



Renewable Energy >>

# India Leaps Forward To The Uncharted Territory



*Solar thermal plants that have storage capacities can drastically improve both the economics and the dispatchability of solar electricity...*

[www.electricalindia.in](http://www.electricalindia.in)





**R**ecent events in the renewable energy sector demonstrates Government of India's determination to install 175 Gigawatt of renewable energy capacity in the country by 2022, of which solar energy alone is nearly 100 GW followed by wind energy of 60 GW (see Table- 3). Of the total 100 GW capacity of solar power, 20 GW will come from solar park and 40 GW each from rooftop and distributed generation projects. Govt has declared 55 cities as solar cities in India; Maharastra is having highest number of cities 6.

Currently India has installed capacity of 275.911 Gigawatt comprising of thermal 191.664 GW, Nuclear 5.780 GW, Hydro 41.997 GW and Res 36.470 GW. If we do not include Hydel projects, share of renewable capacity is 13.22 of the total; inclusion of hydel will take it to 28.44%. This installed capacity is divided among state sector as 96.015 GW; central sector 73.671 GW and private sector 106.226 GW. Generation of power has achieved a growth rate of 8.43%, which increased from 967.15 Billion Units in 2013-14 to 1058.673 Billion units in 2014-15. In the renewable sector, capacity wind energy is 23.762 GW; Biomass/Cogeneration Power 4.419GW; Solar 4.060 GW; Small hydro 4.102 GW and Waste to energy 0.127 GW.

After Sri Narendra Modi took over the responsibility to lead the country, with his experience in mind of solar park in Charanka village in Gujarat, he wanted to address a few issues of India's power sector by giving boosts to solar power which is now dream of the country for 24x7 power for all. In addition, he also wants clean fuel should drive India's progress in the coming days.

This dream, to set up solar energy capacity around 25 times of the existing capacity in the

next seven years by 2022, is unprecedented in the history of the world.

India is poised to make an evolutionary change in the areas of generation and consumption of non-conventional energy and solar power will be the pivot. EY's Renewable Energy Country Attractiveness Index (RECAI) has ranked India at 3rd place in the current year. India has advanced a notch over Germany and US has surpassed China this year to be ranked as first. The comment of the report about India was: A plethora of federal and state auctions are already underway as part of the Government's push to deploy 100GW and 60GW of solar and wind respectively by 2022. At least 20GW of solar is due to be procured under the country's long standing National Solar Mission, though numerous more state-based tender programs are expected over the next 5 years.

### Solar and Renewable Energy

The country is endowed with a very vast solar energy potential. Most parts of the country have about 300 sunny days. Solar energy can be utilised through solar photovoltaic technology, which enables direct conversion of sunlight into energy and solar thermal technologies. It is important to understand that solar thermal technology is not the same as solar panel, or photovoltaic, technology. Solar thermal electric energy generation concentrates the light from the sun to create heat, and that heat is used to run a heat engine, which turns a generator to make electricity. The working fluid that is heated by the concentrated sunlight can be a liquid or a gas. Different working fluids include water, oil, salts, air, nitrogen, helium, etc. Different engine types include steam engines, gas turbines, Stirling engines, etc. All of these engines can be quite efficient, often between 30% and 40%, and are capable of

producing 10's to 100's of megawatts of power. Photovoltaic, or PV energy conversion, on the other hand, directly converts the sun's light into electricity. This means that solar panels are only effective during daylight hours because storing electricity is not a particularly efficient process. Heat storage is a far easier and efficient method, which is what makes solar thermal so attractive for large-scale energy production. Heat can be stored during the day and then converted into electricity at night. Solar thermal plants that have storage capacities can drastically improve both the economics and the dispatchability of solar electricity. Over the last three decades, several solar energy-based systems and devices have been developed and deployed in India, which are successfully providing energy solutions for lighting, cooking, water heating, air heating, drawing and electricity generation. The research and development in this sector have also helped in better efficiency, affordability and quality of the products. As a result many solar energy systems and devices are commercially available with affordable cost in the market.

### Recent Developments

The scaled up installation targets for solar power and the intent of creating conducive manufacturing environment under the 'Make in India' initiative has opened up immense opportunities for investment in RE in India. In first such Global Investors Meet & Expo in February, 2015, nearly 3,000 delegates including representatives from 41 countries participated in this 3-day event. Key among these participants included ministerial delegations from Germany and the UK, industry delegations from several countries including China and about 200 global investors. Over 200

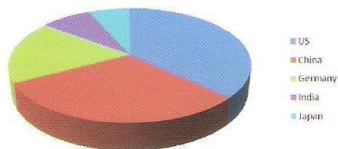
| Current Rank | Previous Rank | Market  | RECAI Score | Technology Specific Indices Ranking |               |          |           |         |             |       |        |
|--------------|---------------|---------|-------------|-------------------------------------|---------------|----------|-----------|---------|-------------|-------|--------|
|              |               |         |             | Onshore Wind                        | Offshore Wind | Solar PV | Solar CSP | Biomass | Geo thermal | Hydro | Marine |
| 1            | 2             | US      | 75.0        | 2                                   | 8             | 1        | 1         | 2       | 2           | 3     | 8      |
| 2            | 1             | China   | 74.2        | 1                                   | 2             | 2        | 6         | 1       | 12          | 1     | 16     |
| 3            | 4             | India   | 65.9        | 3                                   | 16            | 3        | 5         | 15      | 14          | 9     | 11     |
| 4            | 3             | Germany | 65.7        | 6                                   | 4             | 6        | 27        | 8       | 13          | 15    | 27     |
| 5            | 5             | Japan   | 63.2        | 18                                  | 9             | 5        | 26        | 4       | 4           | 4     | 10     |

Table -1: EY's Renewable Energy Country Attractiveness Index...





2014 Consumption Of Renewable Energy MTOE



speakers including more than 40 international speakers shared their perspectives on various aspects of renewable energy. The event concluded with 387 global and domestic investors/ project developers/ companies/ PSUs submitting 'Green Energy Commitment' letters to the Government of India to develop and set up RE projects aggregating to more than 272 GW surpassing our initial target of 100 GW. Similarly, 30 major Banks/ financial institutions committed to finance over 70GW of renewable energy projects. 17 companies have submitted Green Energy Commitment letters for setting up manufacturing facilities aggregating to more than 62 GW.

### Tariff Phenomenon

One of the important constraints was high unit cost of renewable energy compared to conventional sources like coal or gas. Government aims to boost solar power capacity 30 times in seven years. If one resorts to some basic statistics on the renewable energy sector especially solar sector, there is reason to be jubilant on the various development taking place in the sector.

Tariff for solar power, so far perceived as constraint seems to be getting over. In a recent tender for 500 megawatts capacity offered under the national solar mission in Andhra Pradesh, investor bid for a tariff of Rs.

|               | Solar Power (MW) | Wind (MW) | SHP (MW) | Biomass Power (MW) |
|---------------|------------------|-----------|----------|--------------------|
| Northern      | 31120            | 8600      | 2450     | 4149               |
| Western       | 28410            | 22600     | 125      | 2875               |
| Southern      | 26531            | 28200     | 1675     | 2612               |
| Eastern       | 12237            |           | 135      | 244                |
| North Eastern | 1205             |           | 615      |                    |
| Island        | 31               | 600       |          | 120                |
| All India     | 99533            | 60000     | 5000     | 10000              |

Table -2 : Tentative Region-wise break-up of Renewable Power target to be achieved by the year 2022...

5.00 pwer kilo watt hour tariff (kWh). In response to tenders for setting up 10 projects of 50 MW each bids totaling around 5,000 MW has been received. These bids were submitted for solar photovoltaic projects under the new phase of NSM. According to India Ratings and Research, as Mint daily has quoted in its 16th September, 2015 edition that solar tariff has declined in Nehru National Solar Mission phase I batch II from Rs 10.95 to Rs12.76 per kWh in 2011 to Rs 7.49 to Rs 9.44 per kWh in 2012. In pahase II batch I when viability gap funding was introduced, the tariff further declined to Rs 5.45 per kWh.

Below presented (see Table -2) regional distribution of different renewable energy sources the country wants to achieve.

### Global Scenario

World energy consumption has increased from 10919.6 MTOE in 2004 to 12928.4 MTOE in 2014 (see Table 3). During the same period, renewable energy consumption has increased from 75.7 MTOE to 316.9 MTOE. The CAGR (given in the last column) of renewable energy consumption growth is much higher during this

period than the growth of world's primary energy consumption. Further growth of consumption of renewable energy was much higher than world average during this period in the Asia Pacific region; and consumption in India is higher than Asia Pacific region also. China has however surpassed India's growth in renewable consumption during the same period.

### Conclusion

Our sun produces 400,000,000,000,000,000,000,000,000 watts of energy every second and the belief is that it will last for another 5 billion years. The United States reached peak oil production in 1970, and there is no telling when global oil production will peak, but it is accepted that when it is gone the party is over.

The sun, however, is the most reliable and abundant source of energy. Given the current state of focused approach, initiative taken by the government in the areas of renewable energy in general and solar energy in particular, successful implementation of renewable projects will not only change the energy mix in the country and dependence on fossil fuel would reduce drastically.

It is not an easy task but India is determined to make it happen.

|                                    | 2004    | 2014    | CAGR 2004-14 |
|------------------------------------|---------|---------|--------------|
| World Primary Energy Consumption   | 10556.6 | 12928.4 | 1.70         |
| World Renewable Energy Consumption | 75.7    | 316.9   | 14.08        |
| Asia Pacific                       | 15.1    | 94.2    | 18.54        |
| US                                 | 19.6    | 65.0    | 12.74        |
| China                              | 1.1     | 53.1    | 47.35        |
| Germany                            | 8.3     | 31.7    | 14.33        |
| India                              | 2.3     | 13.9    | 19.70        |
| Japan                              | 6.5     | 11.6    | 5.96         |

Table-3 : Consumption of Primary Energy and Renewable Energy (MTOE)...



**Dr. Ahindra Chakrabarti**  
Professor, Great Lakes Institute of Management