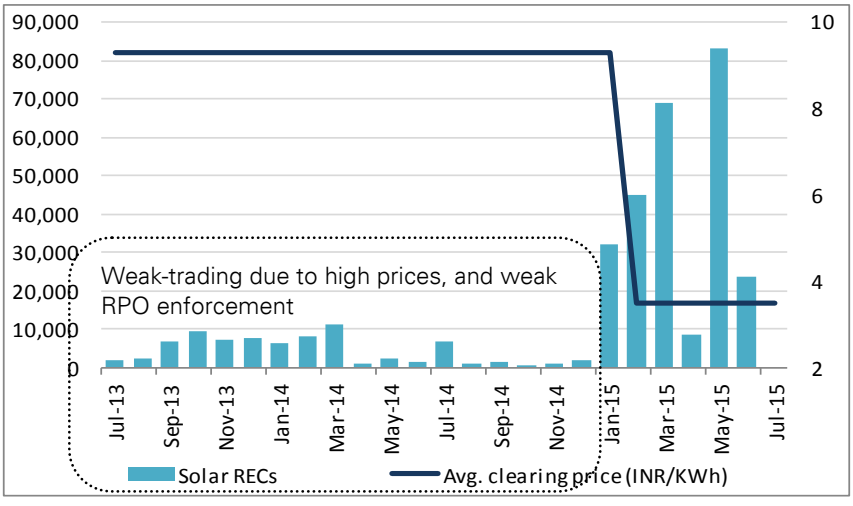
Roof-top solar makes good sense for the end-consumer by fixing tariffs for 20-25 years, and consumer tariffs are similar to cost of solar. Additionally, consumers have the ability to sell energy back to distribution utilities, as most states have adopted net-metering.

2) RPO obligations not strictly enforced

Renewable purchase obligation—Apathy on the part of the state government to meet their purchase obligations under renewable power saw assets being underutilized. State utilities had argued that the previously prohibitive cost of renewable power made it uneconomical to meet purchase obligations.

REC prices—Under the REC sales mechanism, the generating plant is susceptible to both (1) off-take risk and the tariff at which it will be sold, and (2) price at which REC will be sold as well as liquidity in the REC market. We note that CERC recently lowered the floor price for RECs from INR 9,300/REC (INR 9.3/unit of power) to INR 3,500/REC, largely due to the prohibitively high price leading to reluctance from procuring states.

Figure 38: REC trading picking up following the APTEL order



Source: Deutsche Bank, IEXIndia

3) Grid constraints

India is planning to add 100GW solar power capacities by 2022E, from the mere ~3.8GW capacities as of March 15. In contrast, China is targeting 100GW capacities by 2020, from 28GW installed capacities as of December 2014. Potential grid congestion has been a critical issue in China to achieve the installation targets, as per our regional utilities head Michael Tong.

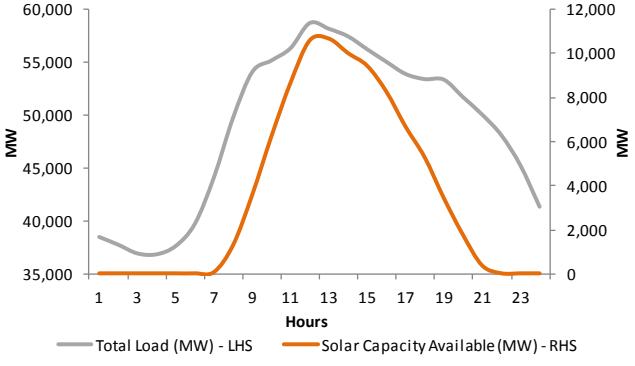
India's grid infrastructure investments have also been inadequate historically, in comparison to investments made in the power generation sector. Many conventional power projects are facing constraints in evacuation. Given the dispersed nature of resources and demand centers in India, transmission is an absolutely critical requirement to meet the targets.

Will wind power constraints in TN be repeated with solar grid constraints?
Although RE gets priority in merit order dispatch, wind power faces evacuation constraints in Tamil Nadu (TN). This is due to the fact that evacuation infrastructure in not available to sell this power outside the state. An even bigger problem is that secondary power support (or ancillary support) is not available in India, when at 6pm solar power dips sharply and peak-load starts – this secondary support is provided by either gas-based projects or pumped-hydro schemes, which are absent or grossly inadequate. This is the single biggest problem the country will face in the integration of standalone solar power, and hence, we prefer NTPC's model of bundling solar power with coal-based power, which can act as a source of tertiary support to the grid.

Grid integration is the single biggest problem the country will face in the integration of solar power

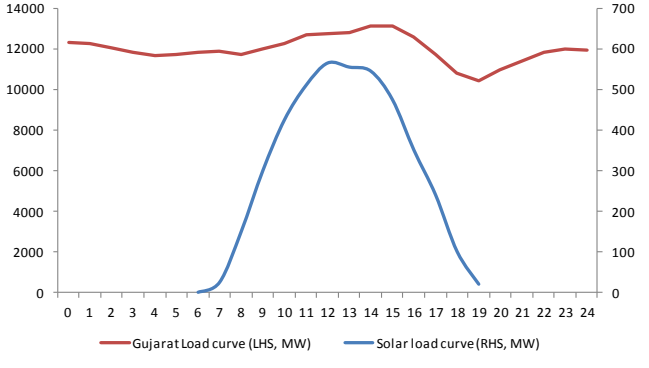
The load profile data comparison for Germany (largest solar market) and Gujarat (advanced state on solar) suggests that whereas in Germany the load profile matches with the solar output, in India, during the peak demand time of 6-8pm, solar power dips considerably. This is likely to escalate integration issues given that secondary power support from gas or pumped hydro is very limited or non-existent in India.

Figure 39: Germany load profile (13 August 2014)



Source: Total Load - ENTSO-E, Solar Capacity Available - EEX Transparency Platform

Figure 40: Gujarat – Solar load curve vs. demand catered (7 June 2015)



Source: SLDC Gujarat

Power Grid has been entrusted to create an evacuation infrastructure for RE – with planned INR 188bn capex. States will pump in an equal amount of INR 205bn for strengthening their respective grid infra. In fact, execution of projects on-ground has commenced, with Power Grid approving ~INR 75bn investments for the creation of a Green Energy Corridor Inter-State Transmission System (ISTS). Funding is provided by KfW (Germany) for Euro 500m.

Execution of projects on ground has been commenced by Power Grid

Figure 41: Green Energy Corridor planned for evacuation of solar power

S.no	Particulars	Estimated Cost (INR bn)
1	Intra State Transmission System Strengthening = (A)	205
1A.	For absorption of power within the state	94
(i)	Tamil Nadu	26
(ii)	Andhra Pradesh	11
(iii)	Gujarat	15
(iv)	Rajasthan	38
(v)	Himachal Pradesh	4
1B.	Other Intra State Strengthening	111
2	Inter State Transmission System (ISTS)	188
2A.	ISTS Strengthening	173
2B.	Other ISTS Strengthening	16
3	Dynamic Reactive Compensation	6
4	Real Time Dynamic State Measurement Scheme as well as Communication Systems	5
5	Energy Storage	20
	Total Inter State Strengthening (Sum of item 2 ,3 , 4, and 5)= (B)	**219**
6	Cost of Establishment of RE management Center = (C) 6 RE rich state, one each for NLDC / 3 RLDC)	2
	Grand Total (Sum of items A, B & C)	**426**

*Source: Deutsche Bank, Power Grid; *Estimated cost on 2012 price levels*

Figure 42: Proposed Transmission Plan to evacuate RE from six big states

Source: Deutsche Bank, Power Grid, Forum of Regulators

4) Limited domestic manufacturing

India's solar module manufacturing capacity at ~1.4-2.5GW per annum is woefully inadequate to meet the annual demand for ~5-15GW. It requires 400m units of solar modules when the country's solar module makers can manufacture only 70m units in seven years. However, in February, Adani Enterprises and SunEdison formed a joint venture to set up a PV panel manufacturing capacity at Mundra. SunEdison in a communiqué shared that this JV will invest USD4 bn in next three years. One of the biggest Chinese PV manufacturers, Trina Solar, is in talks with Reliance Industries to set up a similar capacity. For details, refer to Figure 80: Domestic manufacturing is grossly inadequate in India".

5) Returns and reliability of data

We estimate a 19% average ROE for the lifetime of the project, though we have yet to see a demonstration of on-ground data. Given that the investments in the sector till date have been scattered, the cost of equipment is declining sharply and limited public data are available on financials, it is difficult to analyze whether the projected return profiles will actually be achieved or not. We have therefore enumerated the ROEs of globally listed solar energy developers. The latest data released by MNRE on operations of NSM projects show good 19-21% utilization rates.

Figure 43: Returns of solar energy developers globally have not been consistent

Solar developers	Recom	TP	ROE		
			2015E	2016E	2017E
First solar	Buy	68	6.2	4.7	n.a.
SunEdison	Buy	40	-50.8	7.9	n.a.
Nextera Energy	Buy	113	12.1	12.1	11.9
NRG Yield	Buy	31	1.9	4.6	2.6
Terraform power	Buy	50	2.1	3.1	6.6
Canadian solar	n/a	n/a	22.9	24.7	11.2
Abengoa yield	n/a	n/a	4.8	6.5	7.2
Median			**4.8**	**6.5**	**7.2**

Source: Deutsche Bank, Bloomberg Finance LP for n/a recommended companies, TP and recom as of 17 July 2015

6) Land availability

To meet the solar targets, another big impediment is likely to be the land acquisition hurdle. Every 1MW requires approx 5 acres of land; therefore 100GW would require 2,000 sqkm of land (equivalent to Delhi and Mumbai put together), when the country is already embroiled in a raging debate over the land acquisition law and its compensation.

100GW would require land area equivalent to Delhi and Mumbai put together

7) Funding constraints

Solar power capacity would require around USD 40bn worth of debt for the country to reach the 60GW of utility-scale solar it aims to install by 2022. The majority of this is planned to come from international sources such as the World Bank as well as investments by international solar companies.

The Indian banking system is laden with dubious debts of ~INR 2.7tn, as well as additional unrecognized stress. Additionally, the banking system is already close to the sectoral ceiling of ~15% for the infra sector. Of the INR 60tn of bank advances, more than INR 9.5tn has been advanced to the power sector.

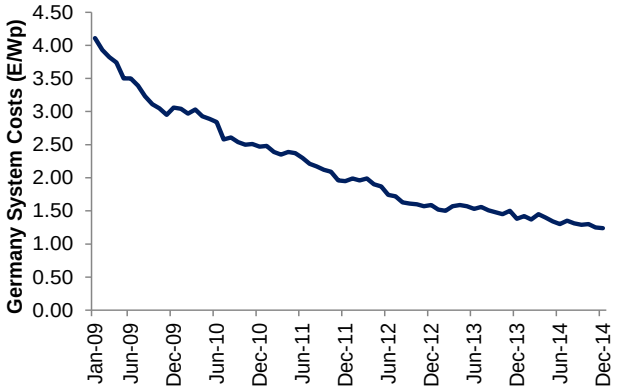
The Government of India may also approach bilateral and international donors and the Green Climate Fund to achieve this solar energy target. The USD 10bn Green Climate Fund is a new international mechanism intended to help poor countries develop in a low-carbon capacity. Meanwhile, the public sector banks (PSBs) in India have committed INR 600 bn (USD 10bn) towards the revised solar energy target, with the State Bank of India and PNB making major commitments.

System cost could decline

System cost has declined by ~70%

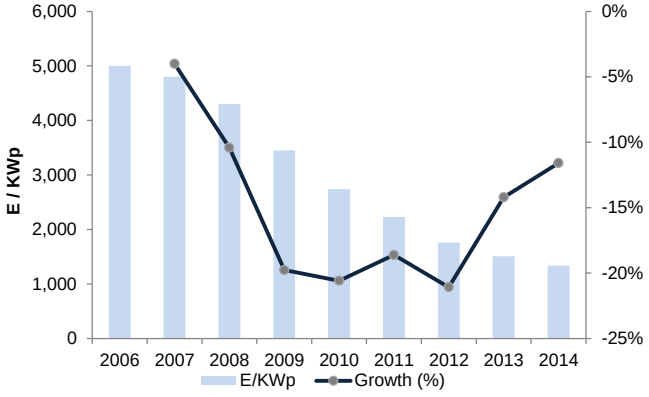
System prices in Germany (which has the most developed solar PV markets and highest installed base of ~38GW in the world) have dropped ~70% since 2009, supported by the drop in module prices by ~80% since May 2009. These cost declines were due to technological advancement and competition. Apart from these factors, adverse regulatory changes in Germany and Spain also played an important role in increasing price pressure, as they led to an oversupply situation. As a result, major players had to take a hit on their margins and focus on technological advancement, making solar more competitive.

Figure 44: German solar PV system costs declining



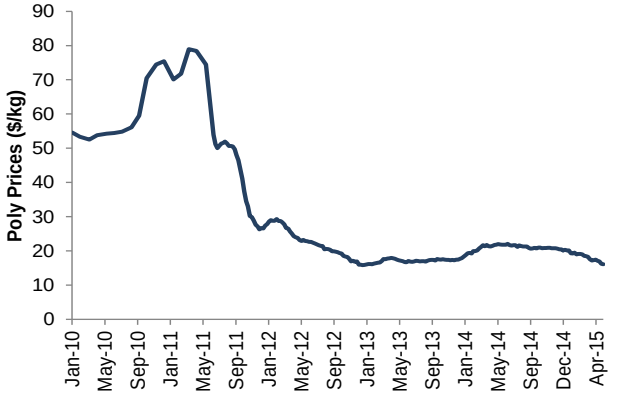
Source: Photovoltaik Guide

Figure 45: YoY decline in cost of equipment



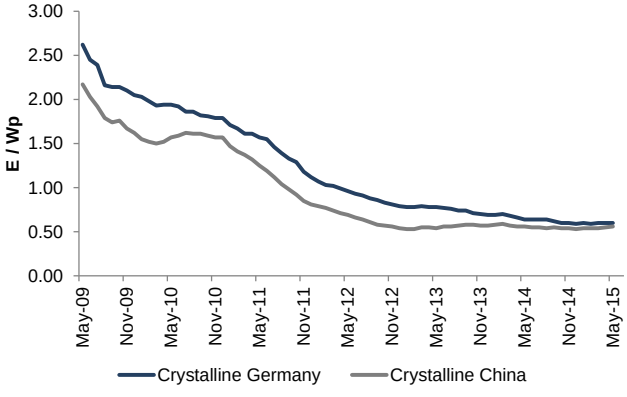
Source: Deutsche Bank, Solar server

Figure 46: Spot polysilicon average prices



Source: Deutsche Bank, BNEF

Figure 47: Module prices decline



Source: Deutsche Bank, Solar server

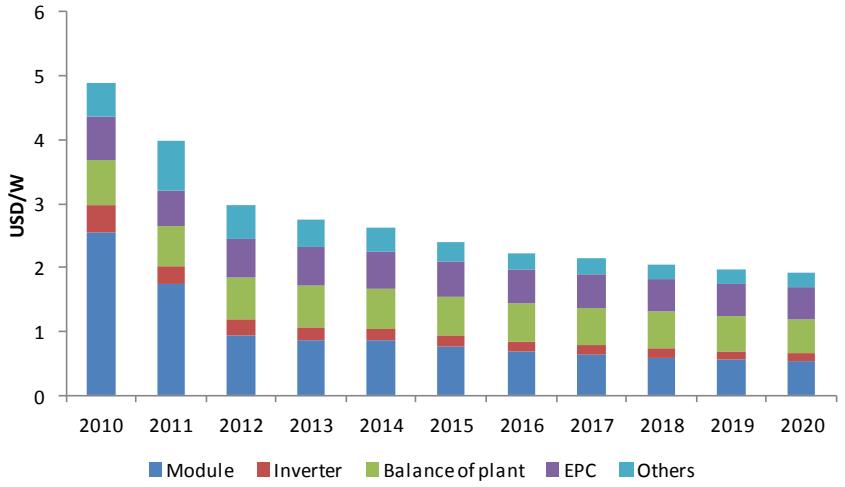
Cost could further reduce by 30-40%

~30-40% reduction in costs over next 4-5 years

Our US solar team in its latest report *Crossing the Chasm* by Vishal Shah, published on 2 March 2015, expects a ~30-40% reduction in costs over the next 4-5 years as current solar module costs continue to decline, increasing panel efficiencies and leading to a decline in the balance of system costs due to scale and increasing competition.

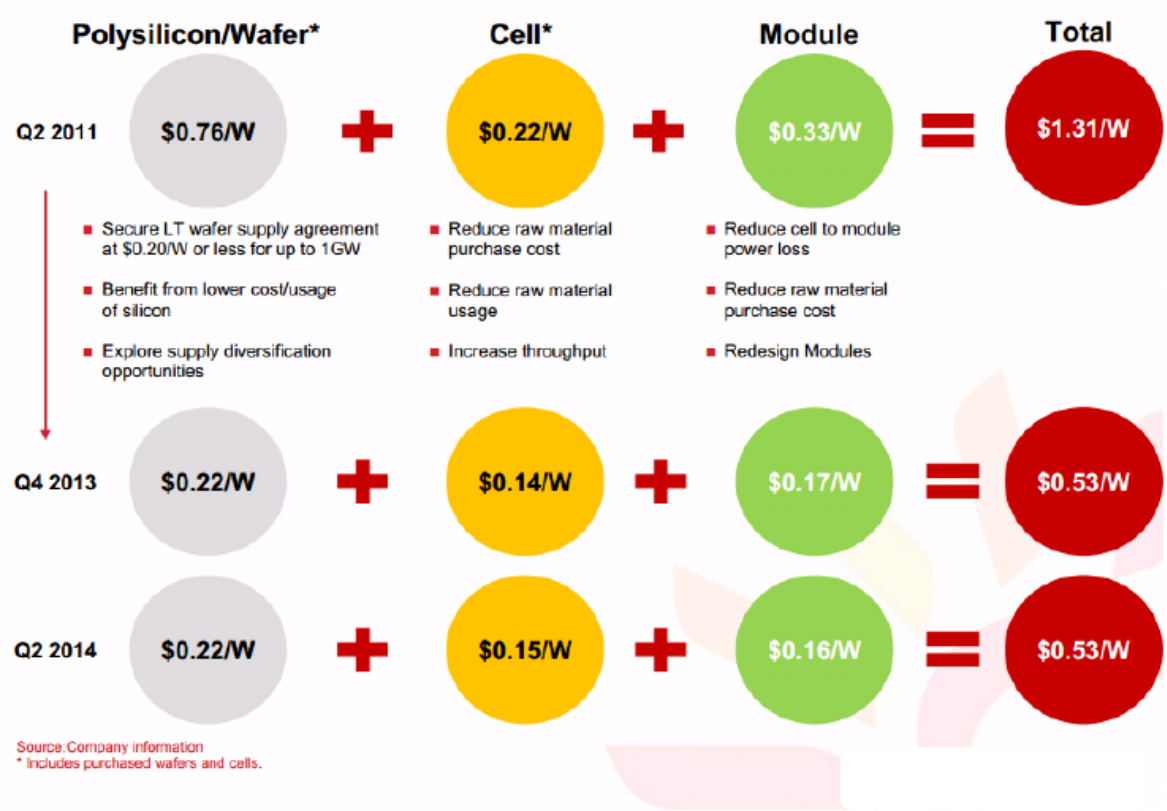
Historically, polysilicon has accounted for major cost reduction; however, in the coming years major reductions are expected to come from other system costs. Efficiency improvements are expected to further reduce the cost of cells and modules. Apart from this, balance-of-plant costs, such as inverters, mounting structures and cables, could fall faster than modules. The solar team expects EPC cost reduction to come from economies of scale. Other costs could decline with solar gaining acceptance and the process becoming more standardized.

Figure 48: Projected solar PV system deployment cost (2010-2020)



Source: Deutsche Bank, IRENA

Figure 49: Canadian Solar cost reduction history



Source: Canadian Solar

Capital cost reduction – efficiency enhancements in technology are key

Capital cost still accounts for the majority of the cost in India (~56%), which leaves scope for further cost reduction and efficiency enhancements.

Figure 50: Benchmark capital cost for solar PV projects in India

Particulars	Capital Cost (INR mn/MW)	% of Total Cost
PV Modules	36	56%
Land Cost	1.8	3%
Civil and General Works	5	8%
Mounting Structures	4	6%
Power Conditioning Unit	5	8%
Evacuation Costs	6	9%
Prelim & Pre-Opp Expenses including IDC and contingency	6	9%
Project Design & Management	1	2%
Total Capital Cost	**64.8**	**100%**

Source: CERC

Thin-film technology drives solar adoption in India

Although government policies in India have been technology-agnostic, cost and performance factors have weighed in favor of PV – specifically, thin-film PV technologies domestically. This is in contrast to the global scenario, where thin-film accounts for only ~10% of total PV capacity (2013 data).

PV over CSP

The Jawaharlal Nehru National Solar Mission (JNNSM) had accorded equal emphasis to both Photovoltaic and CSP technologies, allotting 500MW for each to be commissioned by March 2013. Only a small portion of CSP capacity had been commissioned, and reports suggest that it is facing issues to meet rated utilization. Two major reasons for the delays in commissioning CSP plants are (1) challenges in obtaining heat-transfer fluids from US suppliers and (2) dust levels reducing solar irradiation levels at locations where CSPs have been planned.

Figure 51: Technology comparisons across Crystalline-Silicon and thin-film PV systems

Technology	Efficiency	PV module costs	Area Needed / kW	Temp. Coeff.	Market Share		Adoption	
					Global	India	Global	India
Crystalline-Silicon (c-Si)	15%-19%	0.616 USD/W	7 - 8 sq.m	-0.4 %/K	90%	45%	Popular for mature systems with large-scale production Has been traditionally more expensive than thin-film but more efficient	Slower adoption, driven by Domestic Content Requirement during JNNSM Phase 1 Falling poly-silicon prices has reduced price differentials between the two technologies
Thin-Film	8%-11%	0.652 USD/W	11 sq.m	-0.2%/K	10%	55%	Emerging technology, lower efficiency being a drawback Module efficiency improving with better technology	Performs better in Indian weather conditions due to lower temperature coefficient Preferred in dusty conditions as they are easier to clean

Source: Deutsche Bank, IRENA

Thin-film over Crystalline-Si

Globally, efficiency considerations and land availability constraints have tilted the balance in favor of c-Si PV projects. However, key factors have contributed to the popularity of thin-film technology in India-

- Lower temperature coefficient makes thin-film more appropriate to use in hot Indian weather.
- Thin-films are easier to clean and preferred in dusty environments.
- Phase I of the JNNSM mandated domestic content requirements (DCR) were only for c-Si but the criteria was relaxed to include thin-film (this differential treatment was subsequently removed during Phase II).
- Performance-wise too, contrary to technology standards, thin-film PV installations have performed as efficiently as c-Si within India.

Figure 52: Performance of Crystalline Silicon and thin-film PV technologies in India

	Average Power Generated (kWh per MW per month)				Average CUF			
	2013		Jan - March 2014		2013		Jan - March 2014	
Technology	Batch I	Batch II	Batch I	Batch II	Batch I	Batch II	Batch I	Batch II
Crystalline-Silicon	151,450	152,035	143,926	151,143	20.75%	20.74%	19.99%	20.99%
Thin-Film	150,735	149,113	152,162	154,397	20.65%	21.42%	21.13%	21.44%

Source: Deutsche Bank, MNRE

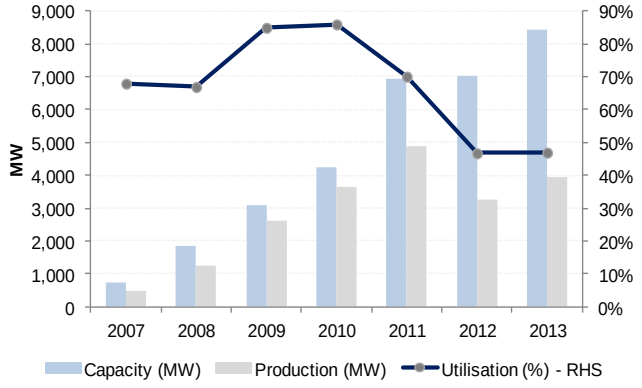
Growing thin-film production could further reduce module costs

Increase in capacity utilization and additional capacity in China key to reducing thin-film module prices

With thin-film gaining prominence as the preferred technology source in India, project cost reductions will be driven by global trends within this technology. Two key reasons suggest that the reduction in costs for thin-film-based PV projects is sustainable in the 2014-2019 timeframe.

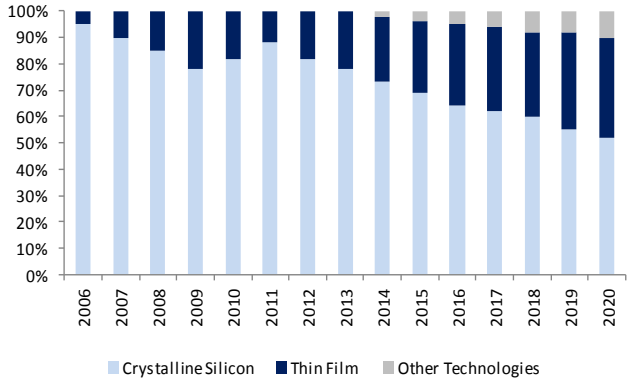
- Increase in capacity utilization – There has been significant capacity ramp-up for thin-film based PV modules over the last two years (Figure 53). This increased capacity is expected to improve production volumes over 2014-15.
- Capacity expansion within China – Thin-film production capacity has been dominated by US-based First Solar. Chinese manufacturing capacity has been focused on crystalline Silicon technology so far. These indicate a steady rise in thin-film capacity going forward (Figure 54). As a reminder, research by the European Photovoltaic Industry Association (EPIA) indicates that thin-film PV modules have a Learning Rate of 22%, i.e. costs decline by 22% for every doubling of capacity.

Figure 53: Global thin-film production capacity



Source: Deutsche Bank, Hanergy Global Renewable Energy Report 2014

Figure 54: Contribution of thin-film to total solar capacity



Source: Deutsche Bank, Hanergy Annual Report (March 2014)

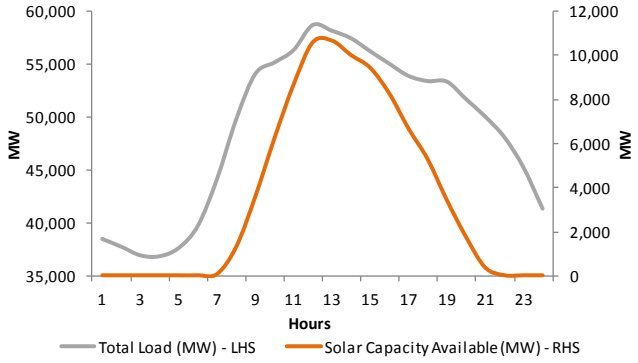
Limited scope for solar to reduce peak load demand

Solar less likely to reduce peak demand requirements

Although the uptrend in solar PV installation in India is encouraging, it will likely have a limited role to play in reducing peak load demand in India, in our opinion. This is in contrast to other developed markets, where solar power has contributed to meeting peak load demand and thereby reducing the on-peak power prices. Germany's peak electricity demand at midday is about 60GW, and solar power contributes to 30-40% of the country's peak electricity demand (Figure 55). Similarly, on 1 July 2014, solar power contributed to 60% of the peak load demand in the Queensland State in Australia, causing peak power prices to turn negative.

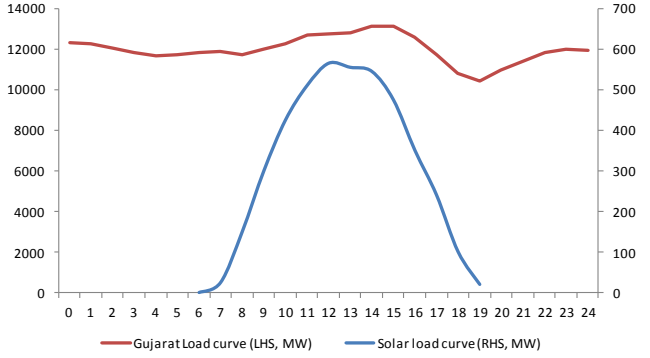
The possibility of solar power reducing peak demand in India remains low. Firstly, existing solar capacity when compared to peak load in many states could be too low to make a material impact. We compared solar load availability data for Gujarat, the erstwhile largest Indian state in terms of solar capacity, along with the state's peak load curve (Figure 56). The analysis indicates a divergence between peak solar capacity availability (1.30 PM) and peak demand period (morning peak between 10 AM – 12 noon and evening peak between 4 PM – 7 PM).

Figure 55: Germany load profile (13 August 2014)



Source: Total Load - ENTSO-E, Solar Capacity Available - EEX Transparency Platform

Figure 56: Gujarat – Solar load curve vs. demand catered (7 June 2015)



Source: SLDC Gujarat

Companies that are positioned to benefit from the Indian Solar boom

Solar power capacity addition could surpass coal power

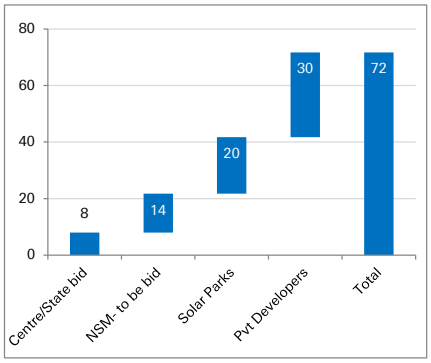
We are raising our solar power forecast by 240% to 34GW by 2020E, from a mere 14GW earlier (based on a simple extrapolation forecast). We now believe that the central and state governments have in total called bids for ~8GW, which are under construction or commissioned. In parallel, 13GW solar parks have been approved and land acquired or identified. Additionally, individual companies are making headway – NTPC with 1.5GW tenders, Adani 2GW MOU with Rajasthan / 0.65GW PPA with Tamil Nadu, etc, which gives us comfort on our new elevated projections of 30GW new capacity addition in five years.

We are not yet well-equipped to make projections for roof-top solar, given the issues related to scattered development, financing and counterparty risks. However, regulations like net-metering are making good headway in various states. Additionally, the RBI recently included Renewable Energy as part of priority sector lending for investments up to INR 150m, which will largely be beneficial for roof-top solar (as it will be easier to get cheaper credit).

Renewable Energy now forms a significant portion of total installed capacities in the country – we forecast a 20% RE from 13% currently over next five years. By 2020, solar power capacity additions and investments could surpass those for coal-based power projects.

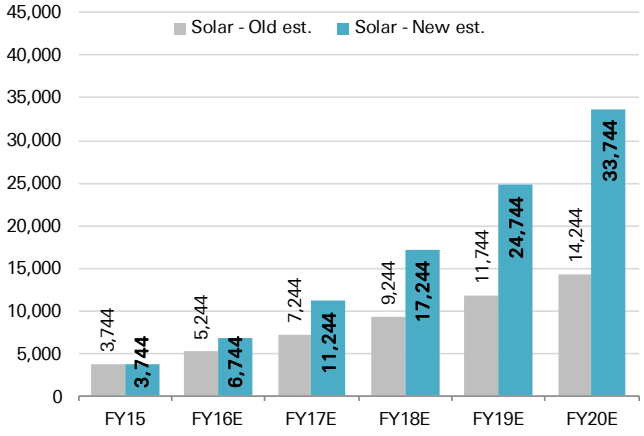
We expect share of RE to rise to 20% from 13% currently over next five years

Figure 57: Utility-scale solar energy projects under consideration



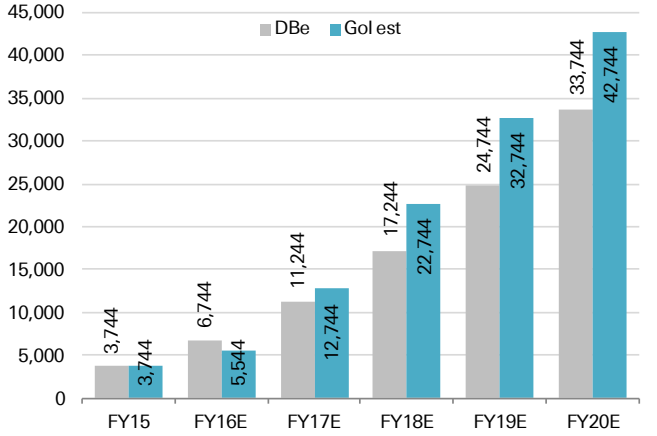
Source: Deutsche Bank estimates, MNRE, Industry data

Figure 58: Solar capacity forecast upped (MW)



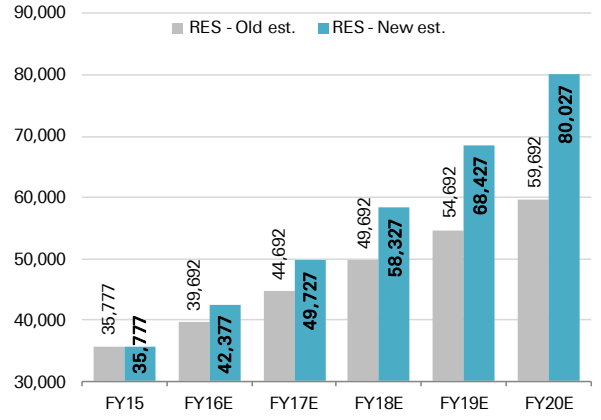
Source: Deutsche Bank, CEA, MNRE

Figure 59: GoI targets vs. our estimates (MW)



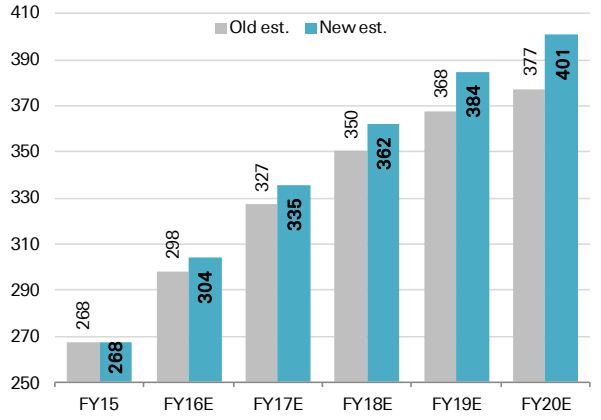
Source: Deutsche Bank, CEA, MNRE

Figure 60: New RE capacity addition forecasts (MW)



Source: Deutsche Bank, CEA, MNRE

Figure 61: New total capacity addition forecasts (GW)



Source: Deutsche Bank estimates, CEA

… followed with solar investments

Given the momentum in solar power capacity addition and slowing new coal project additions, we expect solar capex to overtake that of coal by FY19, and capacity addition in solar power to overtake that of coal in FY20, if not earlier. The new private sector capex has come to a standstill for coal-based power projects. Existing projects are facing demand constraints, low fuel availability and hence are operating at low utilization levels. Even with 8-10% demand growth, utility projects will likely not show a material improvement in utilization rates, given the legacy capacity addition of over 57GW (new 35% capacities) over the current 165GW coal capacities. Legacy projects are continuing and will likely be completed in the next two to three years.

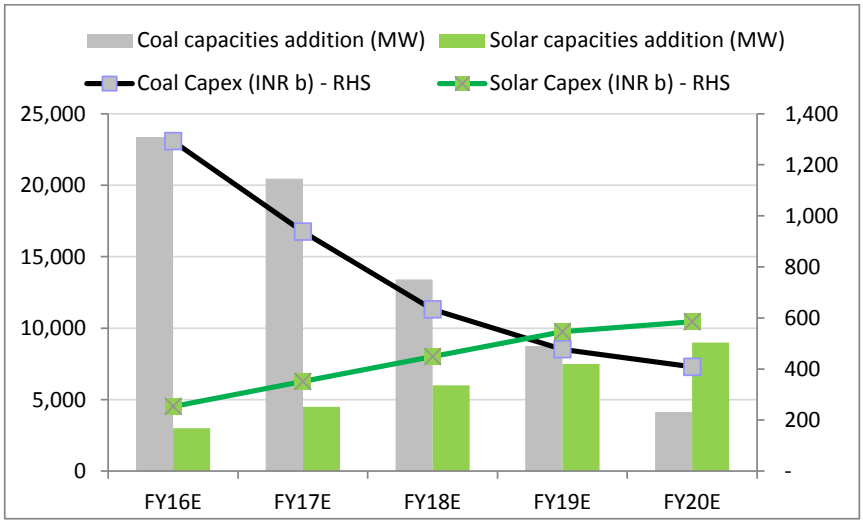
On the other hand, solar power projects are catching the fancy of not only the public sector utilities, but also old and new private sector companies, PE funds as well as international utilities.

Figure 62: Solar & Coal – Capex and capacity estimates comparison

	FY15	FY20E	FY16-20e addition
Coal capacities (GW)	165	235	70
Solar capacities (GW)	4	34	30
Coal Capex (INR b)	1,293	408	3,749
Solar Capex (INR b)	254	585	2,184

Source: Deutsche Bank estimates

Figure 63: Solar capex and capacities could overtake coal



Source: Deutsche Bank estimates

Stock implications

We foresee numerous fund-raising, yieldco structuring and M&A opportunities

Our report focuses on solar power developers among the listed utilities. Due to the scattered nature of development, solar power is being adopted by a number of companies, whether listed, unlisted, PE-backed, or utility-backed. The interest level is tremendous and we foresee numerous fund-raising, yieldco structuring and M&A opportunities.

Utility companies have started adopting Renewable Energy growth strategies

Utility companies have started adopting Renewable Energy growth strategies, given a) competitive pricing structure can impede conventional power growth if utilities do not embrace RE; b) to meet RE generation obligations; c) the government is using conventional power sources to fund renewable energy subsidies (environment cess of INR 200/t is in place and could further increase); and d) to reduce the carbon footprint.

NTPC, Reliance Power and Adani are early adopters and making large-scale commitments. NTPC has taken the advanced action of meeting its goal of 10GW solar power in five years. We believe its capex and regulated equity will increase by 30% and 10-12% over three years, respectively, leading to 20%+ EBITDA and regulated BV CAGR. While we assume a gradual increase in capacity (2.5GW in three years) given the short gestation period, if the company commissions 5GW, it would provide a good 4-5% additional earnings, BV growth and bump-up to the target price.

Figure 64: NTPC and Adani Power are early adopters and making large-scale commitments

Company	Capacity FY16e (MW)	Base Case				Bull Case				Company RE Target 2016-2022	Bull-case assumption v/s target
		RE addition FY16-18E	EBITDA CAGR FY15-18e	BV CAGR FY15-18e	TP (INR/sh)	RE addition FY16-18E	EBITDA CAGR FY15-18e	BV CAGR FY15-18e	TP (INR/sh)		
NTPC	45,904	2,550	21%	22%	173	5,000	24%	24%	186	10,000	50%
Tata Power	8,726	547	11%	5%	90	1,047	12%	5%	94	1,745	60%
- Tata Power PV mfg	250										
Adani Power*	10,440	40	11%	5%	30	690	15%	8%	36	*10,000	7%
Reliance Power	5,945	140	20%	8%	42	640	24%	10%	48	6,000	11%
NHPC	6,366	50	1%	6%	22					NA	NA
CESC	2,455	9	21%	11%	635					NA	NA
JSW Energy	3,140	0	0%	13%	125					NA	NA
JPVL	5,500	0	20%	7%	10					NA	NA
Powergrid (INR bn assets)	1,483	180@								NA	NA

Source: Deutsche Bank estimates;
** Not clear if the RE development vehicle will be Adani Power or Adani Enterprises || @Green Energy Grid investments*

Shift to renewables could reduce coal dependence by ~8%

We believe that the Renewable Energy targets set out by the Ministry of Power are unheard of, with ~15-16GW capacity addition per annum. We have modeled for 30GW solar power capacity addition in our base power demand-supply model till 2020. With this, we could cut coal dependence by 8% or ~70mt by 2020. This could result in a large saving of costs, helping to cut down costly imports (USD 17-18bn/pa), as well as entailing a major reduction in the carbon footprint.

NTPC is leading the pack on Solar

NTPC has committed to add 10GW through Solar Projects in next few years, in order to contribute to Government's 100GW capacity addition vision by 2022. The company has already started action on 1.5GW of tenders, PPA and land acquisition (allocation by the Government) – 250MW is ordered. Commitment for the states like Andhra Pradesh, Telangana and Rajasthan are much higher and only first phase of those tenders are floated as of now. Additionally, it is also exploring availability of land and PPA arrangement in other states like Chhattisgarh, Uttar Pradesh, Puducherry, Gujarat, etc. State governments are fully supporting NTPC in providing land and PPAs, largely at a cost-plus ROE model.

State Governments are fully supporting NTPC in providing the key ingredients, i.e., land and PPA

Figure 65: 1500 MW Solar projects tendered – likely to be commissioned in FY17

Tender	Investment Approval	State	Capacity (MW)	Completion	Likely Capex (INR bn)
Jan-15	25-Apr-15	Andhra Pradesh	250	18 months	17.8*
Mar-15	NA	Andhra Pradesh	500	NA	35.5
Mar-15	NA	Rajasthan	260	NA	17.8
Mar-15	NA	Telangana	250	NA	17.8
Mar-15	NA	Madhya Pradesh	250	NA	17.8
	Total		**1,510**		**107**

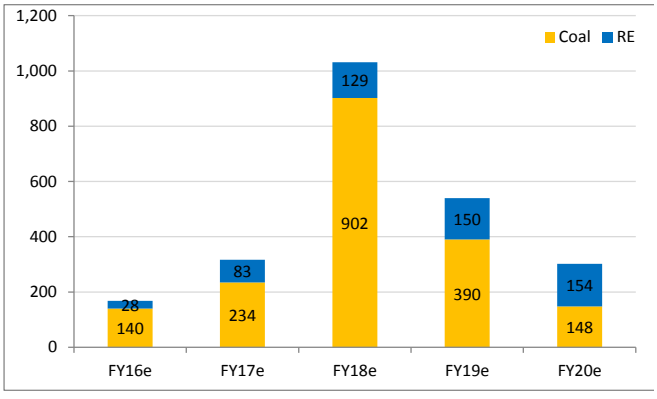
*Source: Deutsche Bank; Note- * approved by NTPC Board and EPC order placed*

We see a strong addition to capex and regulated equity base

We anticipate an average 30% increase in annual capex over FY17-20 owing to renewable energy investments (totaling INR 516bn). We forecast a 10-12% increase in the regulated equity base (REB) over FY18-20, primarily owing to renewables. NTPC has committed to add 10GW through Solar Projects in the next few years, involving capex of ~INR 700bn. The company has already started acting on 1.5GW of tenders, and has ordered 250MW.

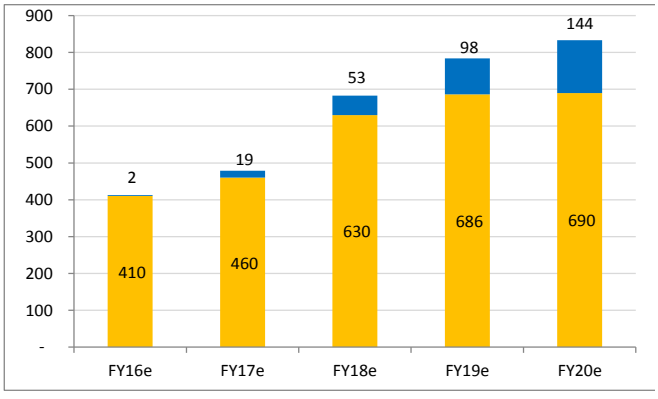
Solar projects get commissioned in 12-18 months, leading to faster turnaround of capital in 1-2 years vs. 4-6 years for conventional power projects. With the decline in capital costs, theoretical ROE is similar to coal-based projects, though we have yet to see a demonstration of on-ground data.

Figure 66: NTPC 30% capex jump from solar (INR bn)



Source: Deutsche Bank

Figure 67: Regulated equity base increased (INR bn)



Source: Deutsche Bank

Reliance Power decisively moving to Solar

Having achieved ~6GW coal based capacities in a relatively short span of time, Reliance Power has now turned their focus decisively on Renewable Energy, particularly Solar. With an asset base of ~INR 500bn, it plans to invest next INR 500bn for RE capacity built-out. Company has already identified locations for setting up of wind and solar based capacities which would take our total renewable capacities to ~1,000 MW in next 5-6 years, largely in Rajasthan and Tamil Nadu. Company targets 10% of its total energy portfolio to be contributed from renewable energy sources.

In the solar energy space, Reliance Power took an early plunge both in the Photo-Voltaic and Concentrated Solar Power (CSP) segments. It has already commissioned a 40 MW solar PV project in Pokharan, Jaisalmer, Rajasthan in March 2012. Lately, it has also commissioned the world's largest compact linear Fresnel reflector (CLFR) based CSP project 100 MW in November 2014. In the wind energy sector, we commissioned a 45 MW wind project in Vashpet, Maharashtra in June 13. Solar currently accounts for ~4% of its profits, and RE accounts for ~7%.

Solar currently accounts for ~4% of its profits, and RE accounts for ~7%.

Figure 68: RPWR Dhursar 40MW PV operations

INR m	FY13	FY14	FY15E	FY16E	FY17E	FY18E
CUF (%)	17%	21%	*21%	20%	20%	20%
Generation (mn kWh)	60	72	*72	70	70	70
Sales	1,084	1,308	1,301	1,270	1,270	1,270
PAT	(169)	756	353	347	366	384
ROE	-9%	42%	20%	19%	20%	21%

*Source: Deutsche Bank estimates, company data**

Adani Group – 10GW solar committed by 2022

Adani Group has set a target of 10GW of solar power generation capacity by 2022. This is over and above ~10GW operational coal-power capacities for the company. We are not sure if the vehicle for renewable energy development will be Adani Power or a subsidiary of Adani Enterprises, as most agreements talk about Adani Group. The development plan is as below-

- Adani Group, commissioned a 40MW solar power plant in Bitta, Kutch district, Gujarat in December 2011. It was commissioned in a record time of 165 days.
- It has signed a joint venture agreement with the government of Rajasthan to set up 10GW solar power capacities in the state.
- Adani Group has proposed to set up five solar power generation centers with a total capacity of 648MW in Ramanathapuram district of Tamil Nadu at an investment of INR 45bn, as per press reports.

Other major players in the solar power development cycle

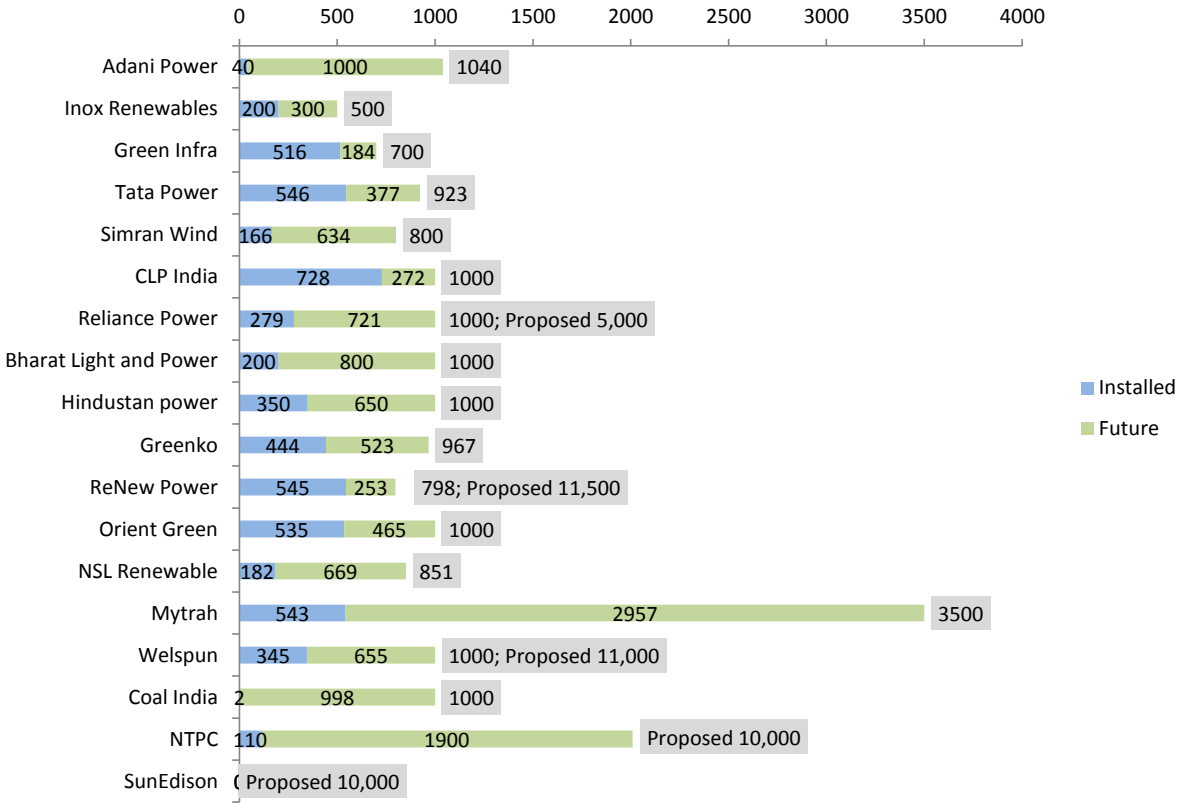
Companies making large commitments for RE

While RE started out largely as an investor phenomenon as a tax-saving instrument, utilities have begun making a large footprint with the advent of technology improvements, competitive costs, maturity in regulations and continued government support.

In June 2015, the largest-ever deal was announced in the Renewable Energy segment: SoftBank will form a JV with Bharti Enterprise and Foxconn Technologies to invest USD 20bn in green energy (largely solar) over the next 10 years in India.

SoftBank will invest USD 20bn in solar over next 10 years

Figure 69: A big leap into renewable energy (MW)



Source: Deutsche Bank, Company data, media reports

First Solar (FSLR US, Buy)

Covered by Deutsche Bank US analyst Vishal Shah

First Solar, an American company, has over 700MW of PV solar technology operating in India. It has 200MW portfolio of projects that wholly owned by First Solar and is in various stages of construction in India. It includes recently won 20MW of projects in Telangana at a levelised tariff of INR 6.49/kWh. At RE-Invest 2015, it has committed to develop 5GW of solar capacity in India by 2019.

Trina Solar (TSL US, Buy)

Covered by Deutsche Bank US analyst Vishal Shah

Trina Solar's supply segment has ~10% market share in India, as per the company release, which it plans to double in coming few years. As of 31 Dec 2014, it had 12.5MW of capacity in pipeline as a developer. Trina solar has collaborated with Welspun Energy to build 2GW solar manufacturing facility in India at cost of USD 500m. At RE-Invest 2015, Trina, along with other partners like Yingli, Solarreserve and China sun energy, has committed to develop 9GW of solar capacity in India.

SunEdison (SUNE US, Buy)

Covered by Deutsche Bank US analyst Vishal Shah

SunEdison had made the largest commitment to develop 15.2GW of renewable capacity

SunEdison is a global leader in solar with 2.4GW of operating capacity and more than 5.5GW of pipeline at various stages. In January 2015, SunEdision and Adani Enterprises announced that they will invest up to USD 4bn to build solar factory in India covering entire value-chain till solar panel. At RE-Invest 2015, SunEdison had made the largest commitment to develop 15.2GW of renewable capacity (Solar - 10GW, Wind 5.2GW) in India. In June 2015, SunEdison announced that it has signed definitive agreement to acquire Continuum wind energy limited with ~250MW of operating and more 1,100MW under various stages of development.

SMA (S92 GY, Buy)

Covered by Deutsche Bank European analyst Alexander Karnick

SMA is one the largest developers and manufacturers of photovoltaic (PV) inverters across the world with a market share of ~11% (2014) in GW. SMA's portfolio also includes energy management solutions including storage. SMA has presence across 21 countries incl. key growth markets such as the USA, Japan and China. In 2014, non-German sales accounted for approx. 76% of the total revenue of the company. SMA Solar India was established in 2010 and has achieved total output of several hundred megawatts. SMA Solar India supplied to the largest PV project 40 MW in Rajasthan. Currently, the first photovoltaic diesel hybrid system in the megawatts in India is being completed using SMA system technology.

GCL-Poly Energy (3800 HK, Buy)

Covered by DB China/HK analyst Yuxiao Peng

GCL-Poly is China's and world's largest polysilicon and solar wafer manufacturer based in mainland China. The company is also engaged in power generation business in China and is expanding its downstream solar farm business via a listed subsidiary GCL New Energy (0451.HK, NR). GCL could potentially benefit from upside in solar demand from India and improving demand and supply globally. Currently, the company has not announced any major plans for Indian presence, but the GCL-Poly's parent company (not the listco) has signed a strategic cooperation agreement with Adani Group on green energy.

Canadian Solar: Canadian Solar is a global energy provider with operations in 18 countries. It has a total project pipeline of 9 GW, and has supplied more than 10 GW of panels from its two state-of-the-art manufacturing facilities in Ontario. In India, Canadian Solar formed a JV with two other Canada-based firms- Sarus Solar, and plans to spend INR 65bn to build a 500-MW PV plant in India. The solar park will be constructed in the state of Maharashtra's Thane district and will be the first of several 500-MW facilities Sarus intends to build in the Asian nation. The second 500-MW project will be in Jharkhand state and has already been approved.

ACME and EDF aims to produce 7.5GW solar capacity by 2017

ACME solar is a part of ACME group (founded by Mr. Manoj Kumar Upadhyay) which is involved in telecom and alternate energy sector. ACME is not only a developer of Solar Energy, but also provides Engineering, Procurement and Construction (EPC) services to other solar power developers. French green energy company **EDF Energies Nouvelles** (EDF EN, has 7.5GW RE capacities across the world) and Luxembourg-based **EREN** have acquired 25% stake each in ACME Solar Energy, the solar energy arm of ACME, to develop solar power projects in India. Its solar division has existing portfolio of more than 850 MW spread across various states in India. In June 2015, it commissioned 100MW solar plant under NSM Phase II. At RE-Invest 2015, company committed to develop solar capacity to 7.5GW by 2017.

Welspun Renewables is co-founded Balkrishna Goenka, and is a part of Welspun group. The company has current portfolio of 545MW, comprising 399 MW in solar and 146 MW in wind. In 2014, GE Energy finance invested USD 24m in its solar plant and ADB invested USD 50m as equity into Welspun Renewables. At RE-Invest 2015, it has committed to develop 11GW of renewable capacity – Solar ~8.7GW and Wind ~2.3GW. In June 2015, **Trina Solar** announced to set up 2GW solar panel plant at the cost of USD 500m in partnership with Welspun Energy.

Renew Power is founded by Sumant Sinha and has received funding from Goldman Sachs, ADB and others. Its primary business being wind with an operating capacity of 545MW, has ventured into solar with 250MW of pipeline at various stage of development. At RE-Invest 2015, it has committed to develop 11.5GW of renewable capacity – Solar 6.5GW and Wind 5.0GW. In July 2015, the company announced to setup a 72MW solar plant in Andhra Pradesh in partnership with **Hareon Solar**, a Chinese company.

Mytrah (MYT LN, NR)- Mytrah Energy is AIM (LSE) listed in 2010. MEIL has built a portfolio of over 500MW of operating wind plants in India, with a further 100MW in 2014 across six big states. The company uses 'turn-key' developers as well as in-house project development, with wind turbines purchased from three leading vendors. It aims to own and operate 5GW of renewable power in India, largely focused on wind.

Axis Energy is promoted by Reddy family from Hyderabad. Axis was largely looking at Wind Power business- MOU of ~1067 MW wind power projects, to be developed, in different parts of the state with the approval of Govt. of AP. It has committed to develop 12.5GW of renewable capacity (Solar - 5.5GW, Wind – 7.0GW) solar capacity at 2015 RE-Invest. It is planning to execute them in Andhra Pradesh - 2.5GW, Telangana - 2.5GW and Karnataka - 0.5GW.

Entire solar value chain could benefit

Domestic PV manufacturers are sub-scale and weak on cost competitiveness

Equipment manufacturers and EPC service providers will also derive benefits from the substantial investments in solar power. However, as per industry experts, the majority of PV cells are likely to be imported given the small scale of domestic PV manufacturers, and therefore, their lack of cost competitiveness. Additionally, the US took India to the WTO to require it to include a domestic manufacturing clause in initial government tenders. The companies vying for business in each of the categories in India are:

- **Module suppliers** – SunEdison, First Solar, Trina, Yingli, Tata Power Solar, BHEL, IndoSolar, etc.
- **EPC service providers** – SunEdison, Moserbaer Solar, L&T, Tata Power Solar, Welspun, Azure Power, Acme Solar, and Mahindra Solar.
- **Electrical equipment manufacturers** –. ABB, Siemens, SMA, Schneider Electric, etc.

Figure 70: Matrix of solar power players

Company name	Developer	EPC	PV Mfg
Acme Solar			x
Adani Power		x	x
Azure Power			x
BHEL			
Coal India		x	x
Euro Multivision Ltd.	x	x	
First Solar			x
Greenko		x	x
Indosolar Ltd	x	x	
JA solar	x		
L&T	x		x
Lanco		x	
Mahindra Solar			x
Moser Baer			
Mytrah			x
NTPC		x	x
Orient Green		x	x
Reliance Power		x	x
ReNew Power		x	x
SunEdison			x
Tata Power			
Titan Energy	x	x	
Vikram Solar	x	x	
Websol Energy System Limited	x	x	
Welspun			x
XL Energy Ltd.	x	x	

Source: Deutsche Bank, company data; x- denotes not present

Brief description of top solar power equipment manufacturing companies in India

Tata Power Solar Systems Ltd

Tata Power Solar is a 100% subsidiary of Tata Power. It is a fully integrated solar solutions provider of cells, modules and solar products. It also offers EPC services and has completed almost 160MW of ground mounted, utility scaled projects and 40MW of rooftop projects till FY 2014. Its present module and cell manufacturing capacity is 180MW and 200MW, respectively.

Figure 71: Financials of Tata Power Solar

INR mn	FY11	FY12	FY13	FY14	FY15
Sales	12,200	15,250	5,105	11,030	8,750
PAT	145	418	(827)	(1,268)	(1,130)

Source: Deutsche Bank, Company data

IndoSolar Ltd (ISLR IN, INR 5.33bn market cap)

Indosolar Limited is a leading Indian manufacturer of solar PV cells. Current manufacturing capacity is 450MW, and company is planning to expand the capacity by 200MW. Machinery and technology have been supplied by industry leader, SCHMID GmbH, Germany, on a turnkey basis. The company's manufacturing facility is located in Greater Noida, Uttar Pradesh. Indosolar has four production lines.

Figure 72: Financials of Indosolar

INR mn	FY11	FY12	FY13	FY14	FY15
Sales	5,812	920	532	157	2,960
PAT	(574)	(2,024)	(1,239)	(1,370)	(782)

Source: Deutsche Bank, Company data

Surana Solar Ltd (SURA IN, INR 1.2bn market cap)

Surana Solar Limited is part of the Surana Group Hyderabad, India. Founded in 1978, the Surana Group is a well-diversified conglomerate which is active in the following areas: Solar & Wind Power, telecommunications, metal processing and infrastructure. SPV Modules Manufacturing Plant (a 100% EOU) was set up at Cherlapally, Hyderabad, India with an installed capacity of 12 MW. Presently the company has a production capacity of 40 MW/pa with ongoing projects to increase it. At present there is a new manufacturing unit coming in Fab City, Hyderabad India, but company is facing liquidity constraints.

Figure 73: Financials of Surana Solar

INR mn	FY11	FY12	FY13	FY14	FY15
Sales	1,023	727	949	1,291	1,254
PAT	165	3	26	30	84

Source: Deutsche Bank, Company data

Vikram Solar Pvt Ltd

Vikram Solar specializes in the manufacturing of PV solar modules. It is part of the Vikram Group of companies, which is a 40 year-old company specializing in engineering and manufacturing activities. The company has an advanced solar PV module manufacturing facility in India. Its manufacturing plant is located in the SEZ of Falta, West Bengal, and has a 150MW installed production capacity. The company executed 20MW projects in Rajasthan and 5MW project each in Gujarat and Tamil Nadu.

Websol Energy (WESL IN, INR 0.5bn market cap)

Websol Energy System Ltd is an Indian manufacturer of PV monocrystalline solar cells and modules. To enhance its competitive edge, the company undertook a 120MW expansion programme in 2006. Websol has the technical capability to handle up to 160 micron thin wafers and process multiple sized wafers. Its products range from 10W to 225W, catering to diverse needs.

Figure 74: Financials of Websol Solar

INR mn	FY11	FY12	FY13	FY14	FY15
Sales	1,302	1,433	1,142	3,047	3,558
PAT	(1,667)	(2,342)	(159)	(743)	(524)

Source: Deutsche Bank, Company data

Moser Baer Solar (MBI IN, INR 2.5bn market cap)

Moser Baer Solar Ltd and Moser Baer Solar Systems Pvt Ltd are subsidiaries of Moser Baer India Ltd, which is a leader in manufacturing of optical storage media. The total manufacturing capacity stands at 250MW. Moser Baer has a significant presence in solar EPC services and solar PV modules in the Indian as well as international markets. In 2013, the company became one of the major players in Kerala's ANERT programme for residential rooftop systems. However, the company is facing liquidity crunch and is in deep losses for the past few years.

Model updated:11 June 2015

Running the numbers

Asia

India

Utilities

NTPC Limited

Reuters: NTPC.BO Bloomberg: NTPC IN

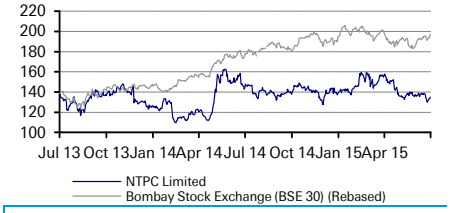
Buy

Price (16 Jul 15)	INR 135.00
Target Price	INR 173.00
52 Week range	INR 127.38 - 159.55
Market Cap (m)	INRm 1,113,137
	USDm 17,531

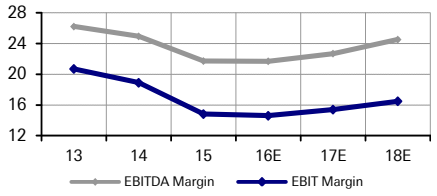
Company Profile

NTPC Limited, established in 1975, is India's largest thermal-power generating company, and also the country's largest power utility. NTPC's installed capacity, as of 1 March 2013, is 40,174 MW, through its 15 coal-based and 7 gas/liquid fuel-based (3,955 MW) projects, and its 5 JVs. NTPC is aggressively increasing capacity through greenfield projects and expansion of existing stations, and foray into hydro-power and non-conventional and nuclear power generation.

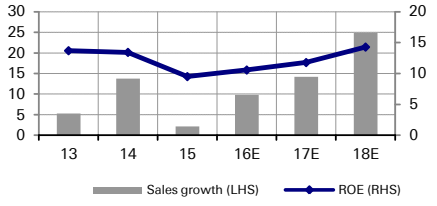
Price Performance



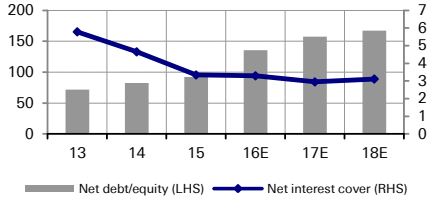
Margin Trends



Growth & Profitability



Solvency



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Fiscal year end 31-Mar	2013	2014	2015	2016E	2017E	2018E
Financial Summary						
DB EPS (INR)	13.06	13.83	10.45	11.68	13.11	17.12
Reported EPS (INR)	13.06	13.83	10.45	11.68	13.11	17.12
DPS (INR)	5.75	5.75	4.57	4.40	4.94	6.45
BVPS (INR)	99.6	106.3	113.4	107.5	115.0	124.6
Weighted average shares (m)	8,245	8,245	8,245	8,245	8,245	8,245
Average market cap (INRm)	1,197,859	1,094,980	1,166,249	1,113,137	1,113,137	1,113,137
Enterprise value (INRm)	1,737,410	1,786,390	2,002,743	2,298,332	2,591,096	2,814,118
Valuation Metrics						
P/E (DB) (x)	11.1	9.6	13.5	11.6	10.3	7.9
P/E (Reported) (x)	11.1	9.6	13.5	11.6	10.3	7.9
P/BV (x)	1.34	1.11	1.30	1.26	1.17	1.08
FCF Yield (%)	nm	nm	nm	nm	nm	nm
Dividend Yield (%)	4.0	4.3	3.2	3.3	3.7	4.8
EV/Sales (x)	2.5	2.3	2.5	2.6	2.6	2.2
EV/EBITDA (x)	9.6	9.1	11.4	12.0	11.3	9.1
EV/EBIT (x)	12.1	12.0	16.8	17.8	16.6	13.5
Income Statement (INRm)						
Sales revenue	693,768	789,217	806,220	885,571	1,011,511	1,262,913
Gross profit	226,701	270,755	252,712	274,664	318,168	411,471
EBITDA	181,825	196,814	175,123	192,108	229,529	309,627
Depreciation	38,232	47,700	55,646	62,817	73,731	101,359
Amortisation	0	0	0	0	0	0
EBIT	143,592	149,114	119,477	129,291	155,799	208,267
Net interest income(expense)	-24,805	-32,031	-35,704	-39,204	-52,798	-66,847
Associates/affiliates	0	0	0	0	0	0
Exceptionals/extraordinaries	-2,534	0	-13,771	0	0	0
Other pre-tax income/(expense)	31,640	27,774	20,789	27,375	28,807	30,702
Profit before tax	166,110	144,858	104,562	117,463	131,808	172,123
Income tax expense	40,247	30,824	4,638	21,143	23,725	30,982
Minorities	0	0	0	0	0	0
Other post-tax income/(expense)	0	0	0	0	0	0
Net profit	107,645	114,034	86,152	96,319	108,082	141,141
DB adjustments (including dilution)	0	0	0	0	0	0
DB Net profit	107,645	114,034	86,152	96,319	108,082	141,141
Cash Flow (INRm)						
Cash flow from operations	146,970	155,855	160,061	194,127	63,686	148,886
Net Capex	-206,808	-244,135	-269,447	-391,558	-302,817	-296,606
Free cash flow	-59,839	-88,280	-109,386	-197,431	-239,131	-147,720
Equity raised/(bought back)	0	0	0	0	0	0
Dividends paid	-43,054	-57,009	-39,546	-42,567	-44,789	-55,155
Net inc/(dec) in borrowings	95,856	113,882	180,271	243,534	217,287	203,167
Other investing/financing cash flows	16,225	16,225	8,257	8,257	0	0
Net cash flow	9,188	-15,182	39,596	11,793	-66,632	293
Change in working capital	*-34,601*	*-11,996*	*31,018*	*34,991*	*29,334*	*107,322*
Balance Sheet (INRm)						
Cash and other liquid assets	189,710	170,507	223,874	132,599	65,966	66,259
Tangible fixed assets	1,183,888	1,380,323	1,594,124	1,922,865	2,299,413	2,697,378
Goodwill/intangible assets	6	6	6	6	6	6
Associates/investments	49,229	33,004	24,747	16,490	16,490	16,490
Other assets	366,622	416,559	412,799	417,778	424,025	413,832
Total assets	1,789,455	2,000,399	2,255,550	2,489,738	2,805,900	3,193,964
Interest bearing debt	778,490	894,922	1,085,115	1,334,283	1,560,415	1,783,729
Other liabilities	189,758	228,638	235,053	268,710	297,663	382,653
Total liabilities	968,248	1,123,560	1,320,168	1,602,994	1,858,077	2,166,382
Shareholders' equity	821,207	876,839	935,382	886,744	947,823	1,027,582
Minorities	0	0	0	0	0	0
Total shareholders' equity	821,207	876,839	935,382	886,744	947,823	1,027,582
Net debt	*588,780*	*724,415*	*861,241*	*1,201,685*	*1,494,449*	*1,717,470*
Key Company Metrics						
Sales growth (%)	5.3	13.8	2.2	9.8	14.2	24.9
DB EPS growth (%)	9.7	5.9	-24.5	11.8	12.2	30.6
EBITDA Margin (%)	26.2	24.9	21.7	21.7	22.7	24.5
EBIT Margin (%)	20.7	18.9	14.8	14.6	15.4	16.5
Payout ratio (%)	44.0	41.6	43.7	37.7	37.7	37.7
ROE (%)	13.7	13.4	9.5	10.6	11.8	14.3
Capex/sales (%)	29.8	30.9	33.4	44.2	29.9	23.5
Capex/depreciation (x)	5.4	5.1	4.8	6.2	4.1	2.9
Net debt/equity (%)	71.7	82.6	92.1	135.5	157.7	167.1
Net interest cover (x)	5.8	4.7	3.3	3.3	3.0	3.1

Source: Company data, Deutsche Bank estimates

Model updated:24 June 2015

Running the numbers

Asia

India

Utilities

Reliance Power

Reuters: RPOL.BO Bloomberg: RPWR IN

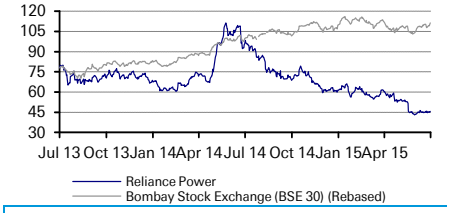
Hold

Price (16 Jul 15)	INR 45.65
Target Price	INR 42.00
52 Week range	INR 43.10 - 98.35
Market Cap (m)	INRm 128,054
	USDm 2,017

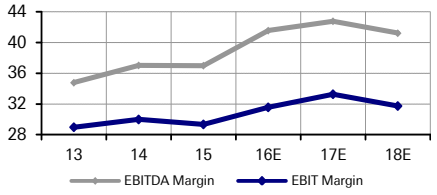
Company Profile

Reliance Power (RPL) is the power generation arm of Reliance Anil Dhirubhai Ambani Group. It currently has 5,760 MW operational coal-based power projects. It has an ambitious pipeline of projects to attain 16 GW size in next few years, including a big presence in Green Energy. Apart from the power business, the company has four captive coal mines in India and 3 coal concessions in Indonesia each with aggregate coal reserves of c.2 bn tonnes.

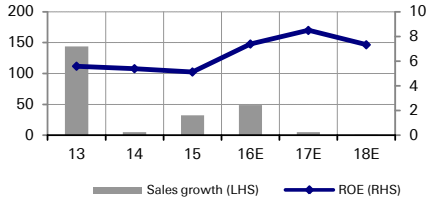
Price Performance



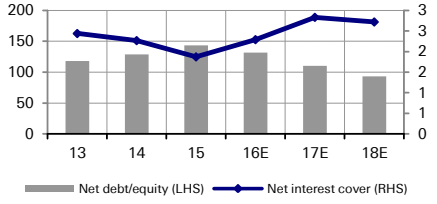
Margin Trends



Growth & Profitability



Solvency



Abhishek Puri
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Fiscal year end 31-Mar	2013	2014	2015	2016E	2017E	2018E
Financial Summary						
DB EPS (INR)	3.61	3.67	3.67	5.65	7.03	6.56
Reported EPS (INR)	3.61	3.67	3.67	5.65	7.03	6.56
DPS (INR)	0.00	0.00	0.00	0.00	0.00	0.00
BVPS (INR)	66.2	69.6	73.6	79.2	86.2	92.8
Weighted average shares (m)	2,805	2,797	2,805	2,805	2,805	2,805
Average market cap (INRm)	262,252	195,287	212,019	128,054	128,054	128,054
Enterprise value (INRm)	481,032	444,618	499,525	412,209	386,480	362,658
Valuation Metrics						
P/E (DB) (x)	25.9	19.0	20.6	8.1	6.5	7.0
P/E (Reported) (x)	25.9	19.0	20.6	8.1	6.5	7.0
P/BV (x)	0.93	1.01	0.77	0.58	0.53	0.49
FCF Yield (%)	nm	nm	nm	12.3	28.8	27.3
Dividend Yield (%)	0.0	0.0	0.0	0.0	0.0	0.0
EV/Sales (x)	9.8	8.6	7.3	4.0	3.6	3.4
EV/EBITDA (x)	28.1	23.2	19.7	9.7	8.4	8.2
EV/EBIT (x)	33.7	28.6	24.8	12.8	10.8	10.6
Income Statement (INRm)						
Sales revenue	49,266	51,748	68,527	102,163	107,374	107,617
Gross profit	17,130	19,159	25,350	42,446	45,924	44,352
EBITDA	17,130	19,159	25,350	42,446	45,924	44,352
Depreciation	2,851	3,639	5,237	10,193	10,193	10,193
Amortisation	0	0	0	0	0	0
EBIT	14,279	15,521	20,113	32,254	35,731	34,159
Net interest income(expense)	-5,853	-6,844	-10,742	-14,079	-12,615	-12,560
Associates/affiliates	0	0	0	0	0	0
Exceptionals/extraordinaries	0	0	0	0	0	0
Other pre-tax income/(expense)	3,572	3,712	3,493	1,625	1,519	1,409
Profit before tax	11,997	12,388	12,864	19,800	24,635	23,009
Income tax expense	1,882	2,121	2,580	3,960	4,927	4,602
Minorities	0	0	0	0	0	0
Other post-tax income/(expense)	0	0	0	0	0	0
Net profit	10,116	10,267	10,283	15,840	19,708	18,407
DB adjustments (including dilution)	0	0	0	0	0	0
DB Net profit	10,116	10,267	10,283	15,840	19,708	18,407
Cash Flow (INRm)						
Cash flow from operations	7,055	23,103	3,666	24,166	36,825	34,973
Net Capex	-89,130	-44,168	-35,944	-8,362	0	0
Free cash flow	-82,076	-21,065	-32,278	15,804	36,825	34,973
Equity raised/(bought back)	0	0	85	0	0	0
Dividends paid	0	0	0	0	0	0
Net inc/(dec) in borrowings	107,039	16,426	11,449	-7,299	-24,488	-22,740
Other investing/financing cash flows	-19,730	-2,884	-14,445	-12,453	-12,615	-12,560
Net cash flow	5,234	-7,523	-35,189	-3,948	-278	-327
Change in working capital	*1,727*	*-28,976*	*19,104*	*14,320*	*4,172*	*25,451*
Balance Sheet (INRm)						
Cash and other liquid assets	48,353	26,411	11,708	7,759	9,000	10,082
Tangible fixed assets	392,866	460,937	491,643	489,813	479,620	469,428
Goodwill/intangible assets	0	0	0	0	0	0
Associates/investments	401	1,414	8,609	8,609	8,609	8,609
Other assets	77,719	71,448	108,299	76,695	81,237	86,100
Total assets	519,339	560,209	620,259	582,876	578,467	574,218
Interest bearing debt	267,519	277,141	307,807	300,508	276,020	253,279
Other liabilities	65,994	88,370	106,117	60,193	60,563	60,649
Total liabilities	333,513	365,510	413,924	360,701	336,583	313,928
Shareholders' equity	185,811	194,684	206,320	222,160	241,868	260,275
Minorities	15	15	15	15	15	15
Total shareholders' equity	185,826	194,699	206,335	222,175	241,883	260,290
Net debt	*219,166*	*250,729*	*296,099*	*292,749*	*267,019*	*243,198*
Key Company Metrics						
Sales growth (%)	144.0	5.0	32.4	49.1	5.1	0.2
DB EPS growth (%)	16.7	1.8	-0.1	54.0	24.4	-6.6
EBITDA Margin (%)	34.8	37.0	37.0	41.5	42.8	41.2
EBIT Margin (%)	29.0	30.0	29.4	31.6	33.3	31.7
Payout ratio (%)	0.0	0.0	0.0	0.0	0.0	0.0
ROE (%)	5.6	5.4	5.1	7.4	8.5	7.3
Capex/sales (%)	180.9	85.4	52.5	8.2	0.0	0.0
Capex/depreciation (x)	31.3	12.1	6.9	0.8	0.0	0.0
Net debt/equity (%)	117.9	128.8	143.5	131.8	110.4	93.4
Net interest cover (x)	2.4	2.3	1.9	2.3	2.8	2.7

Source: Company data, Deutsche Bank estimates

Model updated:25 February 2015

Running the numbers

North America

United States

Clean Technology

First Solar Inc.

Reuters: FSLR.OQ Bloomberg: FSLR US

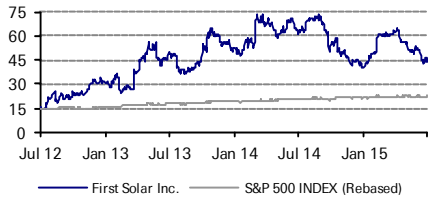
Buy

Price (16 Jul 15)	USD 44.76
Target Price	USD 68.00
52 Week range	USD 39.83 - 72.78
Market Cap (m)	USDm 4,498
	EURm 4,124

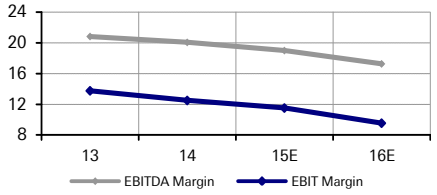
Company Profile

First Solar manufactures and sells advanced solar modules and photovoltaic (PV) solar power systems. The company operates under two segments - 1) component business involved in the design, manufacture, and sale of solar modules and 2) systems business which sells PV solar power systems. The company employs around six thousand people worldwide.

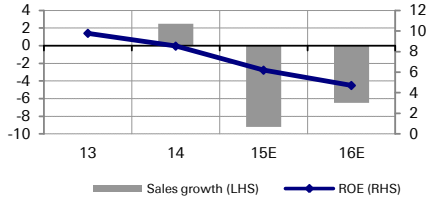
Price Performance



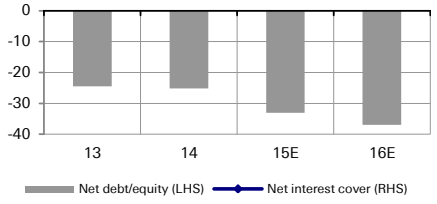
Margin Trends



Growth & Profitability



Solvency



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Fiscal year end 31-Dec	2013	2014	2015E	2016E
Financial Summary				
DB EPS (USD)	4.37	4.00	3.05	2.35
Reported EPS (USD)	4.61	4.00	3.05	2.35
DPS (USD)	0.00	0.00	0.00	0.00
BVPS (USD)	48.08	50.25	49.79	51.57
Valuation Metrics				
Price/Sales (x)	1.2	1.8	1.5	1.6
P/E (DB) (x)	9.8	15.0	14.7	19.0
P/E (Reported) (x)	9.3	15.0	14.7	19.0
P/BV (x)	1.1	0.9	0.9	0.9
FCF yield (%)	14.9	10.5	8.8	6.2
Dividend yield (%)	0.0	0.0	0.0	0.0
EV/Sales	0.5	1.0	0.6	0.5
EV/EBITDA	2.6	5.0	3.1	3.1
EV/EBIT	3.9	8.0	5.0	5.5
Income Statement (USDm)				
Sales	3,309	3,392	3,080	2,881
EBITDA	689	681	585	498
EBIT	455	424	355	275
Pre-tax profit	466	437	379	301
Net income	440	407	311	241
Cash Flow (USDm)				
Cash flow from operations	928	951	657	538
Net Capex	-326	-320	-260	-260
Free cash flow	602	631	397	278
Equity raised/(bought back)	0	0	0	0
Dividends paid	0	0	0	0
Net inc/(dec) in borrowings	0	0	0	0
Other investing/financing cash flows	0	0	0	0
Net cash flow	602	631	397	278
Change in working capital	*254*	*282*	*106*	*65*
Balance Sheet (USDm)				
Cash and cash equivalents	1,325	1,482	1,869	2,137
Property, plant & equipment	1,385	1,402	1,575	1,573
Goodwill	85	204	459	459
Other assets	4,088	3,636	2,684	2,618
Total assets	6,884	6,724	6,588	6,786
Debt	223	217	217	217
Other liabilities	2,157	1,480	1,368	1,365
Total liabilities	2,380	1,697	1,584	1,582
Total shareholders' equity	4,503	5,027	5,004	5,204
Net debt	*-1,102*	*-1,265*	*-1,652*	*-1,920*
Key Company Metrics				
Sales growth (%)	nm	2.5	-9.2	-6.5
DB EPS growth (%)	na	-8.4	-23.7	-22.9
Payout ratio (%)	0.0	0.0	0.0	0.0
EBITDA Margin (%)	20.8	20.1	19.0	17.3
EBIT Margin (%)	13.8	12.5	11.5	9.5
ROE (%)	9.8	8.5	6.2	4.7
Net debt/equity (%)	-24.5	-25.2	-33.0	-36.9
Net interest cover (x)	nm	nm	nm	nm
DuPont Analysis				
EBIT margin (%)	13.8	12.5	11.5	9.5
x Asset turnover (x)	0.5	0.5	0.5	0.4
x Financial cost ratio (x)	1.0	1.0	1.1	1.1
x Tax and other effects (x)	0.9	0.9	0.8	0.8
= ROA (post tax) (%)	6.4	6.0	4.7	3.6
x Financial leverage (x)	1.5	1.4	1.3	1.3
= ROE (%)	9.8	8.5	6.2	4.7
annual growth (%)	*na*	*-12.8*	*-27.4*	*-23.9*
x NTA/share (avg) (x)	47.1	46.9	49.3	50.0
= Reported EPS	4.61	4.00	3.05	2.35
annual growth (%)	*na*	*-13.2*	*-23.7*	*-22.9*

Source: Company data, Deutsche Bank estimates

Model updated:21 May 2015

Running the numbers

North America

United States

Clean Technology

Trina Solar

Reuters: TSL.N Bloomberg: TSL US

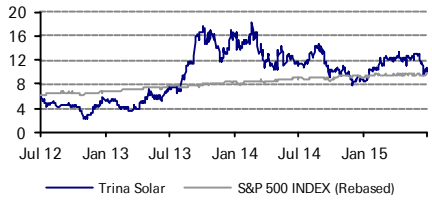
Buy

Price (16 Jul 15)	USD 10.47
Target Price	USD 15.00
52 Week range	USD 7.74 - 14.51
Market Cap (m)	USDm 887
	EURm 813

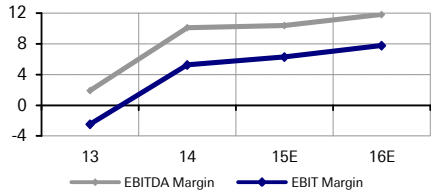
Company Profile

Trina Solar Ltd. is an integrated solar-power products manufacturer based in China. The company sells and markets its products in all major PV markets across the globe - including Germany, Italy, USA, France, and Japan. Trina Solar has regional headquarters in Switzerland, US, Japan and China.

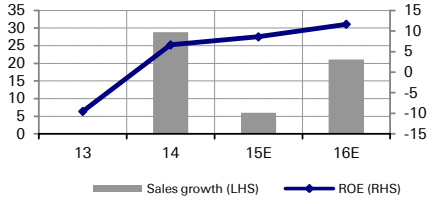
Price Performance



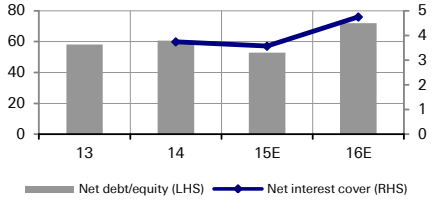
Margin Trends



Growth & Profitability



Solvency



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Fiscal year end 31-Dec	2013	2014	2015E	2016E
Financial Summary				
DB EPS (USD)	-1.10	0.77	0.97	1.45
Reported EPS (USD)	-1.09	0.75	0.91	1.37
DPS (USD)	0.00	0.00	0.00	0.00
BVPS (USD)	11.51	12.54	12.89	14.31
Valuation Metrics				
Price/Sales (x)	0.3	0.4	0.4	0.3
P/E (DB) (x)	nm	16.1	10.8	7.2
P/E (Reported) (x)	nm	16.6	11.5	7.6
P/BV (x)	1.2	0.7	0.8	0.7
FCF yield (%)	nm	nm	1.3	nm
Dividend yield (%)	0.0	0.0	0.0	0.0
EV/Sales	0.6	0.7	0.6	0.6
EV/EBITDA	31.6	6.7	5.8	5.1
EV/EBIT	nm	12.9	9.6	7.8
Income Statement (USDm)				
Sales	1,775	2,286	2,423	2,933
EBITDA	34	231	252	347
EBIT	-44	120	152	228
Pre-tax profit	-91	77	110	180
Net income	-78	59	89	135
Cash Flow (USDm)				
Cash flow from operations	-69	144	253	-11
Net Capex	-56	-225	-242	-293
Free cash flow	-125	-81	11	-304
Equity raised/(bought back)	0	0	0	0
Dividends paid	0	0	0	0
Net inc/(dec) in borrowings	-255	94	70	200
Other investing/financing cash flows	0	0	0	0
Net cash flow	-380	13	81	-104
Change in working capital	*-69*	*-27*	*65*	*-264*
Balance Sheet (USDm)				
Cash and cash equivalents	561	540	622	518
Property, plant & equipment	890	1,254	1,414	1,589
Goodwill	0	0	0	0
Other assets	1,110	1,406	1,462	2,120
Total assets	2,562	3,200	3,498	4,226
Debt	1,036	1,130	1,200	1,400
Other liabilities	709	1,097	1,208	1,601
Total liabilities	1,745	2,227	2,407	3,000
Total shareholders' equity	816	973	1,091	1,226
Net debt	*475*	*590*	*578*	*882*
Key Company Metrics				
Sales growth (%)	nm	28.8	6.0	21.1
DB EPS growth (%)	na	na	25.9	49.2
Payout ratio (%)	nm	0.0	0.0	0.0
EBITDA Margin (%)	1.9	10.1	10.4	11.8
EBIT Margin (%)	-2.5	5.3	6.3	7.8
ROE (%)	-9.5	6.6	8.6	11.6
Net debt/equity (%)	58.1	60.7	52.9	71.9
Net interest cover (x)	nm	3.7	3.6	4.7
DuPont Analysis				
EBIT margin (%)	-2.5	5.3	6.3	7.8
x Asset turnover (x)	0.7	0.8	0.7	0.8
x Financial cost ratio (x)	2.0	0.7	0.7	0.8
x Tax and other effects (x)	0.9	0.7	0.8	0.8
= ROA (post tax) (%)	-3.0	2.1	2.6	3.5
x Financial leverage (x)	3.1	3.2	3.2	3.3
= ROE (%)	-9.5	6.6	8.6	11.6
annual growth (%)	*na*	*na*	*29.5*	*35.6*
x NTA/share (avg) (x)	11.4	11.3	10.6	11.8
= Reported EPS	-1.09	0.75	0.91	1.37
annual growth (%)	*na*	*na*	*21.2*	*50.7*

Source: Company data, Deutsche Bank estimates

Model updated:19 May 2015

Running the numbers

North America

United States

Clean Technology

SunEdison

Reuters: SUNE.N Bloomberg: SUNE US

Buy

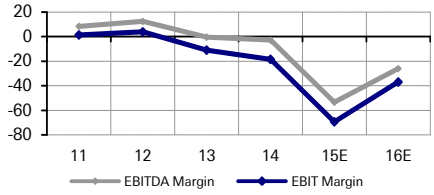
Price (16 Jul 15)	USD 31.17
Target Price	USD 40.00
52 Week range	USD 14.30 - 32.13
Market Cap (m)	USDm 9,237
	EURm 8,467

Company Profile

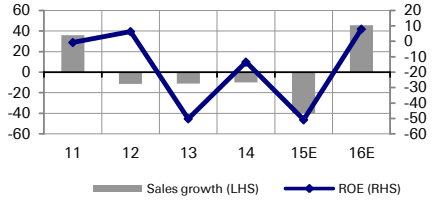
SunEdison, manufactures, and sells silicon wafers and photovoltaic energy solutions. The company operates under three business segments - Semiconductor Materials, Solar Materials, and Solar Energy. The company is based in St. Peters, Missouri and employs around 6500 people worldwide.

Price Performance

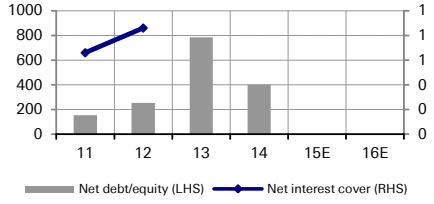
Margin Trends



Growth & Profitability



Solvency



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Fiscal year end 31-Dec	2011	2012	2013	2014	2015E	2016E
Financial Summary						
DB EPS (USD)	0.32	0.17	-0.87	-0.97	-2.85	0.13
Reported EPS (USD)	-0.05	0.18	-0.84	0.00	0.00	0.00
DPS (USD)	0.00	0.00	0.00	0.00	0.00	0.00
BVPS (USD)	3.21	2.49	0.96	5.52	1.63	1.67
Valuation Metrics						
Price/Sales (x)	0.6	0.2	0.7	2.2	6.7	4.6
P/E (DB) (x)	27.1	17.9	nm	nm	nm	246.2
P/E (Reported) (x)	nm	17.0	nm	nm	nm	nm
P/BV (x)	1.2	1.3	13.6	3.5	19.1	18.7
FCF yield (%)	nm	nm	nm	nm	nm	nm
Dividend yield (%)	0.0	0.0	0.0	0.0	0.0	0.0
EV/Sales	1.0	0.9	1.8	4.8	13.9	9.4
EV/EBITDA	11.6	6.9	nm	nm	nm	nm
EV/EBIT	66.7	21.9	nm	nm	nm	nm
Income Statement (USDm)						
Sales	3,243	2,870	2,556	2,301	1,379	2,007
EBITDA	275	358	-9	-65	-735	-520
EBIT	48	113	-278	-423	-954	-739
Pre-tax profit	-36	-25	-556	-1,202	-918	-739
Net income	-12	41	-203	-116	-500	40
Cash Flow (USDm)						
Cash flow from operations	-15	-264	-707	-770	-2,027	-312
Net Capex	-453	-138	-133	-230	-157	-130
Free cash flow	-468	-402	-840	-1,000	-2,184	-442
Equity raised/(bought back)	0	0	0	0	0	0
Dividends paid	0	0	0	0	0	0
Net inc/(dec) in borrowings	0	0	0	0	0	0
Other investing/financing cash flows	343	370	931	1,370	1,878	0
Net cash flow	-125	-32	91	370	-306	-442
Change in working capital	*-231*	*143*	*-278*	*287*	*-1,078*	*77*
Balance Sheet (USDm)						
Cash and cash equivalents	711	645	902	1,230	638	196
Property, plant & equipment	2,393	2,673	3,123	7,074	8,172	8,083
Goodwill	0	0	0	660	402	402
Other assets	1,778	1,427	2,656	2,536	4,250	4,323
Total assets	4,882	4,745	6,681	11,500	13,462	13,004
Debt	1,927	2,368	3,576	7,199	10,761	10,761
Other liabilities	2,170	1,700	2,763	2,816	2,459	2,611
Total liabilities	4,097	4,068	6,339	10,015	13,220	13,372
Total shareholders' equity	785	677	341	1,485	242	-368
Net debt	*1,216*	*1,723*	*2,675*	*5,969*	*10,123*	*10,565*
Key Company Metrics						
Sales growth (%)	35.9	-11.5	-11.0	-10.0	-40.1	45.5
DB EPS growth (%)	-13.4	-46.9	na	-11.2	-194.9	na
Payout ratio (%)	nm	0.0	nm	nm	nm	nm
EBITDA Margin (%)	8.5	12.5	-0.4	-2.8	-53.3	-25.9
EBIT Margin (%)	1.5	3.9	-10.9	-18.4	-69.2	-36.8
ROE (%)	-0.8	6.3	-50.2	-13.5	-50.8	7.9
Net debt/equity (%)	154.9	254.4	783.9	402.1	nm	nm
Net interest cover (x)	0.7	0.9	nm	nm	nm	nm
DuPont Analysis						
EBIT margin (%)	1.5	3.9	-10.9	-18.4	-69.2	-36.8
x Asset turnover (x)	0.7	0.6	0.4	0.3	0.1	0.2
x Financial cost ratio (x)	-0.5	-0.2	1.7	1.9	1.0	1.0
x Tax and other effects (x)	0.5	-2.3	0.4	0.1	0.5	-0.1
= ROA (post tax) (%)	-0.2	0.9	-3.5	-1.3	-4.0	0.3
x Financial leverage (x)	3.2	7.3	14.1	10.6	12.7	26.3
= ROE (%)	-0.8	6.3	-50.2	-13.5	-50.8	7.9
annual growth (%)	*na*	*na*	*na*	*73.1*	*-277.4*	*na*
x NTA/share (avg) (x)	6.5	2.8	1.7	3.2	3.3	1.6
= Reported EPS	-0.05	0.18	-0.84	-0.43	-1.69	0.13
annual growth (%)	*na*	*na*	*na*	*48.7*	*-292.4*	*na*

Source: Company data, Deutsche Bank estimates

Model updated:08 July 2015

Running the numbers

Asia

China

Alternative Energy

GCL-Poly

Reuters: 3800.HK Bloomberg: 3800 HK

Buy

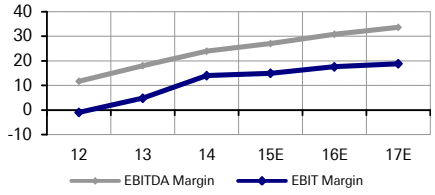
Price (17 Jul 15)	HKD 1.71
Target Price	HKD 2.00
52 Week range	HKD 1.30 - 3.06
Market Cap (m)	HKDm 26,471
	USDm 3,415

Company Profile

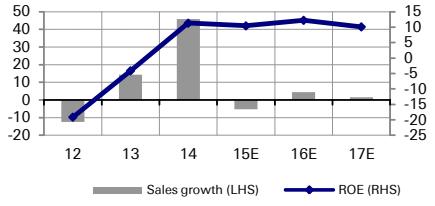
GCL-Poly is principally engaged in the manufacturing of polysilicon and solar wafer in mainland China. The company is also involved in the power generation business in mainland China, which includes coal, gas, waste-to-energy, wind, and solar, and has investments in various solar photovoltaic projects in the United States.

Price Performance

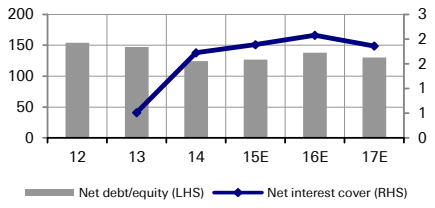
Margin Trends



Growth & Profitability



Solvency



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Fiscal year end 31-Dec	2012	2013	2014	2015E	2016E	2017E
Financial Summary						
DB EPS (HKD)	-0.14	-0.05	0.15	0.14	0.18	0.16
Reported EPS (HKD)	-0.23	-0.04	0.13	0.13	0.17	0.16
DPS (HKD)	0.00	0.00	0.00	0.00	0.00	0.00
BVPS (HKD)	1.0	1.0	1.2	1.3	1.5	1.7
Weighted average shares (m)	15,481	15,480	15,487	15,489	15,489	15,489
Average market cap (HKDm)	27,294	31,468	39,685	26,471	26,471	26,471
Enterprise value (HKDm)	56,255	59,870	69,259	63,980	76,891	86,001
Valuation Metrics						
P/E (DB) (x)	nm	nm	16.9	12.4	9.7	10.5
P/E (Reported) (x)	nm	nm	20.3	13.1	10.0	10.8
P/BV (x)	1.49	2.30	1.51	1.30	1.15	1.04
FCF Yield (%)	nm	16.0	6.7	nm	nm	nm
Dividend Yield (%)	0.0	0.0	0.0	0.0	0.0	0.0
EV/Sales (x)	2.5	2.3	1.9	1.8	2.1	2.3
EV/EBITDA (x)	21.4	12.9	7.8	6.7	6.8	6.8
EV/EBIT (x)	nm	48.4	13.3	12.1	11.9	12.2
Income Statement (HKDm)						
Sales revenue	22,348	25,530	37,225	35,267	36,807	37,389
Gross profit	4,578	6,426	11,357	12,075	13,985	15,274
EBITDA	2,625	4,625	8,934	9,548	11,368	12,595
Depreciation	2,829	3,387	3,707	4,255	4,887	5,534
Amortisation	0	0	0	0	0	0
EBIT	-204	1,238	5,227	5,293	6,481	7,061
Net interest income(expense)	-2,309	-2,416	-3,034	-2,806	-3,120	-3,796
Associates/affiliates	-4	16	48	48	49	51
Exceptionals/extraordinaries	-1,333	164	-402	-113	-79	-55
Other pre-tax income/(expense)	588	742	955	884	1,154	1,152
Profit before tax	-3,261	-256	2,795	3,306	4,485	4,412
Income tax expense	124	190	639	773	969	860
Minorities	130	218	200	505	851	1,091
Other post-tax income/(expense)	0	0	0	0	0	0
Net profit	-3,516	-664	1,955	2,028	2,664	2,462
DB adjustments (including dilution)	1,333	-164	402	113	79	55
DB Net profit	-2,183	-829	2,357	2,141	2,743	2,517
Cash Flow (HKDm)						
Cash flow from operations	2,326	8,507	9,041	8,405	9,602	12,220
Net Capex	-3,828	-3,480	-6,398	-13,028	-19,202	-16,495
Free cash flow	-1,502	5,028	2,643	-4,622	-9,599	-4,275
Equity raised/(bought back)	0	0	0	0	0	0
Dividends paid	-851	0	0	0	0	0
Net inc/(dec) in borrowings	4,096	3,880	3,177	7,315	11,011	9,521
Other investing/financing cash flows	-4,130	-7,234	-6,460	-1,141	-1,058	-1,241
Net cash flow	-2,387	1,673	-640	1,551	354	4,005
Change in working capital	*-1,419*	*3,389*	*507*	*-1,141*	*-1,872*	*-612*
Balance Sheet (HKDm)						
Cash and other liquid assets	9,510	14,249	17,338	18,889	19,243	23,248
Tangible fixed assets	42,233	43,995	50,612	59,384	73,699	84,660
Goodwill/intangible assets	0	0	0	0	0	0
Associates/investments	451	536	562	611	660	710
Other assets	15,624	17,862	21,492	18,841	20,577	20,934
Total assets	67,818	76,643	90,004	97,725	114,179	129,552
Interest bearing debt	36,911	40,791	43,955	51,270	62,281	71,802
Other liabilities	13,137	17,846	24,685	20,894	20,758	20,504
Total liabilities	50,048	58,638	68,641	72,164	83,040	92,306
Shareholders' equity	16,210	16,146	18,406	20,434	23,098	25,560
Minorities	1,560	1,859	2,958	5,127	8,041	11,686
Total shareholders' equity	17,770	18,005	21,363	25,561	31,139	37,247
Net debt	*27,401*	*26,542*	*26,617*	*32,381*	*43,038*	*48,554*
Key Company Metrics						
Sales growth (%)	-12.4	14.2	45.8	-5.3	4.4	1.6
DB EPS growth (%)	na	62.0	na	-9.1	28.1	-8.2
EBITDA Margin (%)	11.7	18.1	24.0	27.1	30.9	33.7
EBIT Margin (%)	-0.9	4.8	14.0	15.0	17.6	18.9
Payout ratio (%)	nm	nm	0.0	0.0	0.0	0.0
ROE (%)	-19.1	-4.1	11.3	10.4	12.2	10.1
Capex/sales (%)	17.1	13.6	17.2	36.9	52.2	44.1
Capex/depreciation (x)	1.4	1.0	1.7	3.1	3.9	3.0
Net debt/equity (%)	154.2	147.4	124.6	126.7	138.2	130.4
Net interest cover (x)	nm	0.5	1.7	1.9	2.1	1.9

Source: Company data, Deutsche Bank estimates

Model updated:10 July 2015

Running the numbers

Europe

Germany

Electrical Equipment

SMA

Reuters: S92G.DE Bloomberg: S92 GY

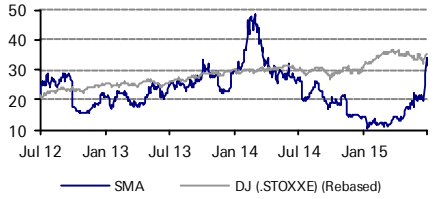
Buy

Price (16 Jul 15)	EUR 31.80
Target Price	EUR 30.00
52 Week range	EUR 10.46 - 33.75
Market Cap (m)	EURm 1,103
	USDm 1,204

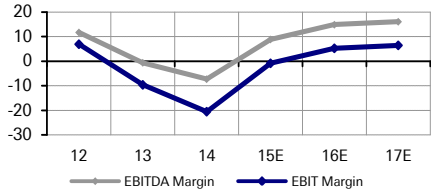
Company Profile

SMA is one the largest developers and manufacturers of photovoltaic (PV) inverters across the world with a market share of ~11%(2014) in GW and ~20% in terms of revenue. SMA's wide product range includes on-grid and off-grid applications, as well as large-scale central inverters, smaller sized string inverters, as well as micro inverters. Its portfolio also includes monitoring & visualization products and energy management solutions including storage. SMA has presence across 21 countries (incl. key growth markets such as the USA, Japan and China) with continuous focus on international expansion. In 2014, non-German sales accounted for approx.

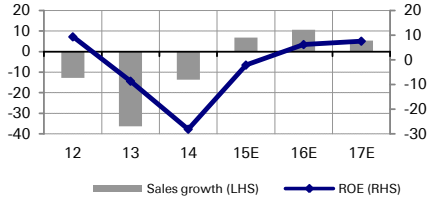
Price Performance



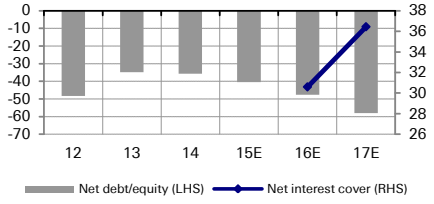
Margin Trends



Growth & Profitability



Solvency



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Fiscal year end 31-Dec	2012	2013	2014	2015E	2016E	2017E
Financial Summary						
DB EPS (EUR)	2.16	-1.92	-5.16	-0.33	1.00	1.30
Reported EPS (EUR)	2.16	-1.92	-5.16	-0.33	1.00	1.30
DPS (EUR)	0.60	0.00	0.00	0.00	0.00	0.00
BVPS (EUR)	23.7	20.9	15.9	15.6	16.6	17.9
Weighted average shares (m)	35	35	35	35	35	35
Average market cap (EURm)	1,010	817	947	1,103	1,103	1,103
Enterprise value (EURm)	563	511	747	882	827	740
Valuation Metrics						
P/E (DB) (x)	13.4	nm	nm	nm	31.8	24.4
P/E (Reported) (x)	13.4	nm	nm	nm	31.8	24.4
P/BV (x)	0.80	1.10	0.96	2.04	1.92	1.78
FCF Yield (%)	1.6	nm	nm	2.0	4.9	7.8
Dividend Yield (%)	2.1	0.0	0.0	0.0	0.0	0.0
EV/Sales (x)	0.4	0.5	0.9	1.0	0.9	0.7
EV/EBITDA (x)	3.3	nm	nm	11.5	5.8	4.6
EV/EBIT (x)	5.5	nm	nm	nm	16.4	11.4
Income Statement (EURm)						
Sales revenue	1,463	933	805	860	951	1,001
Gross profit	344	145	133	149	166	183
EBITDA	172	-6	-58	77	142	161
Depreciation	70	84	106	83	91	96
Amortisation	0	0	0	0	0	0
EBIT	102	-89	-165	-7	50	65
Net interest income(expense)	3	0	-3	-2	-2	-2
Associates/affiliates	0	0	0	0	0	0
Exceptionals/extraordinaries	0	0	0	0	0	0
Other pre-tax income/(expense)	0	0	0	0	0	0
Profit before tax	105	-89	-168	-9	49	63
Income tax expense	30	-22	11	3	14	18
Minorities	0	0	0	0	0	0
Other post-tax income/(expense)	0	0	0	0	0	0
Net profit	75	-67	-179	-11	35	45
DB adjustments (including dilution)	0	0	0	0	0	0
DB Net profit	75	-67	-179	-11	35	45
Cash Flow (EURm)						
Cash flow from operations	116	-2	-28	72	104	126
Net Capex	-100	-50	-73	-50	-50	-40
Free cash flow	16	-52	-101	22	54	86
Equity raised/(bought back)	0	0	0	0	1	0
Dividends paid	-45	-21	0	0	0	0
Net inc/(dec) in borrowings	2	9	-10	0	0	0
Other investing/financing cash flows	-159	75	103	0	0	0
Net cash flow	-186	12	-8	22	55	86
Change in working capital	*-50*	*-14*	*10*	*0*	*-21*	*-15*
Balance Sheet (EURm)						
Cash and other liquid assets	432	326	266	288	343	429
Tangible fixed assets	377	349	323	296	269	242
Goodwill/intangible assets	67	92	90	84	69	40
Associates/investments	51	53	3	3	3	3
Other assets	402	439	498	502	530	552
Total assets	1,329	1,260	1,180	1,173	1,214	1,266
Interest bearing debt	36	73	69	69	69	69
Other liabilities	472	462	559	563	569	577
Total liabilities	508	536	628	633	639	646
Shareholders' equity	821	724	552	540	575	620
Minorities	0	0	0	0	0	0
Total shareholders' equity	821	724	552	540	575	620
Net debt	*-396*	*-253*	*-197*	*-219*	*-274*	*-360*
Key Company Metrics						
Sales growth (%)	-12.8	-36.3	-13.6	6.8	10.6	5.3
DB EPS growth (%)	-55.1	na	-168.8	93.6	na	30.5
EBITDA Margin (%)	11.7	-0.6	-7.3	8.9	14.9	16.1
EBIT Margin (%)	7.0	-9.6	-20.5	-0.8	5.3	6.5
Payout ratio (%)	27.7	nm	nm	nm	0.0	0.0
ROE (%)	9.3	-8.6	-28.1	-2.1	6.2	7.6
Capex/sales (%)	6.8	5.7	9.4	5.8	5.3	4.0
Capex/depreciation (x)	1.4	0.6	0.7	0.6	0.5	0.4
Net debt/equity (%)	-48.3	-34.9	-35.7	-40.5	-47.6	-58.1
Net interest cover (x)	nm	nm	nm	nm	30.6	36.5

Source: Company data, Deutsche Bank estimates

Annexures

Annexure I – India Power demand-supply model

Figure 75: India Power demand-supply model

Annexure	Units	FY10	FY11	FY12	FY13	FY14	FY15	FY16E	FY17E	FY18E	FY19E	FY20E
Capacity (GW)												
- Coal	GW	84	94	112	130	145	165	188	208	222	231	235
- Hydro	GW	37	38	39	39	41	41	42	46	49	51	51
- Other Conventional	GW	23	24	24	26	28	30	32	32	33	34	34
Total	**GW**	**144**	**155**	**175**	**196**	**214**	**236**	**262**	**286**	**304**	**316**	**321**
% increase		7%	8%	13%	12%	9%	10%	11%	9%	6%	4%	1%
Renewable Energy	GW	16	18	25	28	32	36	42	50	58	68	80
Total Power Capacity	**GW**	**159**	**174**	**200**	**223**	**245**	**272**	**304**	**335**	**362**	**384**	**401**
Operational Data												
India Thermal PLF	%	76%	72%	68%	65%	62%	67%	60%	57%	57%	58%	60%
India PCC	Units/pp/pa	779	819	879	917	957	NA	NA	NA	NA	NA	NA
India AT&C losses	%	27.2%	26.0%	26.6%	25.4%	26.5%	26.0%	25.5%	25.0%	24.5%	24.0%	23.5%
Coal Consumption/ Requirement	mn Tons	367	387	418	455	488	529	602	641	673	711	761
- Imported	mn Tons	22	30	45	63	79	91	115	108	113	116	126
Demand-Supply												
Demand	bn Units	830	862	937	996	1,002	1,067	1,131	1,222	1,319	1,438	1,582
- YoY %		7%	4%	9%	6%	1%	6%	6%	8%	8%	9%	10%
Supply	bn Units	746	788	857	909	960	1,029	1,118	1,218	1,308	1,399	1,497
- YoY %		8%	6%	9%	6%	6%	7%	9%	9%	7%	7%	7%
Deficit	bn Units	(84)	(73)	(79)	(87)	(42)	(38)	(13)	(3)	(11)	(39)	(85)
Base (Deficit) / Surplus	%	-10%	-9%	-8%	-9%	-4%	-4%	-1%	0%	-1%	-3%	-5%
Peak Demand	GW	118	123	130	135	136	148	157	170	183	200	220
Peak (Deficit) / Surplus	%	-13%	-12%	-11%	-9%	-4%	-5%	-2%	-1%	-2%	-4%	-6%

Source: Deutsche Bank estimates, CEA

Annexure II – State-wise commitments to achieve 100GW solar and 175GW RE target

Figure 76: State-wise break-up of RE target to be achieved by year 2022

Sates/UTs	Solar	Wind	SHP	Biomass
Delhi	2,762			
Haryana	4,142		25	209
Himachal Pradesh	776		1,500	
Jammu & Kashmir	1,155		150	
Punjab	4,772		50	244
Rajasthan	5,762	8,600		
Uttar Pradesh	10,697		25	3,499
Uttrakhand	900		700	197
Chandigarh	153			
Northern Region	**31,120**	**8,600**	**2,450**	**4,149**
Goa	358			
Gujarat	8,020	8,800	25	288
Chhattisgarh	1,783		25	
Madhya Pradesh	5,675	6,200	25	118
Maharashtra	11,926	7,600	50	2,469
D. & N. Haveli	449			
Daman & Diu	199			
Western Region	**28,410**	**22,600**	**125**	**2,875**
Andhra Pradesh	9,834	8,100		543
Telangana	-	2,000		
Karnataka	5,697	6,200	1,500	1,420
Kerala	1,870		100	
Tamil Nadu	8,884	11,900	75	649
Puducherry	246			
Southern Region	**26,531**	**28,200**	**1,675**	**2,612**
Bihar	2,493		25	244
Jharkhand	1,995		10	
Orissa	2,377			
West Bengal	5,336		50	
Sikkim	36		50	
Eastern Region	**12,237**	**0**	**135**	**244**
Assam	663		25	
Manipur / Meghalaya	266		50	
Nagaland	61		15	
Tripura	105			
Arunachal Pradesh	39		500	
Mizoram	72		25	
North Eastern Region	**1,205**		**615**	
Andaman & Nicobar Islands	27			
Lakshadweep	4			
Other (New States)		600		120
All India	**99,533**	**60,000**	**5,000**	**10,000**

Source: Deutsche Bank, MNRE

Figure 77: State- and year-wise proposed targets for 40,000MW roof-top solar projects

Sr.No.	States	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	Total
1	Andhra Pradesh*	10	240	250	300	350	400	450	2,000
2	Bihar	5	120	125	150	175	200	225	1,000
3	Chhattisgarh	4	84	88	104	120	140	160	700
4	Delhi	5	132	138	165	190	220	250	1,100
5	Gujarat	15	385	400	480	560	640	720	3,200
6	Haryana	5	200	200	235	280	320	360	1,600
7	Himachal Pradesh	2	38	40	48	56	64	72	320
8	Jammu & Kashmir	2	54	55	74	80	90	95	450
9	Jharkhand	4	96	100	120	140	160	180	800
10	Karnataka	10	275	290	344	403	460	518	2,300
11	Kerala	4	96	100	120	140	160	180	800
12	Madhya Pradesh	10	265	275	330	385	440	495	2,200
13	Maharashtra	20	565	588	704	823	940	1,060	4,700
14	Orissa	5	120	125	150	175	200	225	1,000
15	Punjab	10	240	250	300	350	400	450	2,000
16	Rajasthan	10	275	288	344	403	460	520	2,300
17	Tamil Nadu	15	420	438	524	613	700	790	3,500
18	Telangana*	10	240	250	300	350	400	450	2,000
19	Uttarakhand	2	42	44	52	60	70	80	350
20	Uttar Pradesh	20	510	538	650	752	860	970	4,300
21	West Bengal	10	252	263	315	370	420	470	2,100
22	Arunachal Pradesh	2	5	5	8	10	10	10	50
23	Assam	4	30	30	38	42	50	56	250
24	Manipur	4	3	6	8	9	10	10	50
25	Meghalaya	1	6	6	8	9	10	10	50
26	Mizoram	1	6	6	8	9	10	10	50
27	Nagaland	1	6	6	8	9	10	10	50
28	Sikkim	1	6	6	8	9	10	10	50
29	Tripura	1	6	6	8	9	10	10	50
30	Chandigarh	1	12	12	14	18	20	23	100
31	Goa	1	20	20	22	23	30	34	150
32	Dadra & Nagar haveli	1	24	25	30	35	40	45	200
33	Daman & Diu	1	12	12	14	18	20	23	100
34	Puducherry	1	12	12	14	18	20	23	100
35	Andaman & Nicobar	1	2	2	2	5	4	4	20
36	Lakshadweep	1	1	1	1	2	2	2	10
	Total	**200**	**4,800**	**5,000**	**6,000**	**7,000**	**8,000**	**9,000**	**40,000**

Source: Deutsche Bank, MNRE

Annexure III – RE MOUs signed at the maiden Government of India RE-Invest Summit in Feb 2015

Figure 78: Green Energy Commitments given at RE-Invest Summit in Feb 2015

S. No.	Company	Capacity (MW)	Solar	Wind	Others
	Private Sector				
1	Sun Edison Energy India Pvt. Ltd.	15,200	10,000	5,200	
2	Axis Wind Energy Limited	12,500	5,500	7,000	
3	Essel Infraprojects Limited	12,000	12,000		
4	Renew Power	11,500	7,000	4,500	
5	Welspun Renewables Energy Pvt. Ltd.	11,001	8,660	2,341	
6	Azure Power	11,000	11,000		
7	Raasi Solar Energy Pvt Ltd	10,600	10,600		
8	Hindustan Clean Energy Ltd	10,000	7,000	3,000	
9	Greenko Energies Pvt. Ltd.	9,990	3,000	5,900	1,090
10	Sky Power Global	9,900	9,900		
11	CPEC Limited*	9,000	9,000		
12	Acme Solar	7,500	7,500		
13	Mytrah Energy	7,000		7,000	
15	Adani Power Limited	6,000	6,000		
16	Reliance Power Ltd.	6,000	6,000		
17	Vikram Solar	5,500	5,500		
18	Hero Future Energies	5,150	2,850	2,300	
19	GreenBrilliance Energy Pvt. Ltd.	5,000	5,000		
20	Shree Rajlaxmi Power Ltd.	5,000	5,000		
21	First Solar Inc.	5,000	5,000		
22	Waree Energies Ltd.	4,000	4,000		
23	Premier Solar Systems Pvt. Ltd.	2,000	2,000		
24	Green Infra Ltd.	2,000	500	1,500	
25	Solariredirect Energy India Pvt. Ltd.	2,000	2,000		
26	Ujaas Energy Limited	2,000	2,000		
27	Sindicatum Carbon Capital India Pvt. Ltd	1,500	1,000		500
28	Inspira Enterprise India Pvt. Ltd.	1,500	1,500		
29	Orange Renewable Power Pvt. Ltd.	1,400		1,400	
30	Bergen Solar Power & Energy	1,000	1,000		
31	Continum Wind Energy India Pvt. Ltd.	1,000		1,000	
32	Energon Power Resources Pvt. Ltd.	1,000		1,000	
33	Emmvee Photovoltaic Power Pvt. Ltd.	1,000	1,000		
34	Focal Renewable Energy Holdings Ltd.	1,000	650		350
35	PLG Clean Energy Projects Pvt. Ltd. (PLGCEP)	1,000	1,000		
36	Dwarkesh Energy Ltd.	1,000			
37	Ostro Energy Pvt. Ltd.	800		800	
38	Harness Energy Pvt. Ltd.	700		700	
39	Sunborne Energy Services	700	700		
40	Acciona Energy India Pvt. Ltd.	600		600	
41	NSL Renewable Power Pvt. Ltd.	550	550		
42	Ruchi Soya Industries Ltd.	500	500		
43	Punj Lloyd	500	500		
44	Today Green Power Pvt. Ltd.	500	500		
45	Sunil Hitech Engineers Ltd.	500	400		100
46	Abengoa Solar India Pvt. Ltd.	500	500		
47	Orient Green Power Company Ltd.	500			

Source: Deutsche Bank, MNRE, RE-Invest

Figure 78: Green Energy Commitments given at RE-Invest Summit in Feb 2015 (Cont'd.)

S. No.	Company	Capacity (MW)	Solar	Wind	Others
	Private Sector				
48	Indo Magnus Wind Energy	400			
49	Indian Biomass Power Association	320			320
50	Today Homes & Infrastructure Pvt. Ltd.	300	300		
51	Surya Vidyut Limited	300	100	200	
52	Rana Sugars Ltd.	250			250
53	Powerica Limited	224		224	
54	Rajesh Exports Limited	200	200		
55	Pioneer Wincon Pvt. Ltd.	200		200	
56	Indian Energy Ltd.	200		200	
57	OneEarth Power Ventures Pvt. Ltd.	133			
58	Astha Green Energy Pvt. Ltd.	127			127
59	Bermaco Energy Ltd.	120			120
60	Kirloskar Integrated Technologies Pvt. Ltd.	100			100
61	HAL Offshore Limited	100	100		
62	Nano Sciences and Ozone Technologies Pvt. Ltd.	100	100		
63	B S Ltd.	100			100
64	Aditya Suntech Pvt. Ltd.	100	100		
65	Satish Sugars Limited	72			72
66	Scolex Power and Clean Energy Pvt. Ltd.	60			
67	SR Corporate Consultant Pvt. Ltd.	50	50		
68	Gobind Sugar Mills Ltd.	30			30
69	Sahakarmaharshi Bhausaheb Tharat Bhakari Sakhar Karkhana	30			30
70	Smartbrains Engineers Technologist Pvt. Ltd.	25	25		
71	Sai Achyuth Energy Pvt. Ltd.	25			25
72	Green Ripples Pvt. Ltd.	25			25
73	Penna Cement Industries Ltd.	25	5		20
74	Mahakaushal Sugar & Power Industries Ltd.	25			25
75	Shri Bhogawati Sahakari Sakhar Karkhana Ltd.	25			25
76	Nirani Sugars Limited	25			25
77	Oakbrook International Energy & Infra Pvt. Ltd.	25			25
78	Prasad Sugar and Allied Agro Products Ltd.	23			23
79	Pingale Sugar & Agro Products Pvt. Ltd.	20			20
80	Cosmos Hydro Power Pvt. Ltd.	20			20
81	Parvati Sweetners and Power Ltd.	20			20
82	S S Vasantrao Kalessk Ltd.	18			18
83	Paragargo Foods & Allied Products Pvt. Ltd.	18			18
84	Hemasri Agro Power Projects Ltd.	15			15
85	Ind Bharat Energies (Maharashtra) Ltd.	15			15
86	Kalyani Renewable Energy India Ltd.	15			15
87	Shalivahana Green Energy Ltd.	15			15
88	Varun Bio Energy Pvt. Ltd.	15			15
89	Hemasri Power Projects Ltd.	13			13
90	Kishan Industries	10			10
91	Bhavnagar Biomass Power Projects (P) Ltd.	10			10
92	Shriram Powergen Pvt. Ltd.	10			10
93	Shriram Non-Conventional Energy Pvt. Ltd.	10			10
94	Shalivahana (Biomass) Power Projects Ltd.	10			10
95	Trantech Green Power Pvt. Ltd.	10			10
96	V.B.Hydro Projects Ltd.	10			10
97	Renewable Energy Promotion Association (REPA)	10	10		

Source: Deutsche Bank, MNRE, RE-Invest

Figure 78: Green Energy Commitments given at RE-Invest Summit in Feb 2015 (Cont'd.)

S. No.	Company	Capacity (MW)	Solar	Wind	Others
	Private Sector				
98	Green Brilliance Energy Pvt. Ltd.	10	10		
99	Oakbrook International Education & Research Pvt. Ltd.	10	10		
100	Oakbrook International Agrotech & Research Pvt. Ltd.	10	10		
101	Indeen Biopower Ltd.	8			8
102	Global Powertech Equipments Pvt. Ltd.	8			8
103	Selco International Ltd.	7			7
104	Banswara Biomass Energy Pvt. Ltd.	6			6
105	Greenthoughts Energy Pvt. Ltd.	6			6
106	Starwire (India) Vidyut Pvt. Ltd.	6			6
107	Jala Shakti Limited	5			5
108	Yadlapati Agro Products Pvt. Ltd.	5			5
109	Chemtrols Solar Pvt. Ltd.	5	5		
110	Accunergy Pvt. Ltd.	5	5		
111	Happy Engineering	5	5		
112	Dolphin Pharmaceutical Ltd.	5	5		
113	Eco Planet	5	5		
114	Vision Group of Industries	5	5		
115	Shree Swaminaryan Gurukul	5	5		
116	Om Trust	5	5		
117	Niri Energy Company	5	5		
118	Rain Gold Engineering Projects	5	5		
119	Eco Dwellings Pvt. Ltd.	5	5		
120	Ikratos Solargie Pvt. Ltd.	5	5		
121	Godrej & Boyce Mfg. Co. Ltd.	4	4		
122	P. Das & Company	2	2		
123	Dwarikesh Sugar Industries Ltd.	2	2		
124	S S Systems	1	1		
125	Rural Agri Venture India Pvt. Ltd.	1	1		
126	Milind Deshmukh & Associates	1	1		
127	HLL Lifecare Limited	1	1		
	Total	**208,744**	**157,902**	**45,065**	**3,685**
	Public Sector				
1	NTPC	3,333	3,333		
2	NEEPCO Limited	2,500	2,500		
3	Satluj Jal Vidyut Nigam Ltd. (SJVNL)	1,000	1,000		
4	Coal India Ltd	1,000	1,000		
5	National Hydroelectric Power Corporation Ltd. (NHPC)	430	350	80	
6	Gujarat Industries Power Company Ltd.	151		151	
7	Indian Renewable Energy Development Agency Ltd. (IREDA)	52	52		
8	Hindustan Petroleum Corporation Ltd.	50	50		
9	Petronet LNG Limited	40	40		
10	Union Bank of India	9	9		
11	Rashtriya Chemical & Fertilizers Ltd.	2	2		
12	National Institute of Solar Energy (NISE)	2	2		
13	Cochin Shipyard Ltd.	1	1		
	Total	**8,570**	**8,339**	**231**	**0**
	GRAND TOTAL	**217,314**	**166,241**	**45,296**	**3,685**

Source: Deutsche Bank, MNRE, RE-Invest

Annexure IV – RE manufacturing and financing MOUs signed at the RE-Invest Summit in Feb 2015

Figure 79: Other renewables commitments at RE-Invest Summit, Feb 2015

S. No.	Company	Capacity (MW)	Solar	Wind	Others
	Private Sector - Manufacturing				
1	Suzlon Energy Ltd.	11,000		11,000	
2	Gamesa	7,500		7,500	
3	Inox	5,000		5,000	
4	Regen	4,450		4,450	
5	Wind World (India) Pvt. Ltd.	4,500		4,500	
6	Vikram Solar	2,300	2,300		
7	Waree Energies Ltd.	2,000	2,000		
8	RRB Energy Limited	2,000		2,000	
9	Kenersys India Pvt. Ltd.	1,000		1,000	
10	Leitwind Shriram Manufacturing Ltd.	900		900	
11	Emmvee Photovoltaic Power Pvt. Ltd.	750	750		
12	BGR Power Limited	150			
	Total	**41,550**	**5,050**	**36,350**	**0**
	Private Sector - EPC				
1	Suzlon Energy Ltd.	5,000			
2	Mahindra EPC Services Pvt. Ltd.	1,000			
	Total	**6,000**			
	Financing (INR mn)				
1	Yes Bank	5,000			
2	L&T Finance	6,500			
	Total	**11,500**			

Source: Deutsche Bank

Annexure V – Domestic solar manufacturing is grossly inadequate

Figure 80: Domestic manufacturing is grossly inadequate in India

Company	Cells (MW)		Module (MW)	
	Installed capacity	Capacity under operations	Installed capacity	Capacity under operations
Access Solar			18	
Ajit Solar			20	
Alpex			75	
Bharat Heavy Electricals Limited (BHEL)	8		8	50
CEL	3		10	2
EMMVEE Solar			135	135
Euro Multivision Ltd.	40		-	-
Evergreen			20	-
Enfield Solar			20	-
Green Brilliance			45	-
HHV			50	-
Indosolar Ltd	450		-	-
Jupiter Solar	50	50	-	-
KL Solar			-	25
Kotak Urja Pvt. Ltd.			25	75
Lanco			75	-
Maharishi Solar Technology	10		20	-
Microsol			14	-
Moser Baer	250		230	40
Photon Energy Systems			45	-
photonix			15	-
PLG Power			-	40
Premier Solar Systems (P) Ltd.	3		75	
Rajasthan Electronics & Instruments Ltd.			20	
Shurjo			5	
Solar Semiconductor	30		195	
Surana Ventures			40	
TATA Solar	180	70	200	
Titan Energy			100	
TopSun Energy			30	
UPV Solar - Udhaya Energy Photovoltaics	12		7	
USL Photovoltaics PVT Ltd.			7	
Vikram Solar			150	75
Waaree Energy			125	-
Websol Energy System Limited	120	120	100	-
XL Energy Ltd.	60		210	-
Gautam Solar			25	25
Modern Solar			25	25
Shan Solar			60	30
Sova Power			50	50
Jain Irrigation			55	55
Andromeda			30	20
PV Power			14	14
Total	**1,216**	**240**	**2,348**	**661**

Source: Deutsche Bank, MNRE (Jun 2014)

Annexure VI – Compilation of state-level policy on solar power for key states in India

Rajasthan: Rajasthan is targeting ~25GW over the next 7-8 years, through state or private enterprises. Rajasthan has installed capacity of 867MW while projects of 829MW are under implementation. In October last year, Rajasthan revised its Solar Energy Policy for 2014. Some key highlights are:

- **Land –** Government land will be allotted to solar park developers as per the provisions of Rajasthan Land Revenue. The state will promote the setting-up of solar power plants on private land. This allows projects to use agriculture land without land use change. Power producers including third parties will also be eligible for RE (Solar) Certificates as per regulations.
- **Tariff –** Solar power sold to discoms of Rajasthan will be determined by RERC based on competitive bidding process to the extent of the Renewable Purchase obligation (RPO) target fixed by RERC..
- **Evacuation –** The power generated from these power projects shall be purchased by discoms of Rajasthan at Pooled Cost of Power Purchase as determined by the appropriate commission.
- **Incentives –** Solar power plants to be treated as eligible industry and will be incentivized according to the Rajasthan Investment Promotional scheme. Also, solar plants of all capacities are included under Green category. Furthermore, banking will be allowed as per RERC regulations. The state will facilitate development of roof-top PV solar plants under the net metering scheme The state will promote development of solar parks by investing up to 50% equity (including cost of land) in JVCs formed for development of solar parks of capacity of 500MW or more.
- **Investments –** Proposals and joint ventures of 32,000MW from corporate houses such as Adani Enterprises, Reliance Power, IL&FS, Essel Infra, Azure Power and US-based SunEdison. Rajasthan Solar Park Development, a state government subsidiary, is developing solar parks with capacity of 1,400 MW at Bhadla and 2,000 MW in Jaisalmer.

Andhra Pradesh: AP has ample availability of sunny days of ~300 days with solar insolation of 5 KWh/m2/day. Total installed capacity in Andhra Pradesh is 300MW; the target is to take it to 5,000MW in the next few years (by 2019). AP got an in-principle nod for solar parks in Kadapa (500MW), Kurnool (1,000MW) and Kadiri (1000MW) in the last fiscal year. Key points of solar power policy are:

- **Land –** It is the responsibility of the project developer to acquire the land required for the project. All projects developed with the above incentives will be eligible for REC benefits subject to applicable regulations of the appropriate commission. Electricity duty shall be exempted for captive consumption, sale to discom(s) and third party sale.
- **RPO –** Renewable Purchase Obligation (RPO) mandated for power utilities, with a specific solar component. The Solar Power Purchase Obligation for States starts with 0.25% in Phase I and to go up to 3% by 2022.
- Discoms are anticipated to procure around 2,000MW of solar power capacity in a phased manner within the next five years. The discoms would enter into long-term PPA of 25 years with developers based on a competitive procurement process.

- **Incentives –** Transmission and distribution charges shall be exempted for wheeling of power generated from solar power projects for only captive use/third party sale within the state. Banking of 100% of energy shall be permitted for all captive and open access consumers during all 12 months of the financial year.
- **Investments –** NTPC signed an agreement with the state government to develop 1000MW solar power projects in the state with an investment of INR 7000 crore. Also, ACME group invested INR 1250 crore for a 160MW plant.
- Solar power policy shall come into effect from the date of issuance and remain applicable for a period of five years. Solar power projects that are commissioned during the operative period shall be eligible for the incentives declared under this policy, for a period of ten years from the date of commissioning.

Tamil Nadu: In 2012, Tamil Nadu implemented a 3GW target by 2015. Of the 3GW target, 350MW was reserved for roof-top. In addition, the Tamil Nadu Energy Development Agency (TEDA) announced plans to set up solar roof-top projects at about 300 government buildings across the states. Since then the state has made little progress towards the 3GW goal and had an installed capacity of only ~109MW as of late 2014. Some key points of the state's solar policy are:

- **Land –** Land will be identified for development of exclusive solar manufacturing parks. The state will promote the setting-up of solar manufacturing parks in the earmarked regions.
- **Tariff –** To increase the pace of installations, Tamil Nadu's electricity regulator ordered the state's distribution utility to pay a tariff of INR 7.01/kWh for power from solar PV plants and INR 11.03/kWh to plants using solar-thermal technology (or less depending on treatment of depreciation benefits). Solar power projects in TN are developed through competitive/reverse bidding. Investments through joint ventures by state public sector undertakings are encouraged at competitive tariffs.
- **SPO/REC –** TN has a Solar Purchase Obligation (SPO) of 6% for high tension (HT) and low tension (LT) customers. Also it has a renewable energy certificate (REC) mechanism to promote trading of solar power to meet the SPO. All obligated entities have to either buy or produce solar power from TANGEDCO or have to purchase RE certificates of equivalent quantity from power exchange.
- **Incentives –** Net metering is allowed to promote roof-top penetration. Also, wheeling and banking charges for wheeling of power generated from solar power projects to the desired location for captive/third party sale within the state are as per the orders of the TN Electricity Regulatory Commission. Exemption from payment of electricity tax to the extent of 100% on electricity generated at solar power projects used for self-consumption / sale to utility is allowed for five years. Tax concessions as per TN industrial policy are provided. Land is identified by the state for development of exclusive solar parks.
- **Investments –** Some major players anticipated to invest in TN are Adani (1000MW), Welspun (300MW), Sterling & Wilson (150MW) and SunEdison (150MW); however, some of the projects are awaiting clarity on tariff and extension of deadline.

Karnataka: As of Feb 2015, Karnataka had commissioned capacity of 84MW of solar PV. The state government has announced a 2GW target by 2021, under the policy; the government would auction 1.6GW capacity for utility scale projects, while ~400MW would be added in the form of rooftop grid connected projects. Some key points are:

- **Land –** MOU between SECI and KREDL for development of two solar parks of 800MW each. 11000 acres of land have been identified for developing solar parks. Time=bound permissions to acquire land under section 109 of land reforms act and deemed conversion of lands acquired. On payment of fees, developers are allowed to start project without waiting for conversion of agri land.
- **Tariff –** Government plans to implement net metering policy for roof-top solar power. To complement this program and provide financial incentives to households and commercial buildings, an attractive tariff has been adopted for roof-top solar at INR 9.56/unit (without subsidy) and INR 7.2/unit (with subsidy).
- **Evacuation –** Developer is responsible for connecting the generating station to the grid. KPTCL may assist in building the same at the behest of developer with all costs borne by developer.
- **SPO/REC –** Solar projects under REC mechanism shall be eligible for policy benefits as allowed under CERC REC mechanism as per guidelines issued by KERC from time to time. Also, GOK intends to bring HT categories of consumers (<50 kVA) under Solar Purchase Obligation (SPO) with consent of KERC.
- **Incentives –** Exemption from obtaining clearance from state pollution control board projects up to 5MW capacity. Tax concessions in form of Entry Tax, Stamp Duty and Registration as per industrial policy of Karnataka. Further, there are no cross-subsidy surcharges for third parties and no transmission and wheeling charges along with 100% banking for open access projects.
- **Investments –** KPCL plans to set up solar power plants totaling 100MW with players like SunEdison, AES, and Bharti Solar etc. KPCL will form a JV company with a 26% equity stake. Each solar plant will entail an investment of INR 1500 crore. Azure power to invest INR 2000m (two plants at 2MW and 10 MW) and BHEL 3MW plant at INR 420m.

Punjab: The Punjab government announced plans to set up two solar parks of 500MW each by 2022. Additionally, the state government is planning to set up 100MW of rooftop solar power projects on all government buildings, and to install 10,000 solar-powered irrigation pumps. Some major points in solar policy are:

- **Land –** Agricultural land shall be allowed for setting up of Renewable Energy Power Projects in the state and no Change of Land Use (CLU), External Development Charges (EDC) or any other charges shall be levied. Solar power projects are exempted from obtaining any NOC / consent from the pollution control board.
- **Tariff –** In the initial phase (Phase-1) the state will support the setting-up of 300MW solar (PV) power plants. Selection of power projects shall be through a tariff-based competitive e-bidding process and post-bidding

Punjab State Power Corporation Ltd (PSPCL) will directly purchase power. Bidders for power plant have the freedom to choose from various power generation technologies (cSi, thin-film modules etc). The tariff for the project is fixed at INR 7.87/KWh upon adjustment for accelerated depreciation.

- **RPO –** The quantum of electricity consumed by eligible consumers not defined as obligated entity from the rooftop solar system under net metering arrangement shall qualify towards compliance of Renewable Purchase Obligation (RPO) for the distribution licensee.
- **Incentives –** Solar power projects are 100% exempted from electricity duty along with 100% exemption from fee and stamp duty registration and Entry tax for structural goods and raw materials. REC-based solar power will be encouraged. Power can be sold on open access and proponent can claim REC for trading in exchange. Wheeling charges for captive use is at 2% of energy fed.
- **Investments –**Punjab signed MOU of INR 13,500 crore for investment in solar projects. Some major project MOUs include 500MW INR 4000 crore investment by 8-Minute Energy, California, 100MW INR 800 crore by Progetika-SRC, Italy, and 300MW canal-based solar power plant by Lightsource Renewable Development, UK. ACME group invested nearly INR 600 crore to develop 74MW of solar PV power projects.

Uttar Pradesh: The state government came out with its solar power policy in 2013 and it will be operational till 31 March 2017. The government has targeted 500MW of PV capacity by 2017. Some key points are:

- **Land –** Nodal Agency will act as single window clearance for Solar Power Projects. Also, the nodal agency will facilitate identification of suitable location and creation of land bank and also provide assistance in utility infrastructure.
- **Tariff –** Power purchase agreement will be signed between UPPCL and successful bidders for a period of ten years. Power developers who want to set up projects under this policy and sell power to a third party can set up plants under this policy without a bidding process but will not be allowed to sign a PPA even at a future date with UPPCL. Captive power plants above 5MW can avail of the benefits of the policy.
- **Evacuation –** The responsibility of getting connectivity with the transmission system owned by the discom lies with the project developer. The entire cost of transmission including wheeling charges & losses will be borne by the developer. All the facilities will be in accordance with UPERC regulations.
- **RPO –** UP has solar RPO targets of 1.5%, 1.75% and 2% over 2014-15,2015-16 and 2016-17 respectively with additional solar roof-top capacity of 20MW.
- **Incentives –** Provision of special incentive will be made by the state government on a case to case basis for solar farms where many power plants based on solar energy are installed and the total investment is more than INR 500 crores. All the incentives provided under the Uttar Pradesh State Industrial Policy for 2012 will be applicable to the power plants based on solar energy. For the Bundelkhand region, expenditure on the construction of transmission line and substation will be borne by the state government.

- **Investments –** NTPC commissioned a 5MW plant in Dadri at an estimated cost of INR 4859m. Bharti Airtel is planning to set up 300KW solar plant across six locations in UP.

Madhya Pradesh: MP houses the world's largest solar power project of 750MW in Rewa district, which is spread over 1500 hectares of land with a project cost of INR 4000 crore. The solar policy of MP is segregated into four parts based upon bidding process, captive use, JNNSM and renewable energy certificate (REC). Some important points of the policy are:

- **Land –** Developers of solar plant on private land in the state shall be eligible for incentives under the new policy, subject to registration with the GoMP. Furthermore, there shall be a set of qualification criteria fixed by the GoMP for the prospective developers proposing to develop projects on government land. Guidelines for the same will be specified and put into public domain through a website before invitation of proposals.
- **Tariff –** For the projects allotted under tariff-based competitive bidding route for sale to MP discoms, the PPA will be executed between discoms and successful bidders while in the case of third party sale/captive use the PPA will be executed between the Power Producer and the Procurer on mutually agreed rates.
- **RPO –** For sale of power to MP discom, the total capacity under this category will be as per Renewable Purchase Obligation (RPO), where there is no limit of capacity under REC mechanism. For capacity in other categories, they are guided by policies under respective segments.
- **Evacuation –** The developer is responsible for the laying of power evacuation line from generating station to the nearest substation in accordance with the MP state grid code. The developer is responsible for the payment of all wheeling and transmission charges to the distribution company in case of sale of power to third party consumers.
- **Incentives –** In case the developer purchases private land for the project, they will be eligible for an exemption of 50% on stamp duty as per pre-defined notification. All solar power projects (including captive units) are eligible for exemption from payment of electricity duty and cess for a period of 10 years from the date of commissioning of the project. The solar projects implemented under this solar policy will have the status of industry and will be eligible for all benefits under Industrial Promotion Policy. The equipment purchased for installation of solar power plants under the policy is exempted from VAT and entry tax. Regarding other incentives such as Open Access, Reactive Power and Renewable Purchase Obligation, the provisions specified by MPERC shall be applicable.
- **Investment –** MP has a capacity pipeline of nearly 270MW with some major developers such as Welspun (130MW), NTPC (50MW), and ACME (25MW).

Maharashtra – On 6 June 2015, the Maharashtra Cabinet approved achieving 14.5GW of new renewable capacity in the next five years, consisting of 7.5GW of solar capacity. The procurement of electricity will be done under RPO through competitive bidding. The state government plans to set up 11,500MW capacity of renewal energy plant with 7500MW solar energy capacity by 2019. The government arm, MAHAGENCO, will construct 2500MW in the PPP model for the remaining 5000 MW it will float tenders. The government plans to install 8000 solar pumps by the end of the current fiscal year.

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Appendix 1

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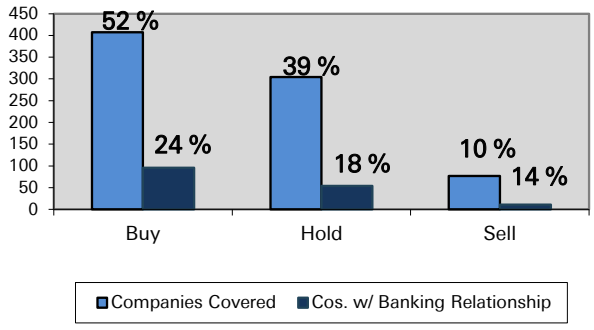

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