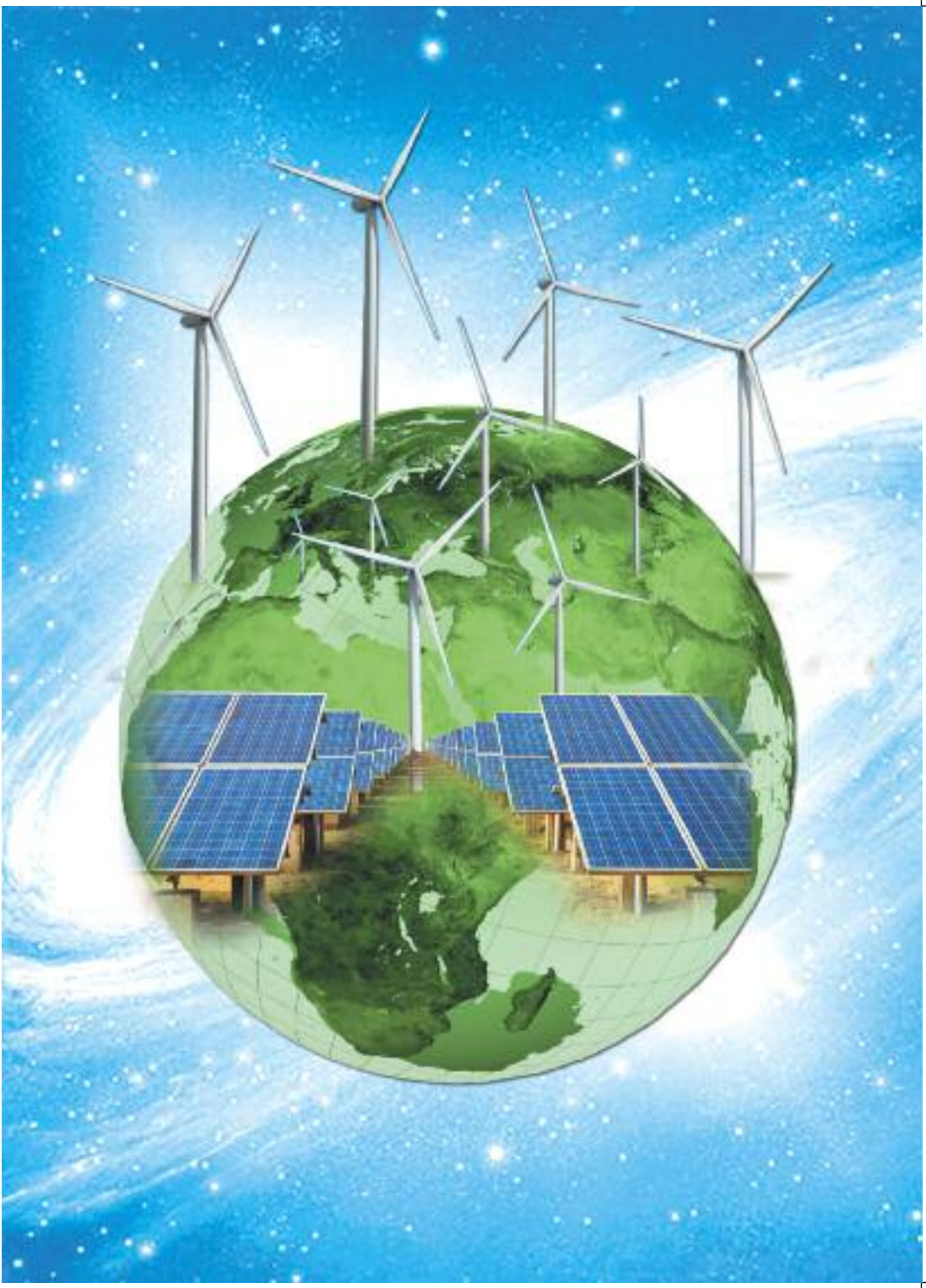
Solar Power: The Agony & The Ecstasy



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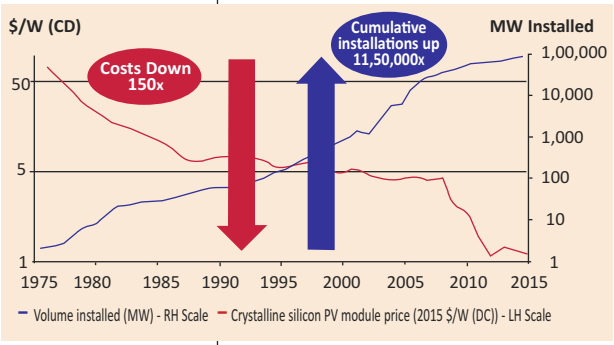
A panel discussion jointly
organised by
The Free Press Journal
and
Indian Merchants' Chamber

On 10th June 2016 at
Indian Merchants' Chamber, Mumbai

Preface

In May this year, Dubai received five bids for setting up phase III of the Mohammed bin Rashid Al Maktoum Solar Park*. One of the contenders offered to set up the 800 megawatts of solar at a stunning US 2.99 cents per kilowatt hour (kWh) — unsubsidized! That translates into Rs.2 per kWh.

Just a month earlier, Michael Liebreichm, Chairman of the Advisory Board, Bloomberg New Energy Finance (BNEF), gave his 'state of the clean energy industry' keynote address at BNEF's Future of Energy Global Summit in New York. Among other things, he underscored how sustained long-term deployment programs had transformed the solar industry. "We've seen the costs come down by a factor of 150 since 1975. We've seen volume up by 1,15,000 . . . . . How much more miracle-y do you need your miracles to be?"



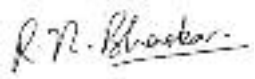
For almost two decades, India looked at this gift-horse in the mouth. It was only by the end of the first decade of 2000 that the government decided to promote solar energy through its Solar Mission programme.

**** Solar Park:*** *http://www.albawaba.com/business/pr/dewa-receives-5-bids-phase-iii-mohammed-bin-rashid-al-maktoum-solar-park-835386*

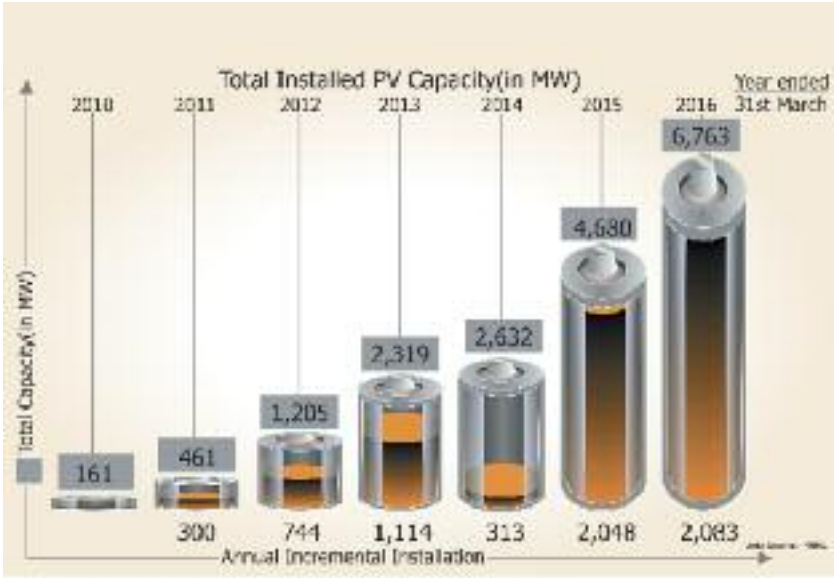
The present government has pushed the envelope further by enhancing the target from 20 GW in 2022 to 100 GW. India has the potential to generate 749 GW of solar power (compared with 303 GW being generated through all sources – thermal, hydro, nuclear etc).

But it was only a couple of months ago that the government began pushing the second strategic advantage India enjoys (in addition to abundant sunlight) – its huge population, hence more homes. Germany, which had a key role in promoting solar power, did so through rooftop solar. That reduced land costs, and also made this sector a bigger employer than even the automotive industry in that country.

India needs more jobs, and it has more roofs. By exploiting rooftop solar, India could reduce the cost of land acquisition and also create more jobs. But that won't be possible till new policies are introduced to take care of the subsidy behemoth that India's political class has created. Unless this problem is addressed, states will not allow commercial offices and homes to benefit from low cost solar, as they want someone to pay for the subsidised power. India's policymakers will have to find a solution for this. Solutions exist. But the ministry for non-conventional and renewable energy (MNRE) will have to determine which solution suits India best – politically, socially, environmentally and economically. If handled well (and coupled with methane generation), India could become foreign exchange surplus in its balance of payments. It could create countless jobs. It could also become a non-conventional exporter, and promoter of good economics and a healthier environment.



R.N. Bhaskar,
consulting editor, FPJ

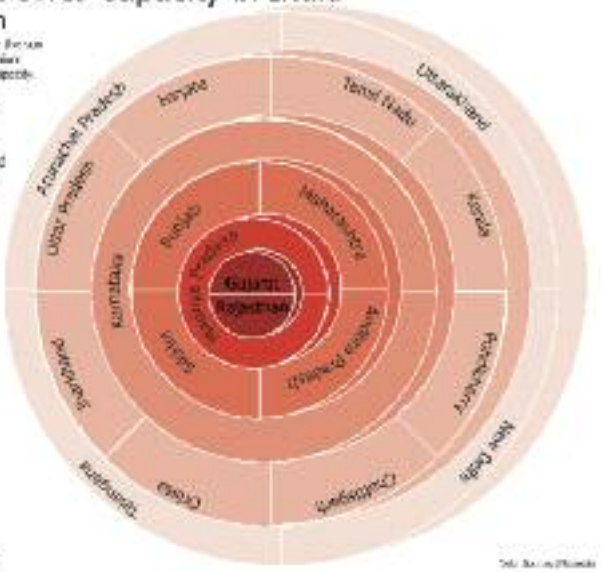


Installed Solar Power Capacity in India

Statewise Distribution

No Data Available for Manipur, Jammu & Kashmir, Bihar, West Bengal, Assam, Tripura, Mizoram, Meghalaya, Nagaland Himachal Pradesh, Goa, Daman & Diu and Dadra and Nagar Haveli.

Installed capacity in MW



Background

– Pankaj Joshi

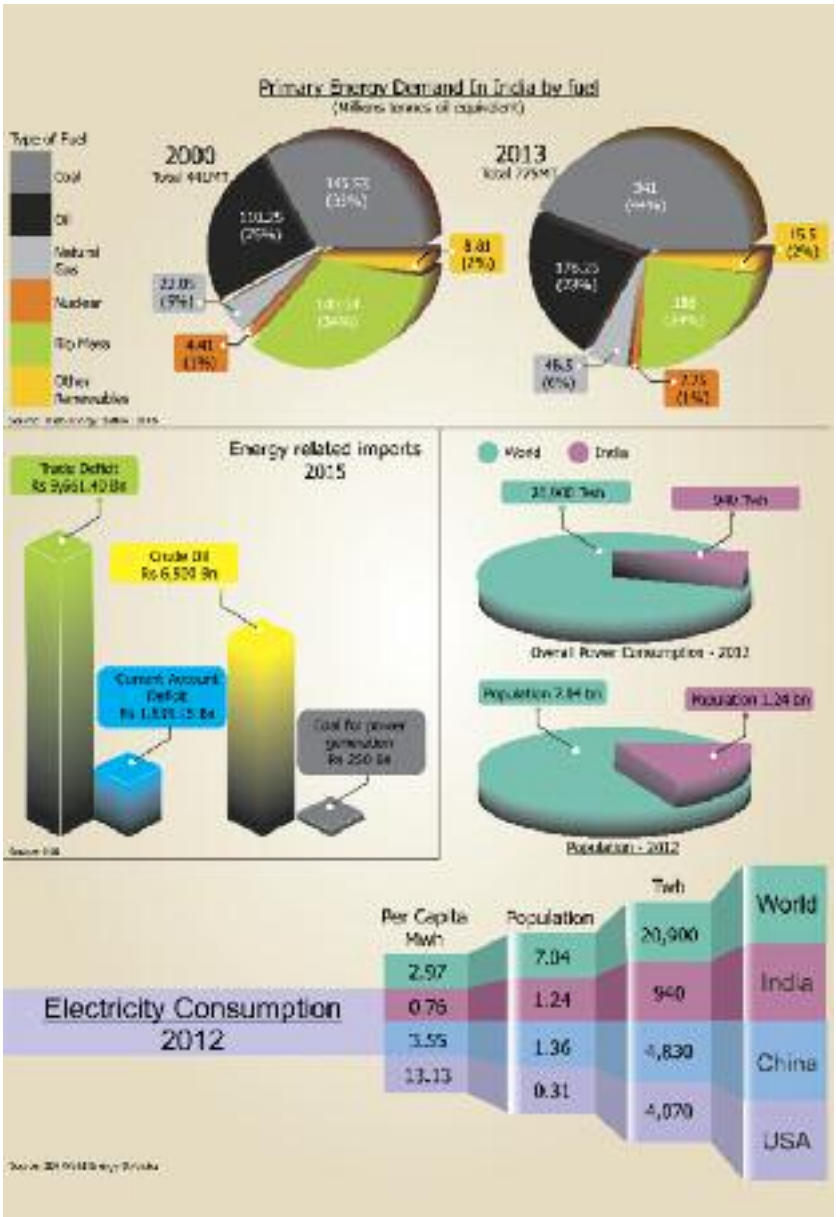
The Indian solar energy story started slowly and unconvincingly, as more of an experiment.

• It can be seen how solar power had negligible presence in the country till 2010 and then till 2014 its growth was not very convincing. However, the scale-up in the past two years under the new government has been impressive, not the least because there has been a modification of the targets for solar energy.

• From an earlier targeted 20 GW capacity of solar energy by 2020, the revised target is now 100 GW, an ambitious upgrade. The 'Bridge to India' estimates that the current 6.7 GW installed capacity would reach around 43 GW by 2020. Other estimates too indicate that the 100 GW target may not be reachable, but the scale-up from the earlier target remains impressive. Moreover, the new policies promise to further galvanise growth rates.

• Rooftop solar capacity, from being an adjunct, is now a key component of this growth plan. There are various schemes and incentives for rooftop solar, including a 30% subsidy, low-cost funding, a tax holiday for ten years (MAT payable) and accelerated depreciation. The RBI's decision to bracket rooftop solar investments of upto Rs.10 lakh into priority sector lending is bound to help.

• The current distribution of installed solar power capacity is heavily skewed towards Gujarat, Rajasthan and Madhya Pradesh. A healthy presence can be seen in Maharashtra, Punjab and Andhra Pradesh.


Primary Energy Demand In India by fuel
(Millions tonnes of equivalent)
Type of Fuel
Coal
Oil
Natural Gas
Nuclear
Big Hydro
Other Renewables
2000
2013
Energy related imports 2015
Trade Deficit
Crude Oil
Current Account Deficit
Coal for power generation
World
India
Overall Power Consumption - 2012
Population - 2012
Electricity Consumption 2012
Per Capita Mwh
Population
Twh
World
India
China
USA
2.97
0.76
3.55
13.13
7.04
1.24
1.36
0.31
20,900
940
4,830
4,070

Importance of solar energy to India

India's energy consumption has doubled in 2000-2015, but there are still substantial deficiencies.

• With 18% of the global population, India uses only 6% of the world's primary energy consumed from fossil fuels and renewables.

• India's annual electricity consumption is again just 5% of the world. The per capita annual consumption has just touched 1 MWh, against a 3 MWh global average (2012). The comparative figures for USA and China are over 13 MWh and 3.5 MWh respectively.

The growth requirement goes beyond the logic of numbers.

• Global population without access to electricity is estimated at 1 billion. A quarter resides in India.

• India's growing economy, listed as the third largest worldwide by the International Energy Agency (IEA), has all policies – urbanisation, manufacturing sector expansion and population welfare – interlinked with higher energy requirements, especially of electricity.

• Traditionally, India has relied on imports for its overall primary and secondary energy production, which is thermal-based. As per FY2015 figures for import of crude oil and coal (for thermal power plants) combined constitute 70% of India's FY2015 trade deficit figure of Rs.9.66 trillion.

• Even a 25% reduction in these would almost eliminate the current account deficit, which stood at Rs.1.84 trillion. The greater indigenisation of energy supply is, therefore, necessary to mitigate the permanent pressure on trade balance and the currency.

A proper energy enhancement, moving away from thermal sources, is essential. Solar energy will be a vital component.

Jawaharlal Nehru National Solar Mission (in MW)

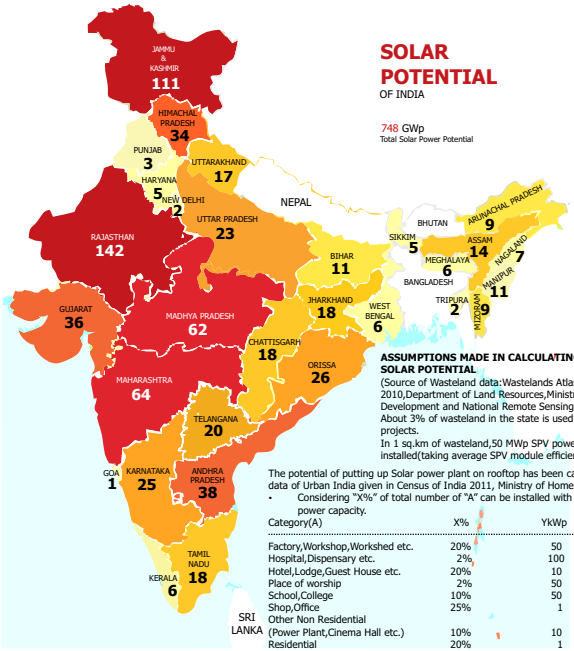
	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	TOTAL
Rooftop Solar Project	200	4,800	5,000	6,000	7,000	8,000	9,000	40,000
Ground Mounted Solar Project	1,800	7,200	10,000	10,000	10,000	9,500	8,500	57,000
TOTAL	2,000	12,000	15,000	16,000	17,000	17,500	17,500	97,000

Source: MNRE,Wikipedia

Disclaimer: All figures in the table are just projections and may vary.

Jammu & Kashmir	111GWp
Himachal Pradesh	34GWp
Punjab	3GWp
New Delhi	2GWp
Haryana	5GWp
Uttarakhand	17GWp
Uttar Pradesh	23GWp
Rajasthan	142GWp
Gujarat	36GWp
Madhya Pradesh	62GWp
Bihar	11GWp
Jharkhand	18GWp
Sikkim	5GWp
Assam	14GWp
Arunachal Pradesh	9GWp
Nagaland	7GWp
Meghalaya	6GWp
Tripura	2GWp
Manipur	11GWp
Mizoram	9GWp
West Bengal	6GWp
Orissa	26GWp
Chattisgarh	18GWp
Maharashtra	64GWp
Telangana	20GWp
Goa	1GWp
Karnataka	25GWp
Andhra Pradesh	38GWp
Kerala	6GWp
Tamil Nadu	18GWp

Data Source: National Institute of Solar Energy



SOLAR POTENTIAL OF INDIA

748 GWp
Total Solar Power Potential

ASSUMPTIONS MADE IN CALCULATING STATE-WISE SOLAR POTENTIAL

(Source of Wasteland data:Wastelands Atlas of India 2010,Department of Land Resources,Ministry of Rural Development and National Remote Sensing Centre,ISRO.)
About 3% of wasteland in the state is used for solar power projects.
In 1 sq.km of wasteland,50 MWp SPV power plant can be installed(taking average SPV module efficiency 15%)

The potential of putting up Solar power plant on rooftop has been calculated by taking data of Urban India given in Census of India 2011, Ministry of Home Affairs.

- Considering "X%" of total number of "A" can be installed with "Y" kWp of SPV power capacity.

Category(A)	X%	YkWp
Factory,Workshop,Workshed etc.	20%	50
Hospital,Dispensary etc.	2%	100
Hotel,Lodge,Guest House etc.	20%	10
Place of worship	2%	50
School,College	10%	50
Shop,Office	25%	1
Other Non Residential (Power Plant,Cinema Hall etc.)	10%	10
Residential	20%	1

The potential and the road map

• The Jawaharlal Nehru National Solar Mission (JNNSM) started off with a modest target of 20 GW of solar power installations, which in the past couple of years was upgraded to 100 GW by 2022.

• Certainly, there is a potential. The adjoining map provided by the National Institute of Solar Energy gives out the detail of a 748 GW solar power potential, given the intensity of sunrays in different parts for different portions of the year.

But, reaching the target will depend on affordability and user-friendly policies. An India Ratings report stated that prices are due to come down 60-70% from peak levels.

• The capital cost for 2010-13 bids was Rs.12-15 crore/ MW and sales were at Rs.15-17/ KWh. The current estimates are Rs.5-6 crore and Rs. 4.50/KWh-7. Bloomberg New Energy Finance (BNEF) estimates that solar PV costs will fall a further 60% by 2040*.

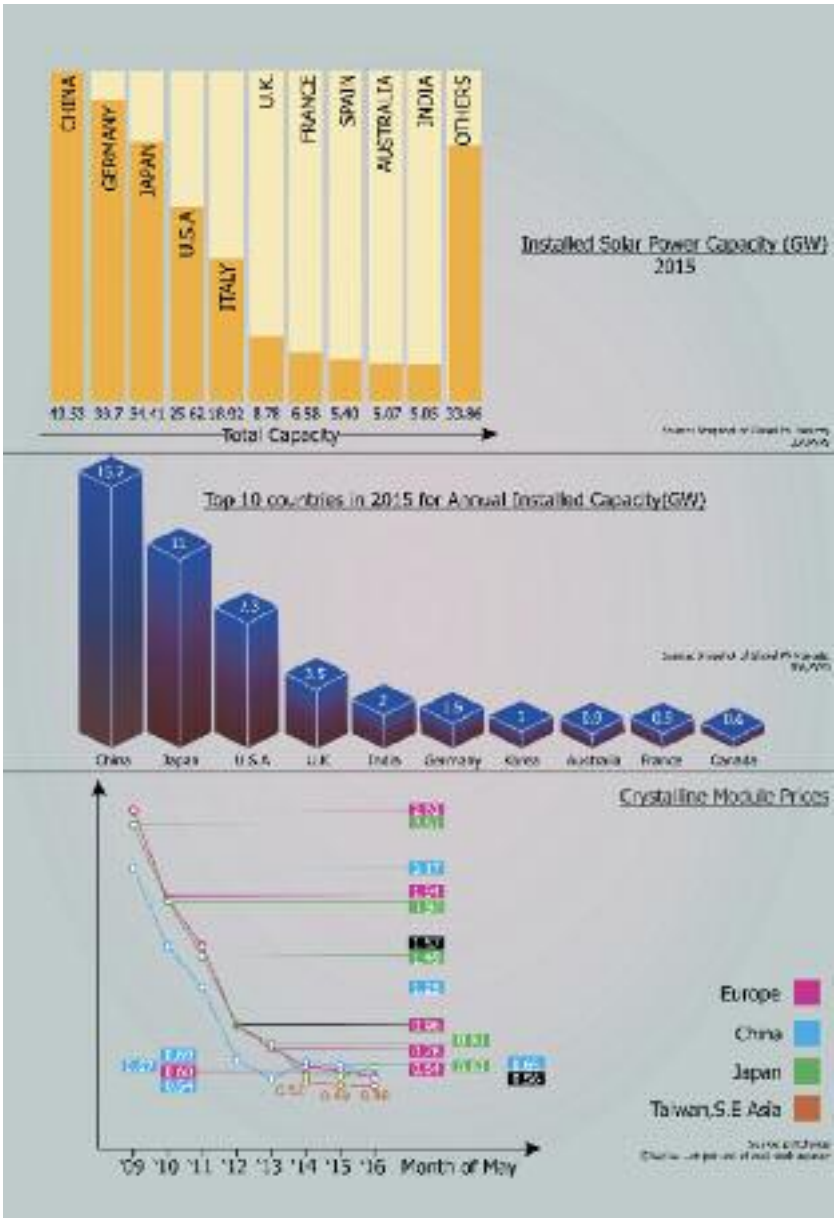
• The key elements in pricing are equipment cost, finance cost and land acquisition cost. The third element disappears with rooftop solar. None the less, other elements for the 100 GW target are also quite substantial.

• Given financial viability and closure, the issue then is grid integration without which power purchase agreements would not happen.

• For rooftop solar model, the Fit-in-Tariff (FIT) structure must be in place, so that small establishments can sell power to the grid.

• Incomplete policies and procedures are a hindrance, though efforts to mitigate this are evident.

**** BNEF's long-term forecast:*** *http://about.bnef.com/press-releases/coal-and-gas-to-stay-cheap-but-renewables-still-win-race-on-costs/*


CHINA
GERMANY
JAPAN
U.S.A
ITALY
U.K.
FRANCE
SPAIN
AUSTRALIA
INDIA
OTHERS
Total Capacity
Installed Solar Power Capacity (GW)
2015
Top 10 countries in 2015 for Annual Installed Capacity(GW)
China
Japan
U.S.A.
U.K.
India
Germany
Korea
Australia
France
Canada
Crystalline Module Prices
'09 '10 '11 '12 '13 '14 '15 '16 Month of May
Europe
China
Japan
Taiwan,S.E Asia

The global picture

Worldwide, solar has a presence, though not a substantial one as yet.

• Legacy power generation systems (coal and gas) still hold around 57% of the 6,400 GW market, with solar having a mere 4% share.

• The data alongside shows that Europe as a whole has the lion's share of current capacity. The real motivation has been Germany, which has combined Government support and incentives with on-ground innovations*.

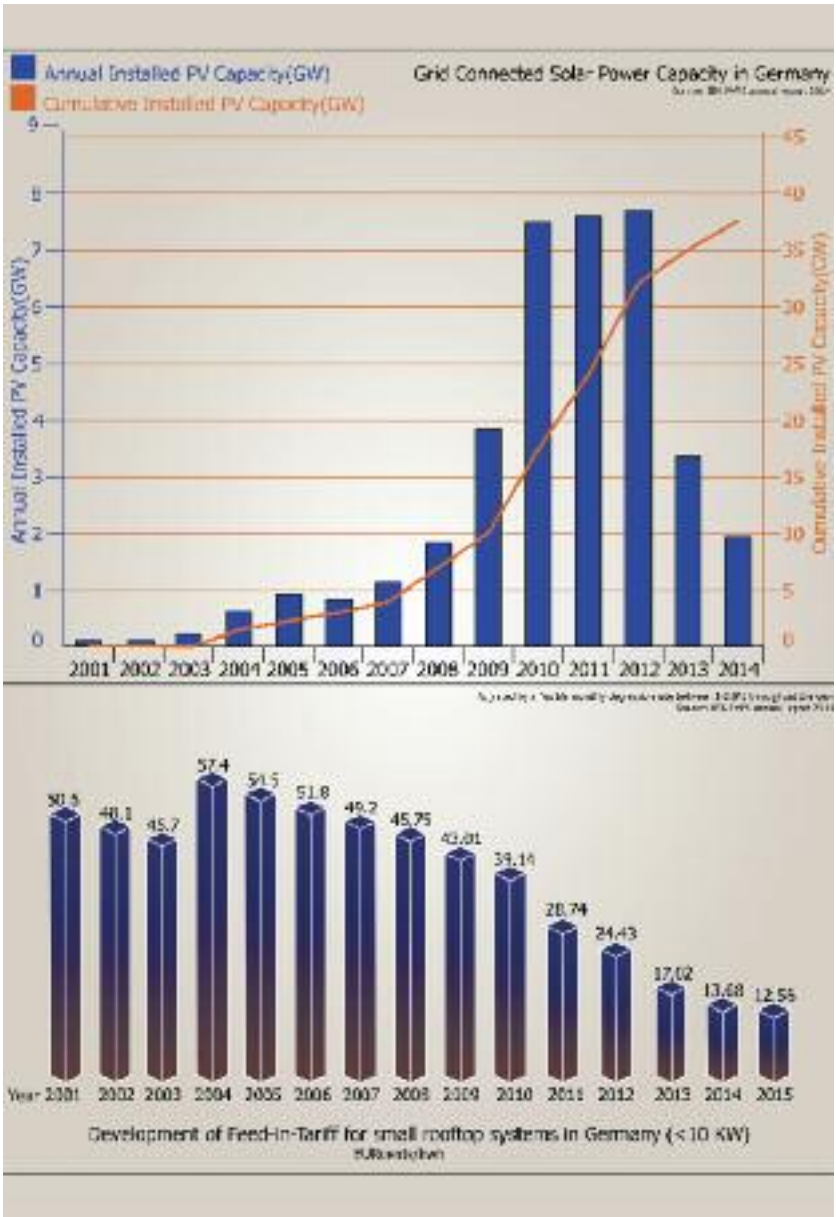
• However, the last few years have seen China catch up and become the nation with the single-largest capacity (44 GW). Last year itself China added 15 GW.

• India has a very small presence, but it is among the most active countries in 2015. Globally, India is recognised as a high-growth market.

• Worldwide, as per IEA estimates, installed capacity for solar power is 227 GW of which the top ten nations have 193 GW and the top five have 162 GW.

• Most of the current capacity is concentrated in one part of the world – Europe. Clearly, there is so much scope for geographical expansion.
One of the tipping points is a decline in equipment cost, which appears sustainable. The module prices have already fallen 75-79% across different regions and this will be a key factor in an industry where operating costs are thin and capital outlays are high. BNEF estimates overall power capacity to double between now and 2040, and solar to grow from 4% share to 29%.

**** German Government:*** *http://www.asiaconverge.com/2016/04/india-not-learn-germanys-hermann-scheer-solar-power-model/*


Annual Installed PV Capacity(GW)
Cumulative Installed PV Capacity(GW)
Grid Connected Solar Power Capacity in Germany
Annual Installed PV Capacity(GW)
Cumulative Installed PV Capacity(GW)
0
1
2
3
4
5
6
7
8
9
0
5
10
15
20
25
30
35
40
45
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
50.5
48.1
45.7
57.4
51.5
51.8
49.2
45.75
43.01
39.14
28.74
24.43
17.02
13.68
12.56
Year 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Development of Feed-in-Tariff for small rooftop systems in Germany (< 10 kW)

Germany the pioneer

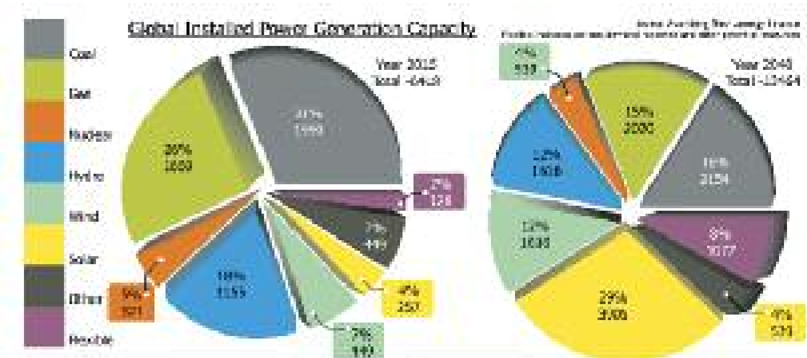
The role of Germany in solar power is immense. Its innovations have spread worldwide.

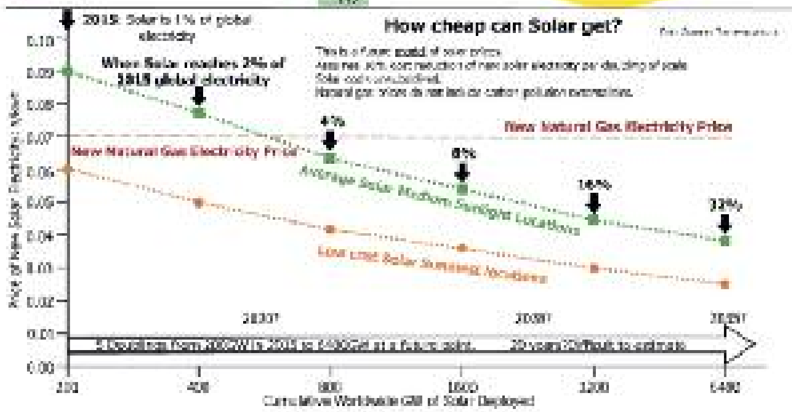
• The core of the German solar energy programme is the FIT mechanism, which gets energy generated from each installation onto the grid, and provides credit for the same against consumption. The FIT programme guarantees a fixed compensation for the power generated from the installation for a period of 20 years. This enthused lenders, investors and users.

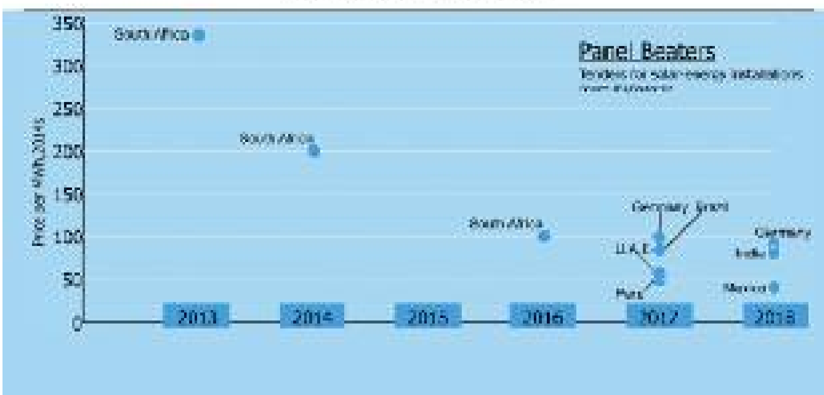
• The FIT innovation created a layer of people for installation, maintenance and aggregation of solar power generated by individuals. Today, this layer employs more people than the automobile sector in Germany.

• That also helped generate demand for solar panels, and this helped lower equipment costs. The aggregate installed solar power capacity of 9.4 GW in 2009 went up to 37.1 GW by 2014. The typical rooftop solar installation cost fell from Euro 5,000 per kWp in 2006 to around Euro 1,200 per kWp, currently.

The rapid rise in capacity, and the falling installation costs, have also seen a reduction in FITs, from Euro 0.5 per unit in 2008 to Euro 0.1 per unit in 2014. This again is an incentive to consumers, and an overall ceiling on the power tariff in the country.


Global Installed Power Generation Capacity
Coal
Gas
Nuclear
Hydro
Wind
Solar
Other
Flexible
Year 2015
Year 2040


How cheap can Solar get?
When Solar reaches 2% of 2015 global electricity
New Natural Gas Electricity Price
Average Solar Medium Sunlight Locations
Low cost Solar Sunbelt locations
Cumulative Worldwide GW of Solar Deployed


Panel Beaters
South Africa
Germany
India
Mexico
2013
2014
2015
2016
2017
2018

Future trends

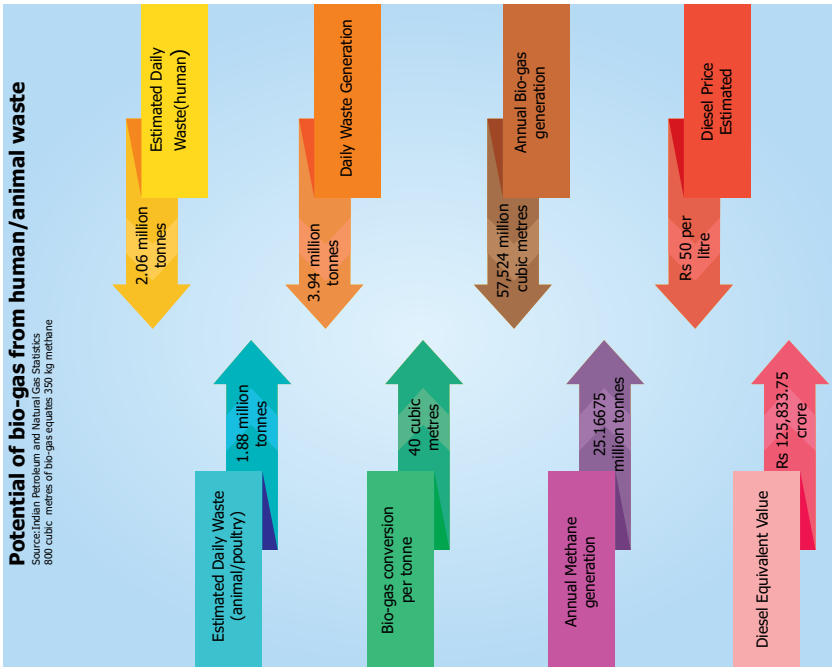
Solar power is available for only half the day and subject to local weather vagaries. That is where storage devices (and inverters) become necessary. Fortunately, battery prices are set to fall by 75% by 2017. Tesla expects battery costs to fall further to around 10% of current costs by 2020*.

This augurs well for solar power, allowing decentralised off-grid solar units to become popular. This could help the Indian government tremendously in providing power to all rural areas at a fraction of current capital and recurring costs.

Globally, efforts to harness solar power in desert areas should gain momentum. It was a key imperative a decade ago when the Desertec# project was launched. Energy experts realised that the sun produced enough energy in just six hours in the Sahara equal to the annual consumption of the planet. The project idea was to carry this power from the Sahara to Europe via HVDC (high voltage direct current) cables. That project took a backseat with political flare-ups in the Middle East and the fall in oil and gas prices globally.

However, local generation of power in these deserts will get a boost. With much more economical storage, falling capacity creation cost and large-scale acceptance, trends are clearly positive for solar power.

**** Tesla:*** *http://www.bloomberg.com/news/articles/2016-06-29/-tesla-solar-wants-to-be-the-apple-store-for-electricity*
 # Desertec: *http://www.desertec.org/*


Potential of bio-gas from human/animal waste
Source:Indian Petroleum and Natural Gas Statistics
800 cubic metres of bio-gas equates 350 kg methane
Estimated Daily Waste(human)
2.06 million tonnes
Daily Waste Generation
3.94 million tonnes
Annual Bio-gas generation
57,524 million cubic metres
Diesel Price Estimated
Rs 50 per litre
Estimated Daily Waste (animal/poultry)
1.88 million tonnes
Bio-gas conversion per tonne
40 cubic metres
Annual Methane generation
25.16675 million tonnes
Diesel Equivalent Value
Rs 125,833.75 crore


A Bio-Digester : How it Works
Bio-Gas generated can be used for cooking
Animal Shed
Latrine
Animal waste
Inlet for Animal waste
Human waste going to digester tank
Outlet for bio-gas
Slurry reidue can be used as manure for crops
Bacterial treatment of waste in bio-digester tank
Outlet for Slurry residue
Image Source: Visual.ly

Methane – the natural complement

If India has the 'sun' advantage, it also has the methane potential. Human and animal waste can generate methane, which can substitute CNG, LNG, kerosene and even generate electricity.

• India's human population (second largest) and cattle population (largest) generate around four million tonnes of excreta daily. At a conversion rate of 40 cubic metres of bio-gas, India currently can generate 57 million cubic metres of bio-gas annually.

• Since 800 cubic metres of bio-gas equates 350 kg methane, this translates into around 25 million tonnes of diesel. At present, the annual diesel consumption of India is around 70 million tonnes.

• At current diesel price levels of Rs.50/ litre, 25 million tonnes is worth Rs.1.25 trillion on diesel-equivalent basis. The converted methane can substitute diesel and kerosene.

• In terms of quantity, agro-waste would have at least 20-30 times additional potential for generating methane.

Harnessing this source with proper technology would reduce crude imports substantially, if not render them almost entirely irrelevant. The forex saving, impact on the current account deficit and the BOP (balance of payments) need not be stated. At village level, generation via local digestors has been proved viable. Policies to facilitate waste-to-energy investments, waste collection and energy conversion could galvanise methane generation. The local administration could focus on machine maintenance and monitoring generation and sale activity.

Such operations can even finance the nationwide toilet construction programme, as well as facilitate organic fertiliser production, which again means reduction in imports.

Recommendations

The long-term utility and viability of solar power for India cannot be doubted. Seen as a subsidised mode, solar operating costs are 5-7% of revenue vis-à-vis the comparable 25-40% costs for thermal power. Actually, solar power works out much cheaper over a 25-year life cycle despite the capacity factor being 30-40% at best.

However, if the growth is to come at the expense of thermal power, there will be other issues. The thermal capacities in India are estimated to grow to 175 GW by 2022. At a reasonable average MW cost of Rs.3.5 crore over the years, it represents an investment of Rs.6.12 trillion, much of it bank-funded. Consumers moving to solar, means gradual cannibalisation of this investment. Hence, solar power penetration has to be gradual and non-intrusive, unless India's economic growth and electricity supply penetration increase dramatically. They probably will.

The key bottleneck will be persuading state governments to promote cheaper solar power for industry, commercial establishments and homes. But these segments subsidise power for agriculture and economically weaker sections. If the three sectors do not pay higher tariffs, subsidies will not be possible. That is politically unacceptable. Hence, the following recommendations:

• Need for a policy framework for dealing with subsidies.

• Need for a policy framework for investments in solar – in such a manner that investors and lenders make money, subsidies are taken care of and users of solar power benefit.

• One way is to promote off-grid decentralised cluster solar power/ methane generation units. The savings on transmission losses, theft and transmission capex will help.

• Need of a financing model which makes subsidies possible without jeopardising profits for investors.

The Solar Energy's Panel

(LtoR) Jayant Parimal, CEO, Adani Green Energy; R.N.Bhaskar, Consulting Editor, Free Press Journal; Dilip G. Piramal, President outgoing, IMC; Upendra Tripathy, Secretary, Ministry of New and Renewable Energy, Government of India; Deepak Premnarayen, President elect, IMC; and Vikram Kailas, Managing Director, Mytrah Energy.

Panel Discussion

Welcome address by Dilip G. Piramal, President outgoing, IMC : In the last two years, the Ministry of Coal – Power, Coal, and New and Renewable Energy under the Honorable Minister's able leadership, has transformed the power sector with comprehensive reforms. The Ujwal DISCOM Assurance Yojana (UDAY), with the aim to turn around loss-making DISCOMs across all states is just one example. Under UDAY, bonds worth Rs.1 lakh crore were issued in 2015-16. In the past year, more than 7,000 villages were electrified, way above the targets. This ministry is helping India run the world's largest renewable energy program with target of 175 gigawatts by 2022.

Recently, Shri. Piyush Goyal launched the Surya Mitra mobile app which aims to create employment opportunities for skilled manpower in installation, commissioning, operation and maintenance of solar power plants and equipments. The clean and green energy in the form of solar power is the major energy source. Our country is endowed with unlimited solar energy. The way solar energy prices are going down and technology is developing, energy costs can become very low. We may even go to days of free energy, something quite unthinkable even a few years ago.

There are challenges, however, to the Government of India's vision of connecting the unconnected and 24x7 affordable and environmentally friendly power to all – such as getting all states to sign up for the UDAY agreements, connecting remote villages, upgradation of infrastructure, new technologies and improved efficiency in order to reduce costs. The panel will today discuss the entire gamut of challenges and the opportunities in the solar segment.

Keynote address by Government of India, Ministry of New and Renewable Energy, Secretary, Upendra Tripathy:

As far as solar power goes, I find no agony. Let me share the journey we had since I took charge on April 1, 2014. In June, the Honourable Prime Minister called me and asked if 1,00,000 MW of solar power was possible. I confidently replied in the affirmative and then afterwards read a letter on the file outlining why 1,00,000 MW cannot be done – no grid, no land and no money. After a two-hour meeting with all officers and scientists, a vote was taken where 58 persons said no and only one who said yes, which meant that the collective strength of the ministry felt it is impossible. I was really devastated.

At that time, we got this idea of a global investor meet for renewable energy and 'Re-Invest 2015' was born (though it finally happened in February 2016). When asked by the Prime Minister about the planned outcome, we said, "We will go beyond MoUs, we will get commitment certificates from the industry as to how many MW are going to be put up." On the question of money we replied that we would get financing commitment letters from banks as well.

There was no clarity at that time, but when the event was done in February we had commitments for 2,77,000 MW, signed by company managing directors. That size again was a new challenge, and these were commitments made from companies of other nations. The regulators there took note and started questioning the respective companies, who hurriedly came back and asked us how to go ahead.

When land loomed as an issue, the solar park idea was developed, a centralised mechanism to facilitate your solar power production, making it easier and perhaps, bringing costs down. At 'Re-Invest', we also obtained commitments from 28 public banks to finance a total of 77,000 MW, a promise they are living up to. Thus, 'Re-Invest' gave us confidence in our 1,00,000 MW solar venture, which was five times the earlier commitment. There was pressure, but it was never agony, more of a challenge and happiness.

In terms of finance, we didn't have a very friendly bond market, no green bonds, no payment security mechanisms or any innovations, only the promises of domestic banks. Till date, no foreign bank has given any money for renewables.

Other questions raised were – are there sufficient engineers and trained mechanics to attend to park or rooftop requirements on regular basis? And, are there independent power producers (IPPs) with agreements? Then, came the material and components question. As of now, we import nearly all the material and the notified anti-dumping duty of 45% would make our target more difficult to attain. There was a question of quality testing, of lab infrastructure in the country at that time.

One of the outcomes was that if land was an issue, we could take out 40,000 MW of this and put that on rooftops, which would not require land. Despite the Land Acquisition Act not coming through, the local governance offered quite a few mechanisms for land acquisition. Karnataka has some 2,000 MW on nearly 10,000 acres of land obtained through lease from a society created just by farmers, without acquisition or notification.

Another was having 50,000 mechanics trained, which is now called Surya Mitra. Like a taxi service, you can go to the app and provide the information, whereby a mechanic will contact you and charge you Rs.150 as per rules.

Our minister, being a lawyer and a chartered accountant helped the states to not only patch things up, but to get money from the ministry. In just two years' time, our budget has gone up six times from Rs.1,500 crore to Rs.9,000 crore. The carbon cess, which rose from Rs.50 to Rs.400, also partly helped us get money. The RBI stated that upto Rs.1,500 crore investment in renewable energy would be treated as priority sector lending. The Rs.10-lakh proposals in the rooftop segment would be priority sector lending. The technological innovations are also getting capital costs down.

To find land in one place or a few places is difficult. But, if you take the count of 11 KV substations in the country, or for that matter 33 KV and distribute 1,00,000 among that, each will come around 2 MW. You don't need long connectivity lines, nor a lot of green energy corridors. You can easily put 1,00,000 MW onto the grid, in those tail-end areas where it is precisely needed. If asked to finance 10,000 unemployed graduates, we could give them say one MW each and make them solar entrepreneurs. We never thought it would be so easy to achieve, hence, there was no agony.

Today, I am sure we can put 1,00,000 MW in place within eight months. Thermal Energy is equally costly (in capital), it takes four years to get started and you have to keep on buying coal. With solar you start in eight months and then for 25 years you do not have input costs.

Getting the states to buy costlier solar power is a matter of concern for them. Their main paying clients could also get access to their own power

through rooftops. So renewable energy, apart from forcing states to buy costlier power, can also get their best customers moving away, and so persuading them to buy renewable energy has been a challenge. However, we do have the famous Renewable Purchase Energy Obligation which many states have respected.

Today, Delhi Metro plans to produce 500 megawatt in Madhya Pradesh, bring it to Delhi and use it for the metro. The Honourable Chief Justice has asked us to ensure that the Parliament, the Rashtrapati Bhavan and the Supreme Court, all become 100% solar. People are becoming conscious of the benefits of solar energy, of how would we leave the planet for our grandchildren. Every MW of solar energy means 50 vehicles off the road, 2% lesser premature deaths caused by air quality. So, if you are an active partner – a company, a consultant – playing a role in this revolution of oil in the sky, you should be proud of it. All corporate players must do their bit to promote and undo what we have done in the past.

Government's approach

UPENDRA TRIPATHY,
Secretary, Ministry of New and Renewable Energy, Government of India

In many countries, the energy conservation and renewable energy are in the same ministry. In India, we have two different ministries but under the same minister.

Upendra Tripathy: Today, we have solar usage commitments from 45 secretaries of the Government of India across ministries, aggregating 5,000 MW. The atomic energy ministry committed for 50 MW and even, the department for personnel and training has a commitment for 2 MW. We are proactively going around having discussions with departments. For instance, we tell them if your rooftop is empty, then you have savings of Rs.3-4 per kilowatt hour like Delhi Metro, you should go for it. When departments find out about rooftop model being cheap in many places, they are vulnerable to queries if they do not implement it.

As an incentive, some cities do get extra FSI, but that is ultimately a municipal government decision. In some places like Gurgaon, rooftop solar energy has been made compulsory. On the other hand, places like Pune and Bengaluru have it compulsory for water heaters.

Through our website, any society can give a tender to find a respondent company to perhaps, install solar power equipment without any cost and provide five-year free maintenance. Against that, there would be a civil enforceable contract that the society would buy power from that company for 25 years at a rate attractive vis-à-vis current cost.

JAYANT PARIMAL,
CEO, Adani Green Energy

Our aspiration is 15 GW in the renewable energy space. 700 odd MW is set up, and 1,300 MW more is under construction. That makes us already the largest player in India and at 5 GW, we will be the largest worldwide.

Jayant Parimal: On a thumb rule, a rooftop should cost you Rs.60,000 per kilowatt, and there is a simple 30% Government subsidy scheme for the project cost, but I am not aware of how simple the process is. And, it is a viable project because many states have net metering installed. But, DISCOMs are no longer making it easy to get net metering installed, just because they think that the good and paying customers will go away.

Tripathy: On the waste to electricity topic, the Kasturirangan Report says it should be under the urban development ministry, even though we still look after the technology part. Right now, the 'Waste-to-Energy' policy is that, in the notified cities, if anyone gets electricity from waste, it shall be purchased and in case of multiple parties there will be some sort of reverse bidding. However, in the absence of segregation and quality of waste, it will need a lot of local collection efforts. For this, plans are being discussed and enquiries are coming in. This is an area which will see activity.

In many countries, the energy conservation and renewable energy are in the same ministry. In India, we have two different ministries under the same minister and we work closely with each other. We all work together on a WhatsApp group of 84 secretaries.

Around 10.4 crore LED bulbs have been installed. The state governments have come up with new programs and the ministry of power has made it very popular.

Panel participant profiles and aspirations

Parimal: Adani Group is the largest conventional private power producer which operates approximately 11 gigawatts (GW) of power. We are also acutely aware of climate change issues and the importance given to clean and renewable energy by the Government of India, with a renewable energy target of 175 GW.

In 2011, we had a 40 MW solar plant which was then the largest, although, it sounds very small today. During 'Re-Invest', we gave a modest commitment of 6,000 MW and after that, we started looking at this sector seriously. Right now, our aspirations are big. As we speak, we are constructing the country's largest solar manufacturing plant at Mundra, which is 1.2 GW megawatts cell plus module, which will go upto 2 GW in phase II expansion. Coupled with that is manufacturing of what is called ingot and wafer and backward integration upto poly silicon which is the goal. We want to be end-to-end player in the chain, which includes manufacturing of the solar panels and related activities upto development of the power plant. On the development side, our aspiration is 15 GW in the renewable energy space. 700 odd MW is set up, and 1,300 MW more is under construction. That makes us already the largest player in India and at 5 GW, we will be the largest worldwide.

We have already built the world's largest single-location solar power plant in Tamil Nadu which is 648 MW spread over 3,000 acres. The Chinese are in the process of building a 2 GW single-location plant, but 648 MW is currently big by Indian standards. Apart from that, 2 GW solar capacity is under implementation and we are also setting up solar parks, MIDC equivalent, wherein we give plots to prospective solar power producers. We are developing one park in Rajasthan (10,000 MW equivalent) and in Gujarat (30,000 MW equivalent). Wind power is an area where we have similar aspirations.

VIKRAM KAILAS,
Managing Director, Mytrah Energy

Today, solar power is intermittent, unstable and comes in the day. Right now, storage is expensive at Rs.10 per kwh, but prices are falling 20% every year. In 3-4 years, solar or wind with battery storage will be a reality, starting from developed countries with low cost of debt.

Vikram Kailas: In India, Mytrah is the largest player in wind energy, with operational wind power of 930 MW. It also has 700 MW solar energy under construction, which will be operational in a year. About five years back when I started this company, wind and solar power was more of a tax instrument that people bought. Wind or solar was not used in the same sentence as power generation ever, the way it is today. What we have done is to play the role of classic disruptor and take a lot of initiative to participate in the creation of this sector.

As a company, we don't have any grand visions or missions. I am a big believer in 30-day or 60-day business plan in this ever-changing world. We never thought solar would reach the levels of pricing that it reached today with 75% drop in capex cost in the last four years. So, we don't make plans written in stone. Every 60 days we evaluate our plan. Our plan depends upon oil prices, interest rates and changing scenario in Siberia, Russia and the US. We rub the slate clean and rewrite the plan all over again. This is a young and aspirational company, but with a different ethos. We have donated all our shareholding into a trust and if we sell the company the entire money will go to charity.

Counterparty risk and assessment

Parimal: Generally, the reason why solar producers prefer to bid for the central government JNNURM projects, rather than the state government projects, is that the level of counterparty risk is significantly different. Most DISCOMs are not in good shape, they have payables of a year or more. They are unable to pay regular bills of thermal power plants which are only Rs.3-3.50 per unit. Solar power would be significantly more expensive.

Having said that, the Central government has now come up with the UDAY scheme and we believe that things will change, but as of now counterparty risks are fairly high, so we don't want to have PPA with the state entities.

In case of Indian Government-controlled entities, the counterparty is NTPC which has an excellent balance sheet, so risk is fairly low. Solar Energy Corporation of India again is an MNRE-controlled entity so the pseudo-sovereign guarantee is there, although not written in the PPA. This is why most of us prefer to bid and bid aggressively in the bids of these entities.. We (Adani) are not in wind but Vikram is and he knows how the Tamil Nadu or even Maharashtra government entities delay or try to cut down the payment. We too have the world's largest solar power plant, but are being backed down on a regular basis and not being paid in time. With this behavior, risk premium goes up and banks get reluctant, too.

Kailas: At the end of the day, the state governments are bankrupt, and then land is a big issue. In solar parks, the government gives you land, a PPA with NTPC and provide the evacuation infrastructure. There is limited risk, strong counterparty and I can easily do my part of putting in panels. So, there is some substance in the concept of solar parks, and of course, you can do large scale at one place.

The solar parks are purely real estate in nature, the only thing they

resolve is the risk of land and evacuation. The counterparty risk does not come in play because solar park organisers do not buy the power. It is sold by the solar power developers though some DISCOM or some third-party. The risk of land and evacuation are big risks because they can delay execution.

The DISCOM dilemma

Kailas: Today, in a scenario of falling solar prices, the state government (DISCOM) doesn't want solar power to take away its most lucrative customers. It adds on all kinds of arbitrary charges that would make solar power less viable. So, that the existing mechanism is not disrupted. Despite all this, would you believe the electricity boards are bankrupt? Maharashtra has not paid people for one year, nor has Rajasthan, despite having monopoly and charging so much money, cess and all that. Today, you need someone to say let's take a leap.

This is what happened with telephones when BSNL was playing the role of a regulator, implementer and disruptor. One major difference is that BSNL didn't owe a lot of money to banks. So, the official forces could have supported the move to cellphones. Today, all the electricity boards between them owe banks probably Rs.3-4 lakh crore. Firstly, the authorities need to first find a way to make the banks good for that money, and then they can force disruption. This is the right time for the electricity boards to pay down the debt and get away with the subsidy, because oil prices are low and we are running revenue surplus.

Parimal: The new act is already with Parliament, which aims to bifurcate the electricity business between carrier and content. So, with that the DISCOMs will get sorted out, get paid an assured sum for their wire network where the content can come from anywhere. After that, if they put obstructions, the technology will bypass them, the way mobile wireless technology bypassed BSNL.

In the late nineties, a state government was trying to set up an ISP and

BSNL was being an obstacle. They owned the copper wire network to which they refused access, and that time wireless was not so well known. 16 years down the line, copper has been bypassed through a technology directly using 3G and 4G. So, if the state entities do not improve, then in all Tier II – III cities where growth is horizontal, solar technology along with storage, will bypass these DISCOMs and people will become independent in energy terms.

Kailas: Because of the cross-subsidy, it is easier to distribute solar power and industry pays lower, but the after-effects should be considered. You take away lucrative customers from the DISCOM utility and tell the utility to earn money from the non-lucrative customers. It's a small problem but it is causing disruption. In 3-4 years with battery prices and panel prices still on a falling curve, we can generate electricity on top of our houses. So, then how to separate the loans from the utility at such time? This is a much larger issue that as a country and a power department we have to resolve. There are environmental issues of coal-based electricity, but at the same time these are funded projects where people have put in money and banks have lent. Are we going to honour those contracts?

That is the motivation why right now a lot of electricity boards are not giving open access permissions, or are putting artificial charges – so that you do not take away lucrative customers. There is a much larger canvas to look at and discuss in a 20-30 year format for a solution.

Future outlook

Kailas: Regarding a drop of solar power tariffs in India from Rs.4.50 per unit, there are several factors playing a part. In Dubai, there is no income tax which means a 30% differential straightaway. The USA has investment tax credit and production tax credit, below the EBITDA line. Some other factors which reduce solar tariffs include lower funding cost, long-term tenures and lower counterparty risk. In addition, there are streamlined activities for land and permits process, and predictability of project costing is better.

However, those costs are still coming down and levels of Rs.3-3.50 in 3-4 years would be possible for projects without battery storage. India has seen those prices when projects started, which were then expensive because coal-based power was Rs.2-2.50 at that time. While prices are also influenced by comparison, solar prices are flat for 25 years and there is no pass through like in thermal or gas-based power projects. Four years ago, when we sold solar power at Rs.3.50 we did make money, and we do even today.

Parimal: Attrition between the legacy thermal power and new cheaper solar power is a few years away. Technology and market forces have already created a price-based revolution in simple solar power generation. In Dubai, somebody quoted US$0.0299 per unit, which is hard to understand, but such bids are indeed credible. A year or two down the line, we are looking at that range of prices. Prices will fall, at what speed is debatable, but the bottom has not been found.

Today, solar power is intermittent, unstable and comes in the day. Right now, storage is expensive at Rs.10 per kwh, but prices are falling 20% every year. In 3-4 years, solar or wind with battery storage will be a reality, starting from the developed countries with low cost of debt. In India, it will take more time, because the cost of capital is high.

Basic economics says that a fixed 25-year purchase price is deflationary, even if it looks a little high today.

Kailas: On operating skill development, it is simpler to operate a wind farm or a solar farm compared to a gas plant or a coal plant. Right now, I can check on my app what my wind plant or solar plant is generating. This industry will provide employment to the kind of people who don't hold a Ph.D or is not an engineer as it is a nut and bolt job. There is a lot of work on the data analytics side in terms of improving performance. So, it will also employ data scientists.

On the efficiency part, both wind and solar efficiencies are among the highest worldwide, because we have so much sunlight and so on. Wind efficiencies have already reached 31-32%, with improved technology. In 2-3 years, we are going to talk of 42-45% efficiency. If you integrate that with solar and storage, then in 4-5 years you have hybrid plants with 60-65% efficiency levels.

Jayant Parimal, CEO, Adani Green Energy; R.N.Bhaskar, Consulting Editor, Free Press Journal; and Vikram Kailas, Managing Director, Mytrah Energy, during the session.

On behalf of The Free Press Journal, Upendra Tripathy handed over a memento to Dilip G. Piramal who completed his tenure at IMC.

Ashok Karnani, Director, The Free Press Journal handed over a memento to Upendra Tripathy.

On behalf of IMC, Dilip G. Piramal handed over a token of appreciation to Upendra Tripathy.

Vote of thanks by Deepak Premnarayen, President elect, IMC:

Thanks to Dilip Piramal and Bhaskar, we had a fantastic program. The secretary, Ministry of New and Renewable Energy was here and we understand his agony and ecstasy. I would like to thank Mr. Parimal and Mr. Kailas, who made this discussion very interesting.

I would like to add about foreign banks who are launching renewable energy funds. This could be of interest because the funds offered is $250 million each and less of interest. A foundation, Harsh Mariwala, which organises Innovation Award Event every year, gave away an award to a gentlemen whose company was given a special award because they supply solar equipments and so on. This company gets into this 25-year plan, and exactly this is what the secretary was also talking about. So, there is no capital cost and effectively, there is a depreciating charge also. I would like to thank the media for supporting us and everyone present for really staying back and asking such interesting questions. Thank you.

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