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TATA POWER DELHI DISTRIBUTION LIMITED

A Tata Power and Delhi Government Joint Venture

Solar rooftop for Residential Sector

with you Non-Stop

10th January,2017

Solar Potential in India

Tropical Country

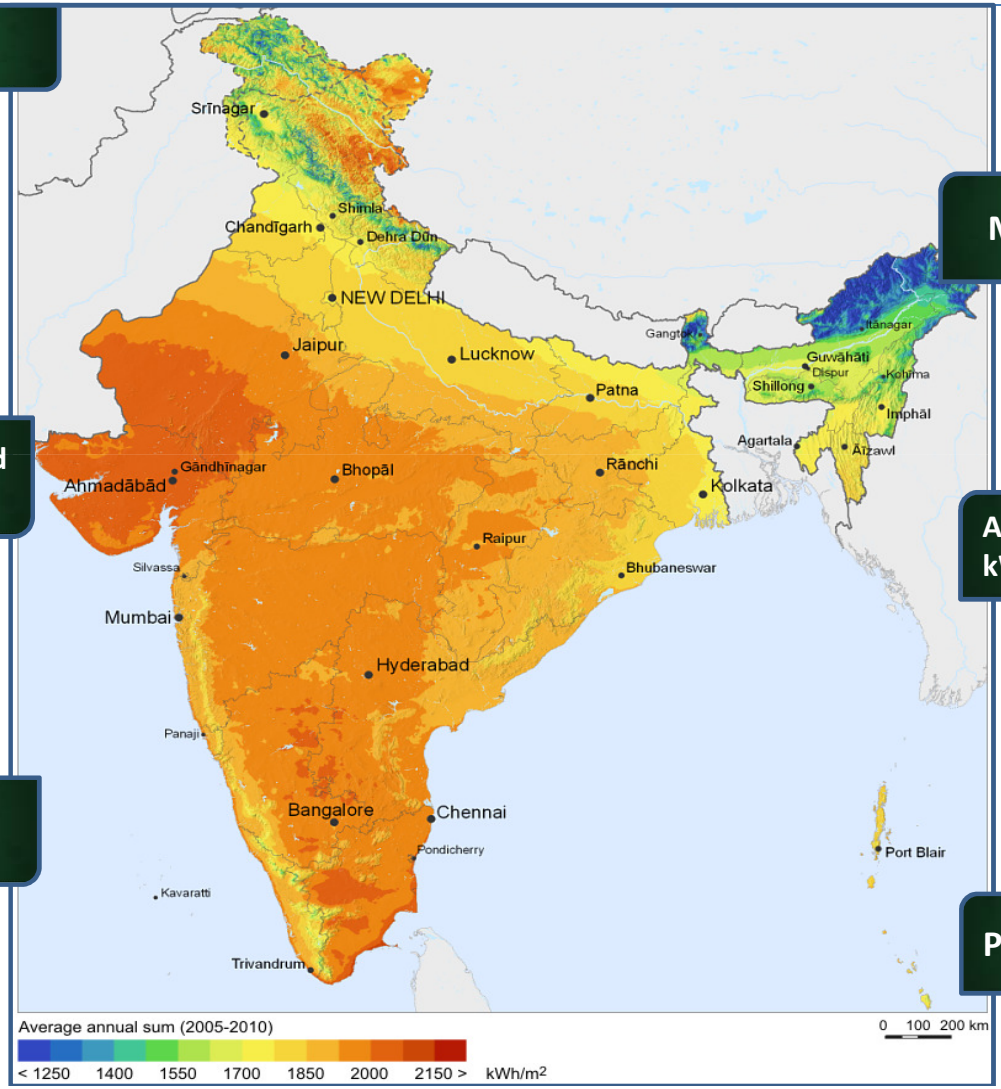
More than 300 sunny days

Highest global radiation received in Rajasthan & Northern Gujarat

Almost all parts of India receive 4-7 kWh of solar radiation per sq metres

Around 5000 trillion kwh/year energy incident over India

Potential: 600 GW



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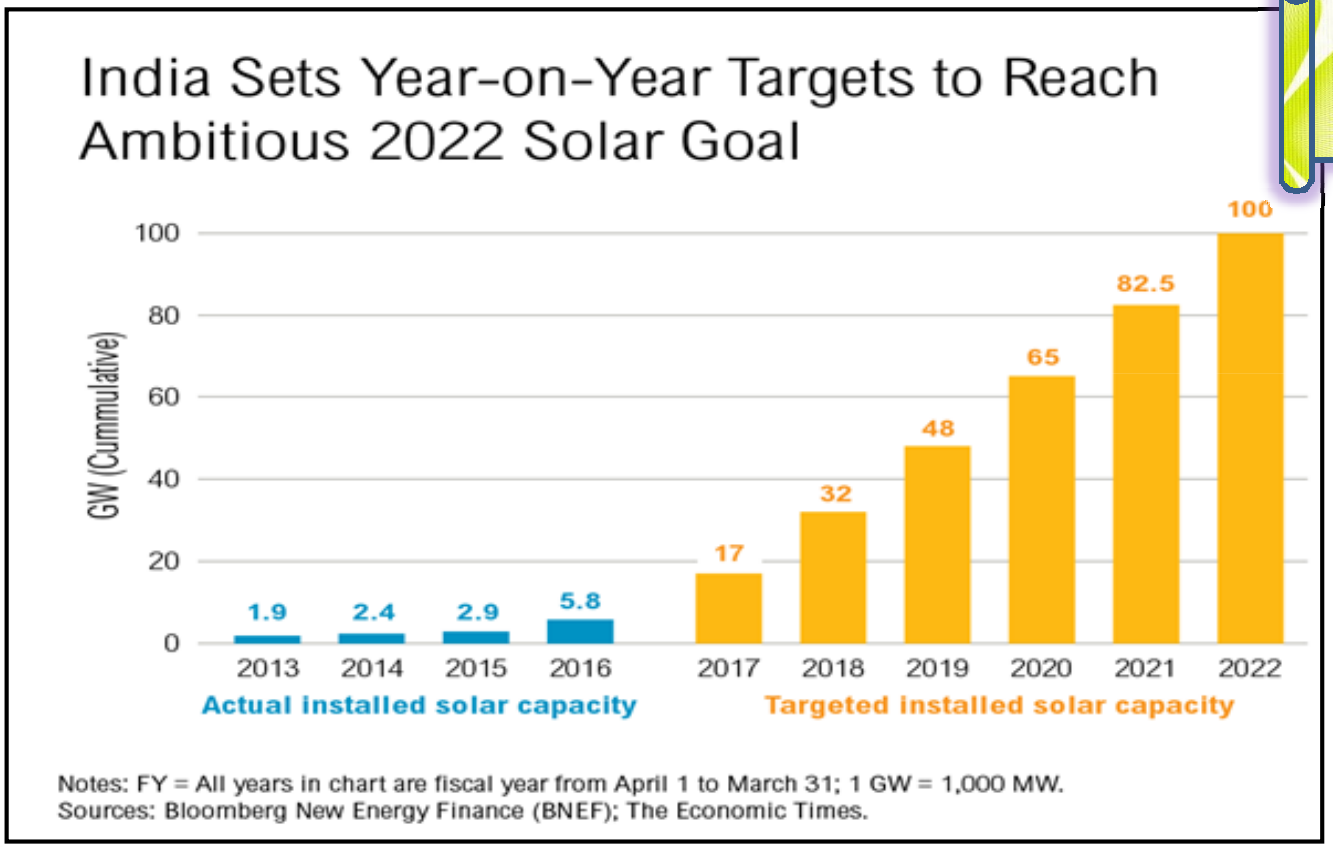
Solar Targets :India

Rooftop solar to account for 40 % of the target (40 GW)



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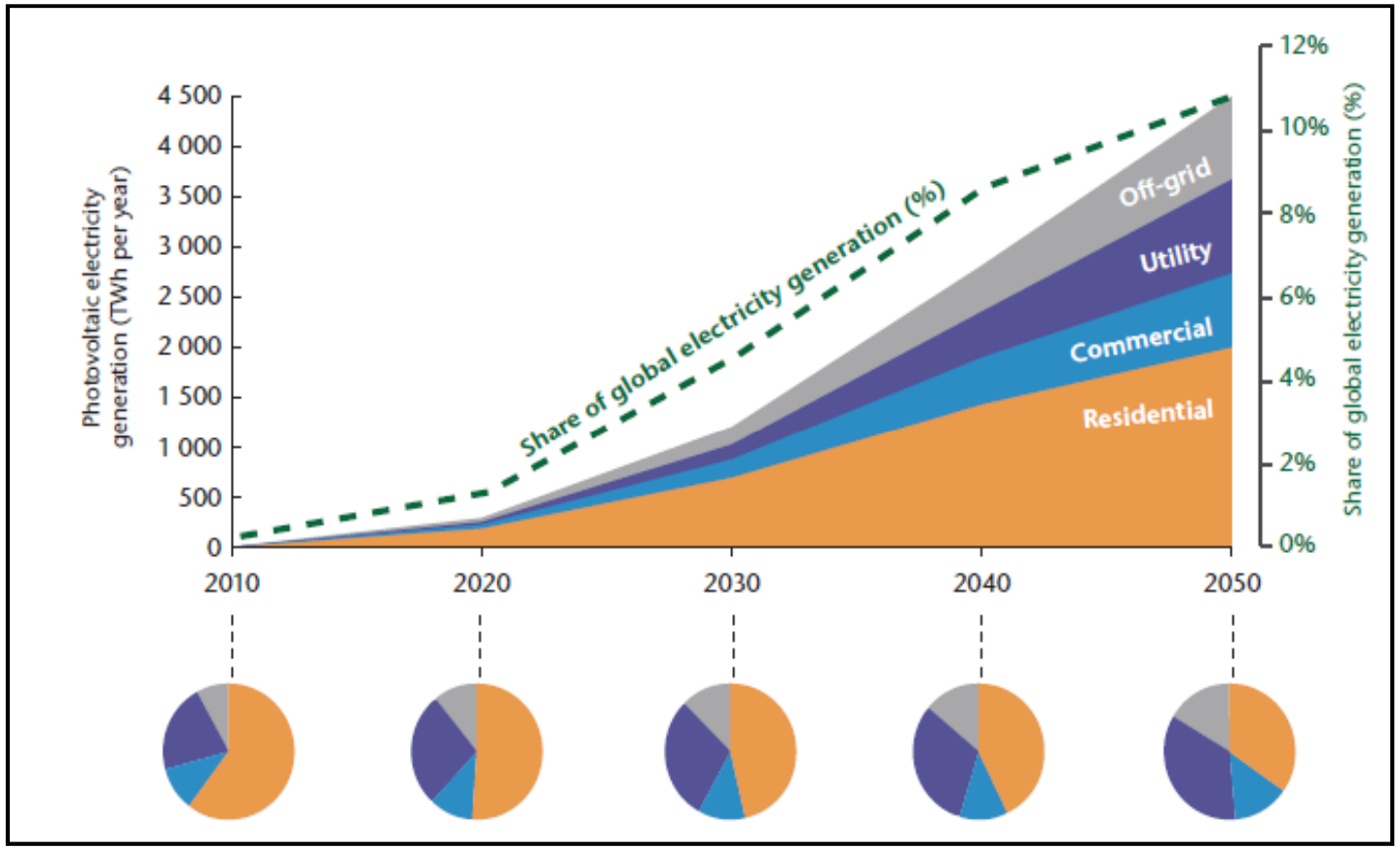
Global PV installations projections



Source :IEA

Residential sector expected to be the major contributor

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Key Benefits for Consumers

- Reduces the dependency on grid power, Long term reliable power source
- Reduction in Utility Electricity Bill; Higher benefits in TOD regime
- Option for revenue generation through Net Metering Framework
- One time investment provides 25 years' solar generation
- Accelerated Depreciation Benefits for I&C consumers
- Levelized cost of generation vis-à-vis increasing fossil fuel cost makes economically viable project

Growth Drivers for Residential Consumers

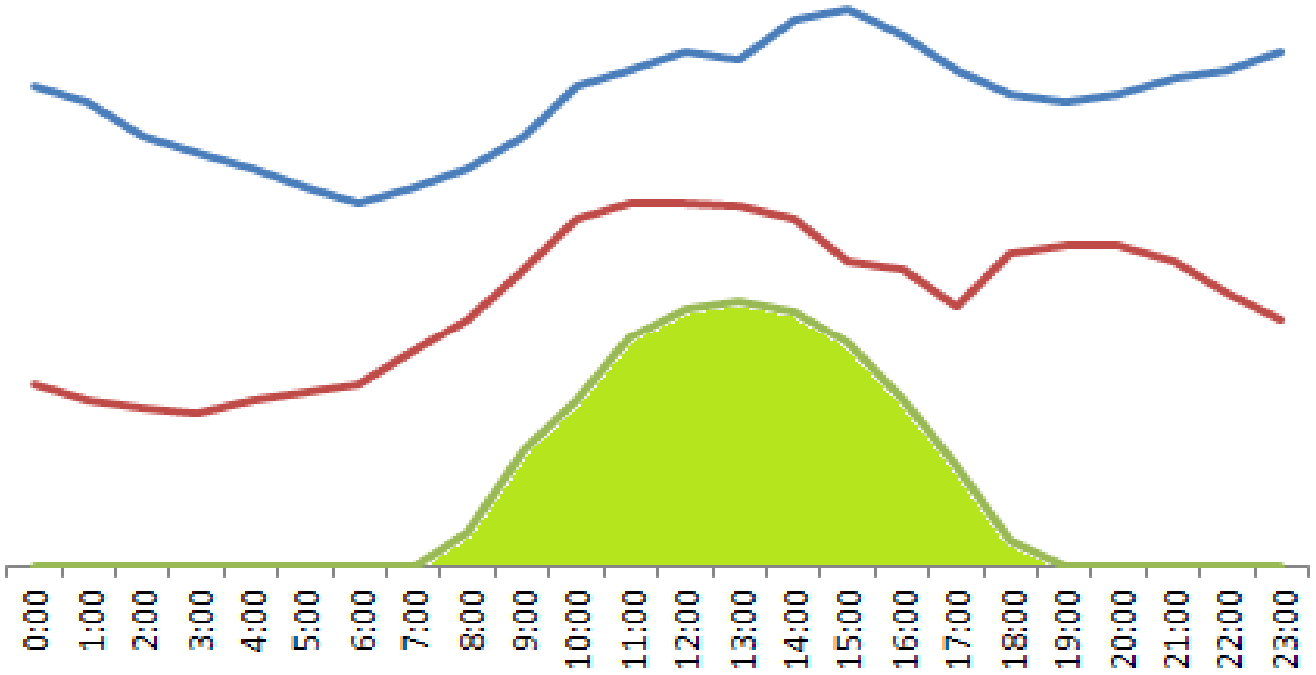
- 30% Capital Subsidy by MNRE
- Generation Based Incentive (GBI)-Provision of GBI under Solar Policy @ Rs. 2/unit for 3years; applicable to solar plants which generate > 1100 units /KW/annum
- Option to Sell extra power to Discom under Net Metering Framework
- Value creation from unutilized roofs
- No Maintenance Cost

Rooftop Solar : Benefits for Discoms

- ✓ Minimal technical losses as power generation near to the place of consumption
- ✓ Enable Discom to meet its RPO obligation
- ✓ Partial Coincidence of Solar Power with Utility's Peak Demand Period - Avoids the need to buy short term expensive power
- ✓ Improved tail end grid voltage and reduction in system congestion
- ✓ Decentralized Generation reduces pressure on Grid
- ✓ Avoided Network Augmentation Cost

Impact on System Peak Load

80% Solar Generation Off-sets Normal Hours & 20% Off-sets Peak Hour Load for ToD Consumers



Summer Load curve
Winter Load curve
Solar Generation

Summer Peak Periods
Afternoon - 3pm to 4:30pm
Evening – 11pm to 1am

Winter Peak Periods
Morning- 9am to 11am
Evening – 6pm to 8pm

Peaking of Rooftop Solar Generation is partly co-existent with Peak Demand of Discom

Barriers in Large Scale Deployment : Residential Consumers

- High Upfront Investment under CAPEX Model
- Solar Projects still not commercially attractive for residential consumers owing to low utility tariffs-Arising Need for subsidy
- Non availability of attractive financing schemes by Banks
- Apprehensions about the technology
- Lack of successful demonstration projects in residential sector

Challenges :Discom Perspective

- Reduced Electricity Sale
- Shift of I&C consumers (High Paying consumers) to solar result in revenue loss for Discoms
- Issue of Cross subsidy to be handled
- Regulators don't often compensate for the cost of the grid support provided by Discoms to the solar consumers (Network Augmentation and Management Cost; Up gradation of IT softwares for net meter billing etc.)

Financial Challenges

Financial Incentives required to address these challenges

UTILITY

Technical Challenges

- Grid Operation Stability (Non Controllable Variability , intermittent supply)
- Unintentional Islanding
- Reverse power flow
- Quality and Reliability of Power (Harmonics ,Flicker, Voltage fluctuation and imbalance)

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Way Forward :Road Map for Discoms

Identify key markets for solar- Focused Consumer Awareness campaign**,** Utility can begin offering Commercial & Industrial customers quality and financially attractive rooftop solar systems

Standardize and improve quality Streamline the interconnection process for customer Solar Plant

Develop standards to ensure quality of solar installations; monitor and track system performance and costs

Manage Utility Portfolio: Further develop complementary programs: Demand Side Management /Energy Efficiency, Demand Response to maximize utility value from the solar

Manage Supply portfolio: As the installed solar increases, manage the conventional supply portfolio in a complementary manner

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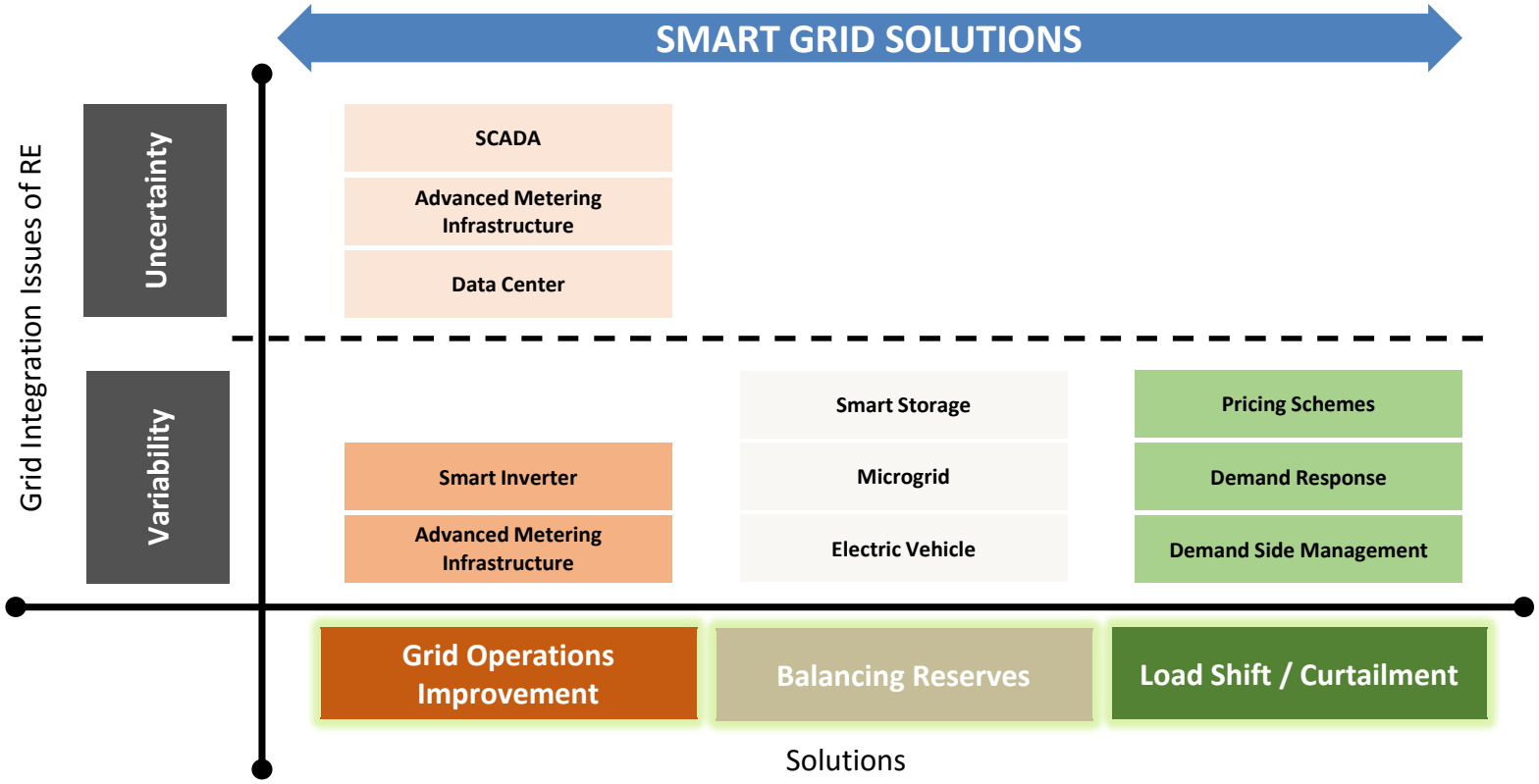
Smart Grid Technologies Supporting RE Integration



- Issues of variability and uncertainty can be solved using improved measures in grid operations, enabling balancing reserves and implementing load shifting/curtailment techniques.
- Smart grids through it various applications helps in seamless RE integration by enabling the above solutions.

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Thank You

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power to the people