

Pune: Maximum Solar City

1. Introduction: Global Warming and Climate Reality

Recently concluded Climate Conference in Paris demonstrated serious recognition of the climate reality by the global community that global warming is indeed an eminent threat to earth's eco-system and to ultimate human aspirations for development, progress and peace. 195 countries made Intended Nationally Determined Contributions (INDC) for reducing CO₂e emissions by 2020 and beyond to contain global warming in an attempt to remain within 20C threshold. India on its part took an active role in initiating a 'Global Alliance for Solar Energy'.

India's INDC submission to the United Nations Framework Convention on Climate Change (UNFCCC), among other things, aims to reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level and to achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030 (GoI, 2015). A large part of this commitment would come from the 175 GW renewable energy target to be achieved by 2022. The mainstay within this target would come from solar power at 100 GW. This would entail a huge transformation in India's energy economics and a major contribution to mitigating global warming.

Solar electricity generation technology has made phenomenal progress in the past 3-4 years with increasing efficiency and falling costs, down to less than Rs 5 per KWh of electricity. Solar and wind energy are not only clean sources of energy, but once installed they require no fuels or material supply chains.



2. Solar Power: National Perspective

Most of Western, Central and Southern India gets very good level of Sun's radiation where a one can about 1.75 MU energy from 1 MW of Solar PV installation, which requires 5 acre land. Theoretically, all of India's electricity requirement by 2030 can be met from less than 1.5% of India's land mass. Transforming a fraction of this theoretical potential into reality requires several actions. Firstly, the solar electricity has only recently become cost competitive and people are yet to get fully convinced about the long term reliability of the technology. Further, the investments already made in fossil fuel power supply chain are very robust and no economic model can ignore their role over the life-cycle of 40-50 years for the thermal plants that currently provide over 70% of power requirements. In India, for a smooth and rapid transformation to predominantly RE based energy, a multi-pronged process and strategy needs to be adopted. We will need innovative and robust R&D in all renewable technologies, and related aspects such as grid integration and energy storage. There needs to be comprehensive and synergistic policy and regulatory actions from local to national level. Aggressive business and financing models in PPP mode will be needed for a 'win-win' change over to solar. Such actions will enable India to achieve truly transformative changes in the energy sector.

Share of solar power capacity in India's energy basket has grown rapidly and currently stands at just under 2% of capacity and the target is to achieve 100 GW by 2022. Present installed capacity is 4750 MW (as of Dec 2015) and significantly more, nearly 10 GW is in the pipeline stage. While central push for GW level projects can facilitate rapid capacity addition and development of associated eco-system, bring down costs, the potential for distributed generation (DG) and local utilisation of SPV power is also enormous. It offers added advantage such as reducing T&D losses, enabling participation by common citizens in this energy transformation and empowering communities. The evolving solar policies for 'Net-Metering' in India can make this very cost effective by eliminating the need for storage batteries for individual consumers.

3. Solar power for Indian Cities

The energy map of India depends heavily on its major cities responsible for bulk of the industrial and commercial activities that support over 65% of the national GDP. Large cities can offer vast amount of rooftop areas for solar panel deployment at zero land cost, making solar power even more attractive. Another feature of the cities is the high peak power requirements during day-time when solar power delivery can be maximum.

Rooftop solar PV power with net-metering is a major success in many advanced countries because it offers the ideal win-win solutions with active involvement of people that helps the societal transformation towards RE based economic development. Total potential of distributed / RTPV in India is estimated to be 100 GW and this potential would increase in step with growing urban population and expansion of residential or commercial buildings. There are many attractive financing models where the solar developers can provide the initial capital and take responsibility for RTPV installation and operation for 20 years, and owners can enjoy economical, environment friendly RE for 20 years.



4. Maximum Solar City

As brought out in the PIC Policy Paper on 'Making Pune Smarter', Pune can transform itself as a 'Maximum Solar City' way ahead of the definition of solar city (5% reduction in fossil fuel use every 5 years) by targeting 10% reduction in thermal power usage every 5 years. Aggressive use of Solar PV would be a key step in making Pune become a carbon neutral city by 2047 without compromising any of its development goals or smartness ambitions. Pune can thus lead by example by and contribute to national objectives.

PMC population was estimated to be about 35 Lakh in 2013 and this is expected to rise to about 50 Lakh by 2030. Correspondingly, the larger Pune Metropolitan Region (PMR) population of about 50 Lakh will likely increase to 80 Lakh by 2030. Per Capita (PC) Electricity Consumption in Pune 883 KWh and with modest 6% GDP rise, the PC electricity demand may grow to 1200 Units in the PMC area, taking the total consumption to about 60,000 Lakh Units/year by 2030. Pune region, with high level of solar radiation for over 300 days a year can produce 1500 Units (KWh) of electricity per year for every 10 SqM of SPV panel surface at the current efficiency of SPV technology. To meet the likely demand of 6000 Million Units/year in 2030, through solar PV will need about 70 sq km. area.



5. Think Big, Start Small, Scale Fast

Recent announcement by the GoI on RTPV and earmarking of Rs 5000 Cr for providing 30% subsidy, opens the opportunity for municipalities like PMC to plan big in solar energy deployment with an integrated development plan. Starting initially with PMC's own buildings, schools and institutions, Pune can rapidly expand the RTPV to include hospitals, hotels, commercial buildings and residential complexes by facilitating innovative financial arrangements in PPP mode both for RTPV developers as well as the consumers who would finally own major assets without any up-front capital costs. Starting with modest 1 MW (10,000 m² of roof space) target for 2016 first quarter and 5 MW in FY 2016 over PMC buildings alone, RTPV potential would keep growing with increasing construction activities and by 2030 Pune region could have RTPV capacity in the range of 1000-2000 MW with increasing technical efficiency requiring smaller deployment areas.

It is important to note that cost of solar power without subsidy, amortised over the life cycle of 25 years is already below Rs 5/kWh (for MW scale large projects) and falling; while the real cost of coal power without subsidy is rising and accounting for externalities could be anywhere in the range of Rs 5-8/kWh depending on assumptions for fuel prices and externality costs. Therefore innovative grid-interactive schemes that can encourage and enable solar power adoption through market price discovery by ensuring net metering by MSEDCL can help the fast scale-up process and make Pune largely energy independent during daytime while also reducing the carbon signature significantly. If Pune model succeeds for 100 other Indian cities, this could be a significant step towards a low carbon Indian economy.

To achieve transformational changes in the energy mix, which are inevitable and feasible, a strategy of **Think Big, Start Small, Scale Fast** is essential. Broad contours of such a strategy are illustrated below.

Think Big:

Adopt an aspirational target of say 200 MW RTPV in five years in Pune

Start Small:

PMC Buildings (1 MW in first quarter of 2016 and then 5 MW in CY 2016)

Mandatory solar projects on all new, large building construction, as per current DC rules.

Scale Fast:

Encourage and enable adoption of RTPV by large number of Pune residents, by facilitating market based price discovery and net metering through MSEDCL. This could be achieved through 'Pune: Maximum Solar City Movement' which would involve streamlining procedures, communication campaign to educate Pune citizens about benefits of RTPV, use of web-based Apps and tools, GIS and vendor database, to support citizens decision making, and leveraging vast pool of Pune's vibrant civil society, academic and cultural groups.



6. Key Enablers and Key Deliverables

Key Enablers

Subsidy for RTPV installations by non-commercial and non-industrial consumers can accelerate solar adoption on a large scale and provide the scale-up benefits to the solar industry in the country.

DISCOM like MSEDCL may require gentle hand-holding by state government for the transition to RE which will entail some initial losses.

Focus on PMC-MSEDCL MoU towards enabling Net Metering in real practice. Presently realising Net-Metering in actual practice has significant hurdles.

Key Deliverables

- Pune must aim to produce 5% of Maharashtra target for 7500 MW RE by 2022 – which would be 375 MW coming mainly from RTPV.
- Maharashtra has already declared the Solar power target of 7500 MW and Govt of India has recently announced 30% subsidy for RTPV with Rs 5000 Crore earmarked for to accelerate the process. Pune must utilise this opportunity to fullest.
- A community solar initiative can be started in Pune to attract medium income households to use solar in virtual mode even though one may not have adequate and suitable rooftop for RTPV deployment. Such an initiative can encourage crowd-funding and make people participative in the solar transformation.
- Pune must set ambitions much higher than national average to emerge as a 'Maximum Solar City' by 2022 and set an example for other cities.



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