



SAARC Knowledge Sharing Workshop on “Modern Techniques including Renewable Energy Auctions for Economizing Renewable Energy Tariff”

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**Ministry of New and Renewable Energy
Government of India**



Ministry of New and Renewable Energy (MNRE)....



- **MNRE is the nodal Ministry of the Government of India for all matters relating to new and renewable energy.**
- **Aim is to develop and deploy new and renewable energy for supplementing the energy requirements of the country**
- **Developments...**
 - **Department of Non-Conventional Energy Sources (DNES) in 1982**
 - **Ministry of Non-Conventional Energy Sources (MNES) in 1992**
 - **Renamed as Ministry of New and Renewable Energy (MNRE) in 2006**



Institutes under the Ministry (MNRE)....

- **National Institute of Solar Energy (NISE)**
- **National Institute of Wind Energy (NIWE)**
- **Sardar Swaran Singh National Institute of Bio Energy (SSS NIBE)**
- **The Indian Renewable Energy Development Agency (IREDA)**
- **Solar Energy Corporation of India (SECI)**



Indian Renewable Energy Scenario



Total Power Installed Capacity (as on 31.03.2018)

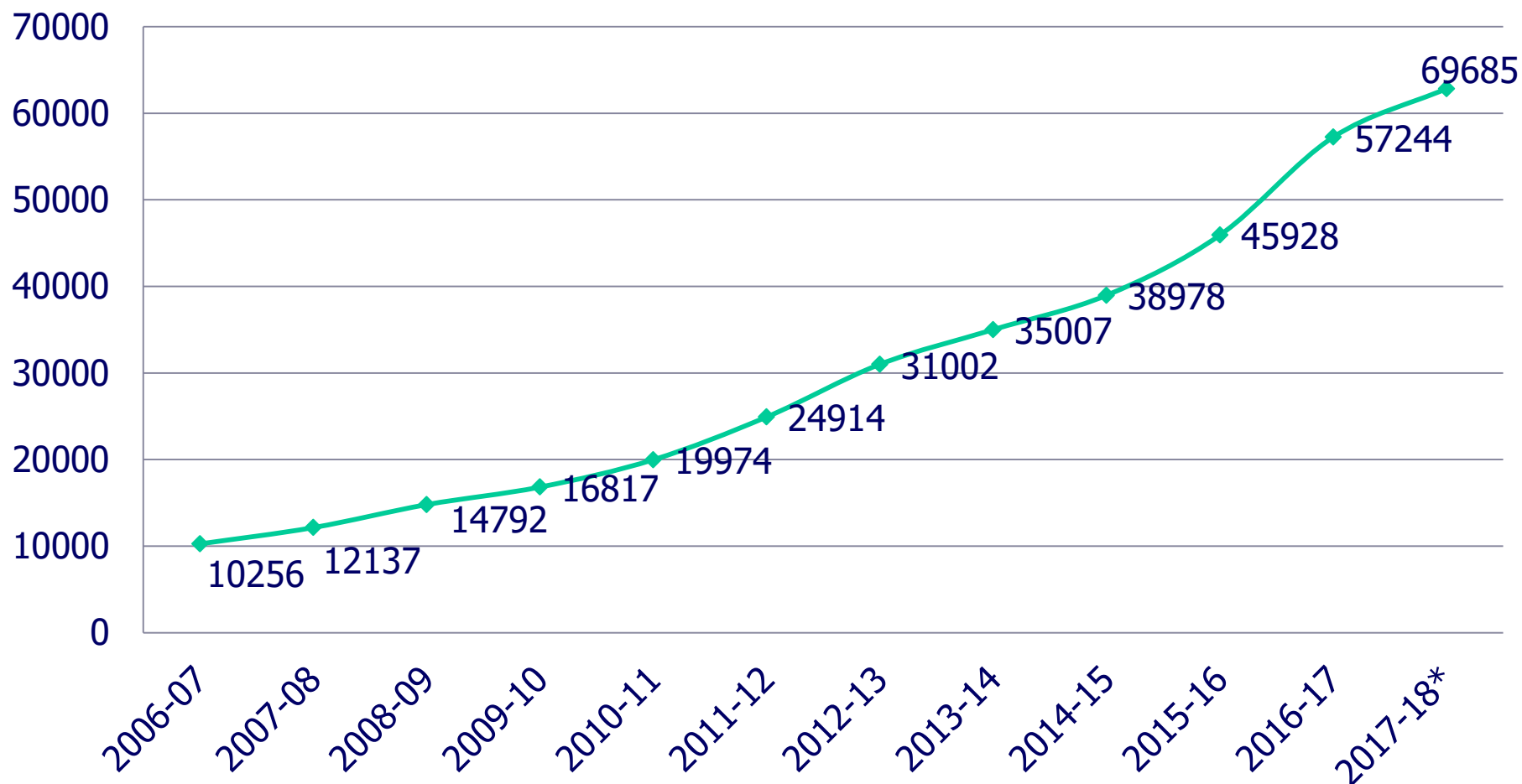


SOURCE	INSTALLED CAPACITY (MW)	% SHARE
RENEWABLE ENERGY	69,685	20.21
LARGE HYDRO	45,293	13.15
NUCLEAR	6,780	01.96
THERMAL	222,907	64.67
TOTAL	344,665	100.00



Renewable Capacity Addition

Total Installed Renewable Capacity (GW)





Renewable Energy Installed Capacity

(As on 31.03.2018)

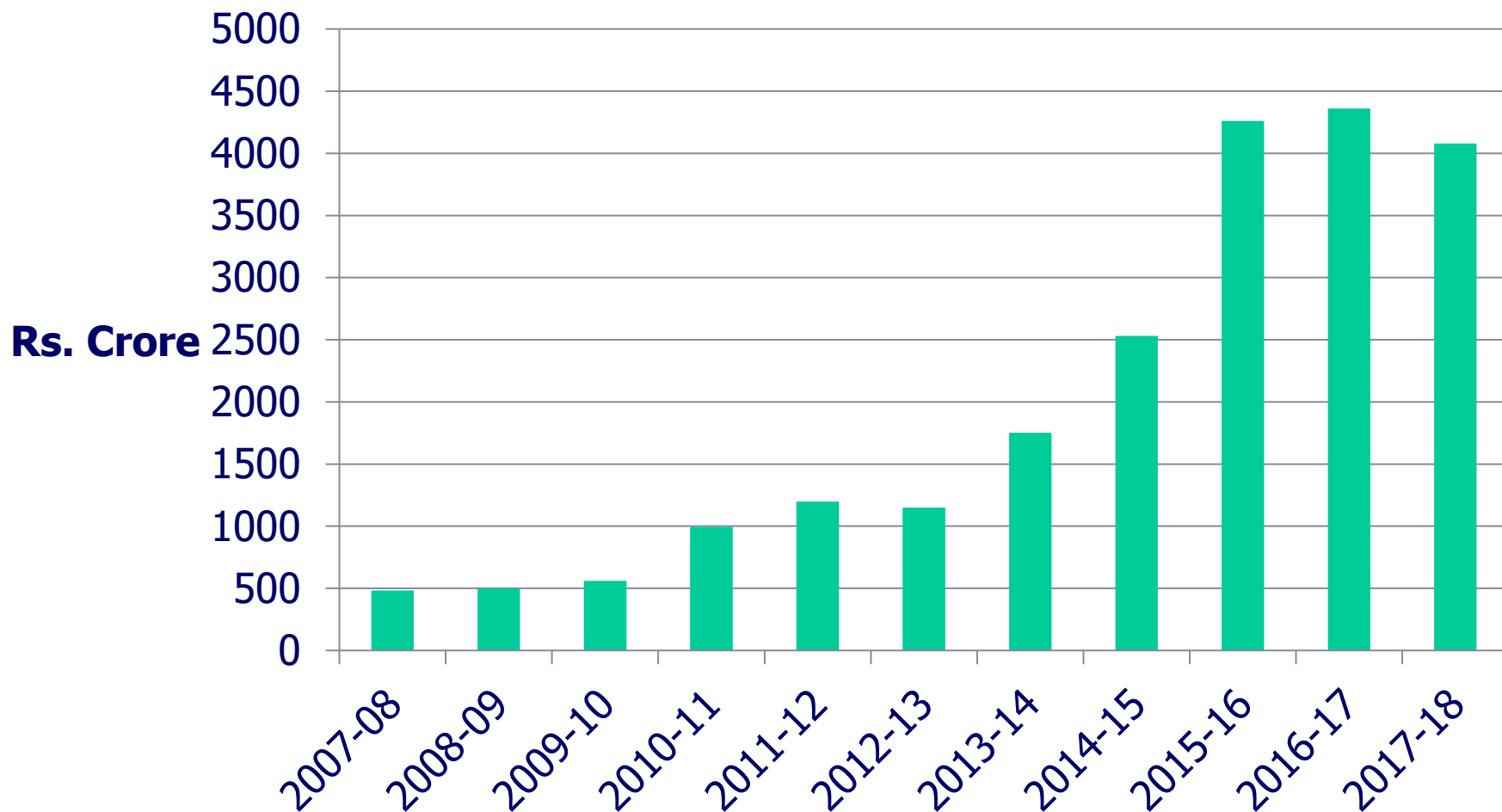
Solar power	Wind power	Bio power	Small Hydro Power	Waste to Power	Total Installed Capacity (MW)
21651	34046	9362	4485	138	69685



Budgetary Support over the Years



Trends in Budgetary Support (Revised Estimates)





Mission 175 GW by 2022



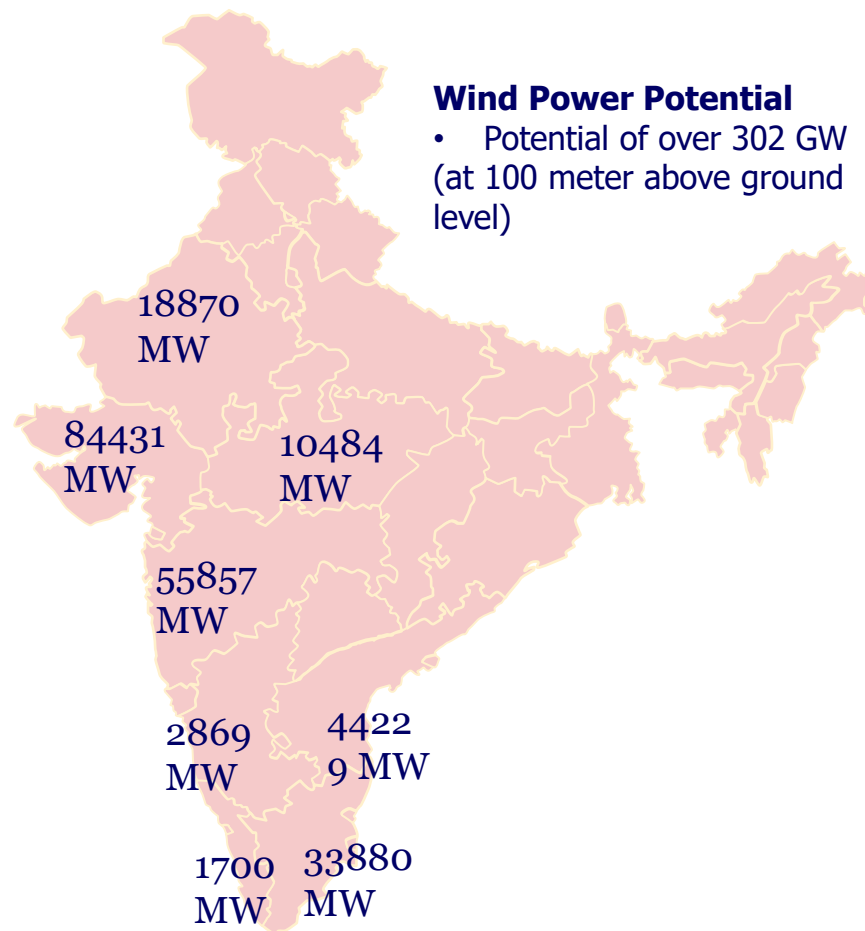
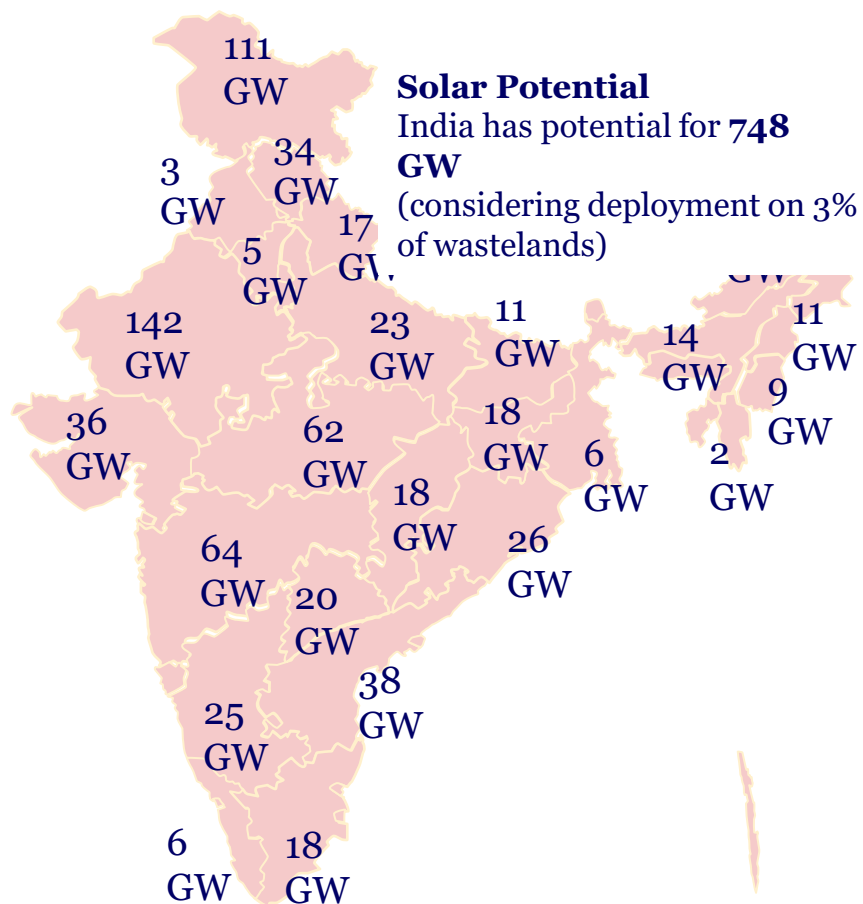
Mission 175 GW RE by 2022



- **India made a commitment in Paris Agreement**
 - to reduce emission intensity of the economy and
 - for having at least 40 % electric power installed capacity from clean energy sources by the year 2030
- **To achieve this, an ambitious target of 175 GW by 2022 announced in 2015:**
 - **Solar : 100 GW, Wind : 60 GW, Biomass : 10 GW and Small Hydro : 5 GW**
- **Renewable Purchase Obligation (RPO)**



Potential of Solar and Wind Power in India





National Solar Mission (NSM) - 100 GW through Solar by 2022

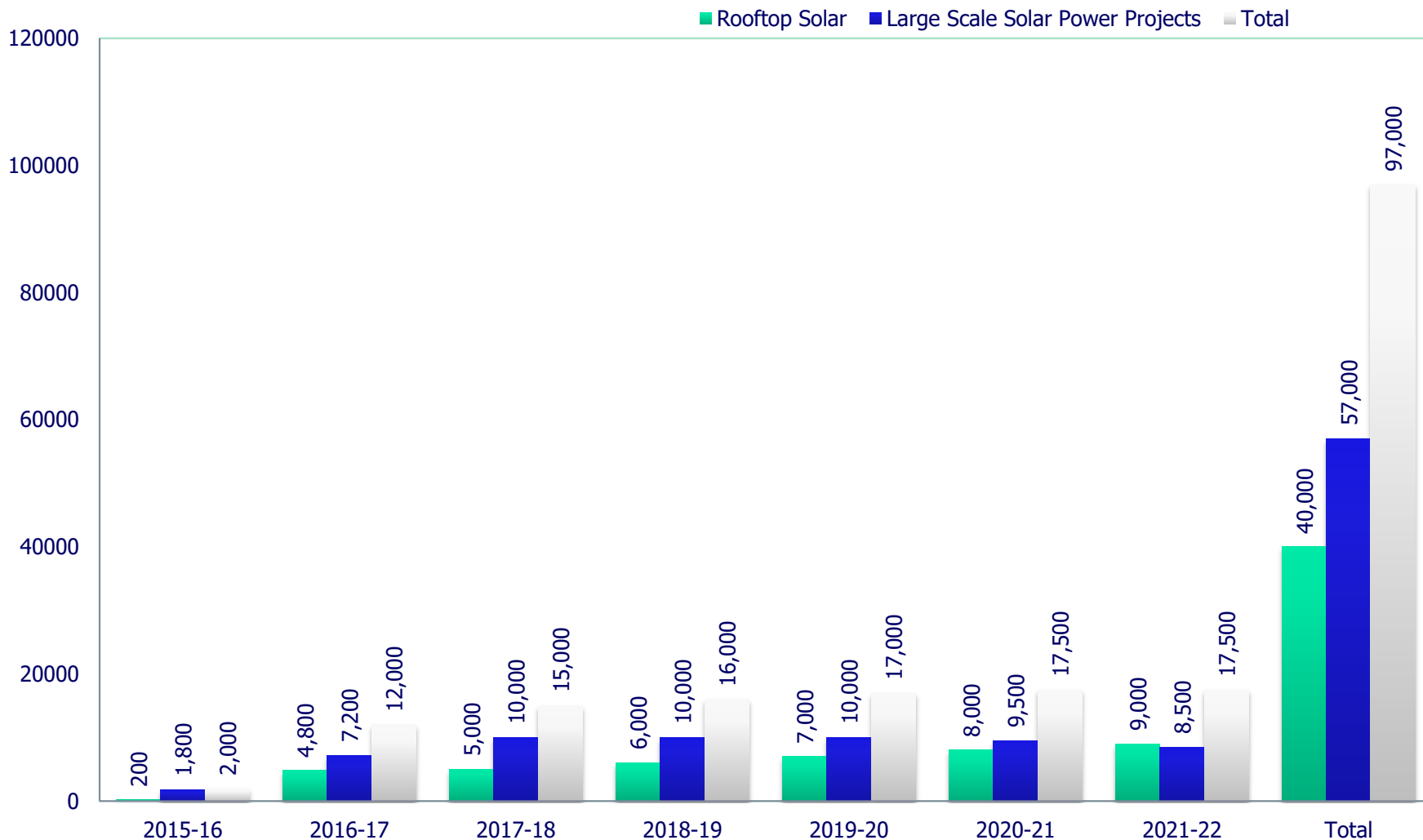


NSM: An Introduction

- ❖ **National Solar Mission (NSM) launched on 11.01.2010 with a target of 22,000 MW by 2022.**
- ❖ **Target revised to 1,00,000 MW (grid connected) by 2022 on 17.6.2015**
- ❖ **Out of the above:**
 - **40,000 MW Grid connected Rooftop**
 - **60,000 MW Ground mounted solar power projects.**



Year-wise Cumulative Targets under NSM

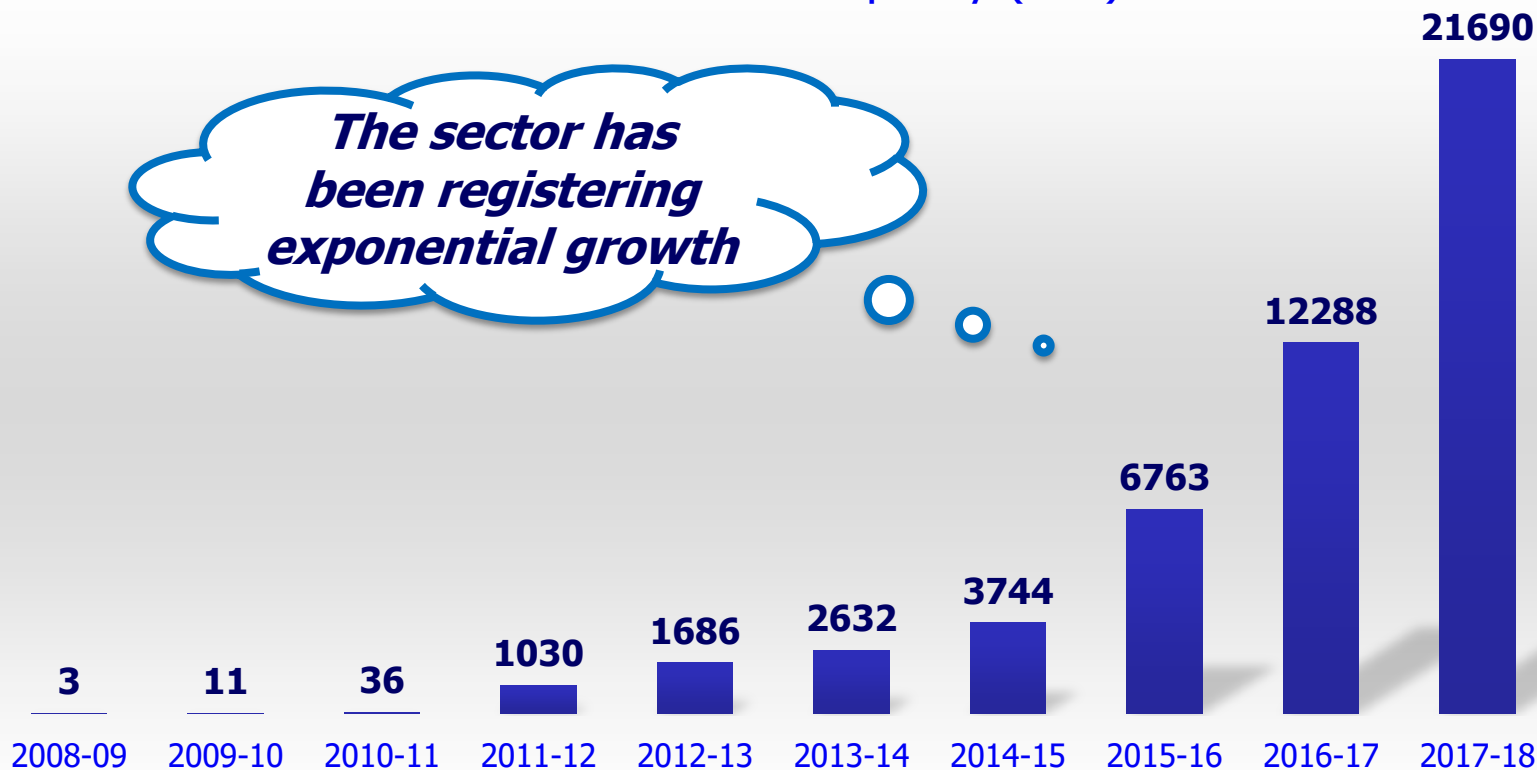




Achievement Growth of Solar in India

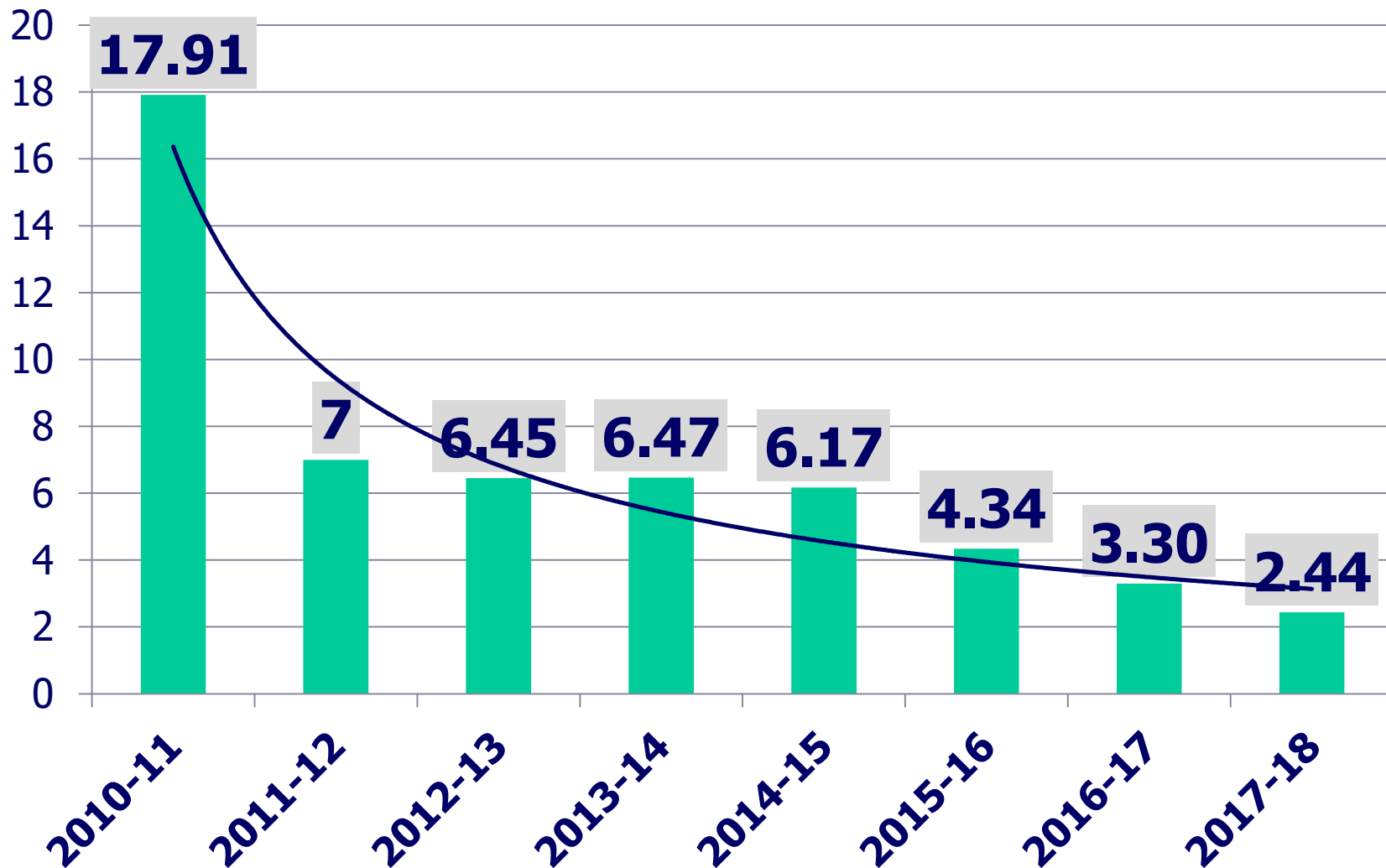
Cumulative Installed capacity (MW)

*The sector has
been registering
exponential growth*





Year-wise lowest solar tariff in(Rs./kWh)





Major Schemes for Solar Sector



- ❑ **Solar Park Scheme**
- ❑ **VGF Scheme: 750 MW, 2000 MW & 5000 MW**
- ❑ **Roof top Scheme**
- ❑ **Off-grid schemes**
 - ❑ **Solar Pumps**
 - ❑ **Streetlights**
 - ❑ **Home lights**
 - ❑ **Study lamps**
 - ❑ **Small Solar Power plants**



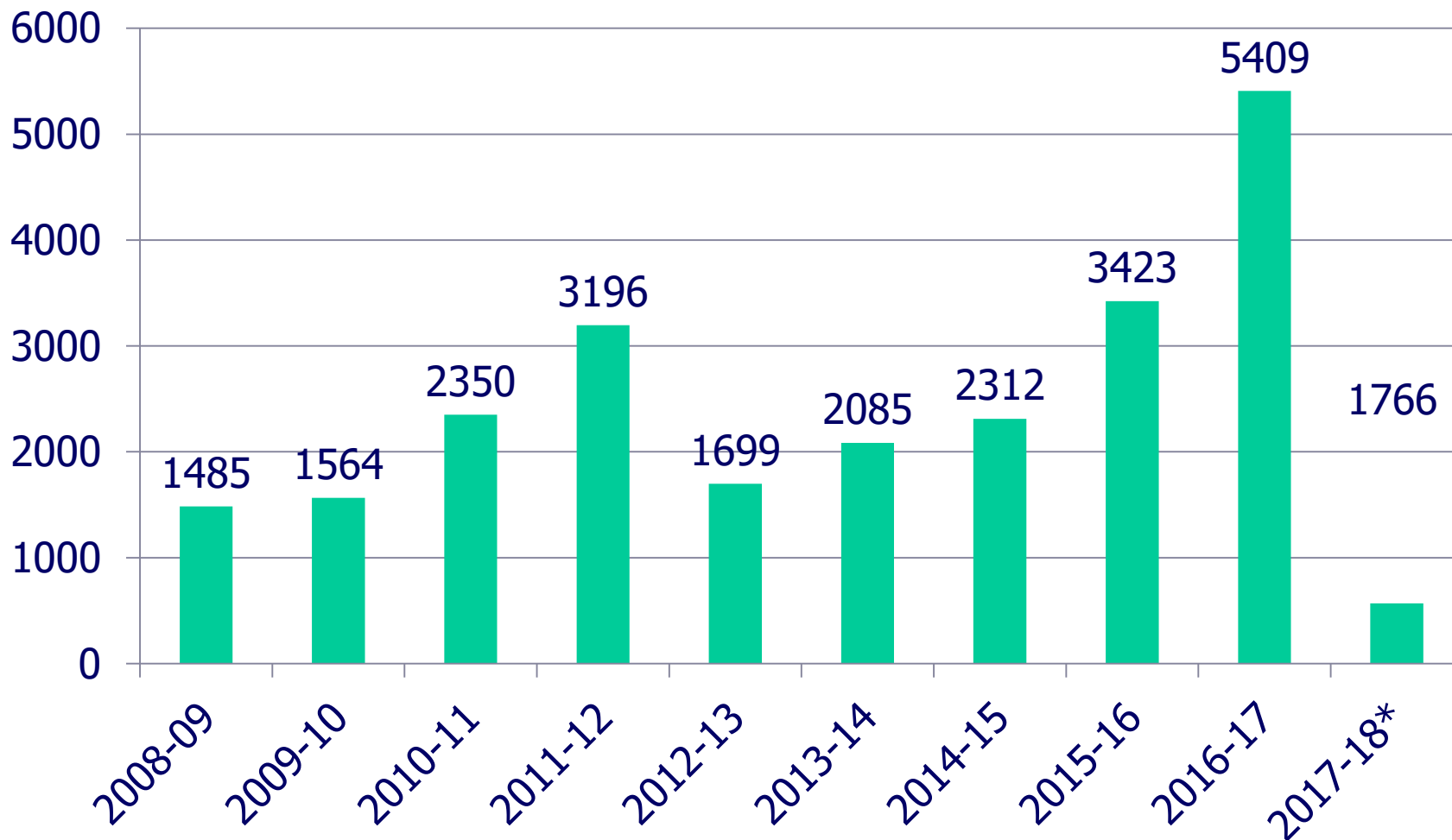
Mission 60 GW through Wind by 2022



Annual addition to Wind Power Installed Capacity



Year wise wind power installed capacity (MW)





New Initiatives in Wind Sector

- ❖ **Offshore Wind**
- ❖ **Wind Solar Hybrid**



Off-shore Wind

- ❖ **The National Offshore Wind Energy Policy has been notified on 6 October 2015. The policy provides facilitative framework for development of off-shore wind power in the country.**
- ❖ **Initial studies indicate offshore wind energy potential in the coasts Gujarat and Tamil Nadu**
- ❖ **First LiDAR (Light Detection and Ranging) installed and commissioned off Gujarat coast for gathering wind resource data.**
 - **Second one to be installed off TN coast**



Wind-Solar Hybrid

- ❖ **Ministry has issued a draft Wind-Solar Hybrid Policy.**
- ❖ **Goal is to reach capacity of 10 GW by 2022**
- ❖ **To take advantage of the complementarities of wind and solar**
- ❖ **Will also help in utilizing the infrastructure, including land and transmission system.**



GREEN ENERGY CORRIDOR (Intra-State Transmission System)



➤ Eight RE rich States : Tamil Nadu, Rajasthan, Karnataka, Andhra Pradesh, Maharashtra, Gujarat, Himachal Pradesh and Madhya Pradesh

➤ Scheme Details:

Total Outlay	Govt. of India Share	Loan from KfW	Transmission Lines Target	Substations Target
10,141 Cr	40 % grant by MNRE (4056 Cr)	EUR 500 Million	8550 circuit kilometres	19000 Mega Volt-Ampere

➤ Scheme is being implemented by respective State Transmission Utilities

➤ Scheduled Commissioning: March 2020

➤ Loan disbursement from KfW to States till 31.01.2018: EUR 107 Million

➤ Work under progress: 1200 ckm completed



Competitive bidding of solar and wind projects in India





Status of Phase-I



- **RPSSGP scheme -78 projects of cumulative capacity of 98 MW allocated – 68 projects of 89 MW commissioned.**
- **Bundling scheme, batch 1**
 - **150 MW (30 projects allocated)-130 MW commissioned (26 projects)**
 - **Tariff 10.95 to Rs 12.76**
 - **470 MW(7 projects) of solar thermal projects allocated – 200 MW (3 projects) commissioned.**
 - **Tariff Rs.10.49 to Rs. 12.24**
- **Bundling scheme batch -2**
 - **350 MW(28 projects) allocated- 330 MW(26 projects commissioned).**
 - **Tariff Rs. 7.49 to Rs 9.44**
- **Around 20 MW projects were developed under REC mechanism.**



Status of phase-II



- ❖ **Viability gap funding Scheme launched in phase -2 of the mission.**
- ❖ **Fixed tariff of Rs.5.50 offered with Rs 25 Million grant support per MW.**
- ❖ **The VGF support quoted was ranging from Rs1.7 million Rs22 million with average of ~Rs12 million / MW**
- ❖ **750 MW capacity allocated for 46 projects.**
- ❖ **680 MW capacity has been commissioned.**
- ❖ **REC market was lost attraction - trading reduced drastically due to rapid tariff reduction.**



Status of phase-II



- ❖ **Batch – 2 to 6 are is under process in both VGF and bundling schemes.**
- ❖ **Target**
 - **10000MW under bundling scheme by NTPC**
 - **20000 MW under VGF schemes by SECI**
- ❖ **VGF scheme- Tariff- Rs.4.43 – Support –Rs 10 million/MW**
 - **Zero VGF bids received.**
 - **Tariff quoted – 2.44/kWh**



Bidding in wind power projects

- Wind power was mainly developed through FIT schemes by various states.
- The tariff of wind used to vary from Rs. 4.5 to 6.0/ kWh.
- With The success low tariff s in Solar, MNRE decided to go for reverse bidding on tariff for wind power projects.
- SECI recently concluded 6000 MW wind power auctions.
- Received the record low tariff of Rs. 2.44/kWh.





Schemes being implemented by SECI



❖ VGF Schemes under JNNSM Phase II

- 750 MW scheme: 680 MW commissioned
- 2000 MW scheme: RfS for 2425 MW; PPA for 2295 MW. Projects under execution.
- 5000 MW scheme: RfS for 2900 MW; PPA for 970 MW. Projects under execution. Record low tariff of Rs. 2.44 per kWh discovered.
- 100 MW Canal-top and Canal-bank Scheme;
- 300 MW scheme for Defence /Para military forces;
- 1000 MW scheme for CPSUs

❖ Grid connected Rooftop Schemes: 1000 MW, About 100 MW commissioned.

❖ 40,000 MW Solar Parks Schemes: 34 solar parks in 21 States

❖ 6000 MW scheme for Wind power plants: Record-low tariff of Rs. 2.44/ kWh discovered.



Factors Impacting Solar & Wind Tariff

Project Structuring

- Stakeholder's Risk Assessment
- Ring fencing of risks
- Creditworthiness of the off-takers

Contract Structuring

- EPC Vs Package-Wise Contracting
- Managing commercial risks
- Mitigation of Technical Risks

External Conditions

- Policy Visibility
- Change in Law
- Economic conditions of the Host Country (inflation, growth)
- Geo-political conditions



Transparent Tendering Process

- ❖ Industry standard open, transparent bidding process
- ❖ e-bidding platform
- ❖ Reverse Auction platform.
- ❖ Project specific elaborated technical specifications.
- ❖ Continuously updating the technical specs along with market trends and best practices.

The screenshot shows the homepage of the ELECTRONIC TENDER High Security Tendering portal. The header includes the site logo, navigation links (Home Page, ETS Site Map, Useful Documents), and a login section with fields for User ID (prashant) and Password (*****). Below the header, there are sections for BENEFITS OF ETS, REGISTRATION, and PUBLIC PAGE. The REGISTRATION section lists options for Buyer-Organization/Auctioneer, Supplier-Organization/Bidder, Bidder Registration for Specific e-Forward Auction, and Pay Regn Fee using Temp-OID. The PUBLIC PAGE section includes links for Buyer Public Page and Supplier Public Page. On the right side, there are search boxes for TSC-based Search, RASC-based Search, and FASC-based Search, each with a 'Go' button. A large watermark of the FCIL logo is visible in the center. At the bottom, there is a blue box for 'ETS User-Guidance Center for Buyers and Suppliers' and a text line stating 'The FIRST e-Procurement Software to be duly certified by STQC for FULL COMPLIANCE with DIT-Guidelines'.



Other Factors

- ❖ **Bankability of PPA: Tri-patriate Agreement between, State Govts, RBI and SECI.**
- ❖ **FDIs: Number of foreign investors are investing aggressively.**
- ❖ **Solar Parks: Development of solar parks reduced number of issues.**



SOLAR PARKS



Solar parks

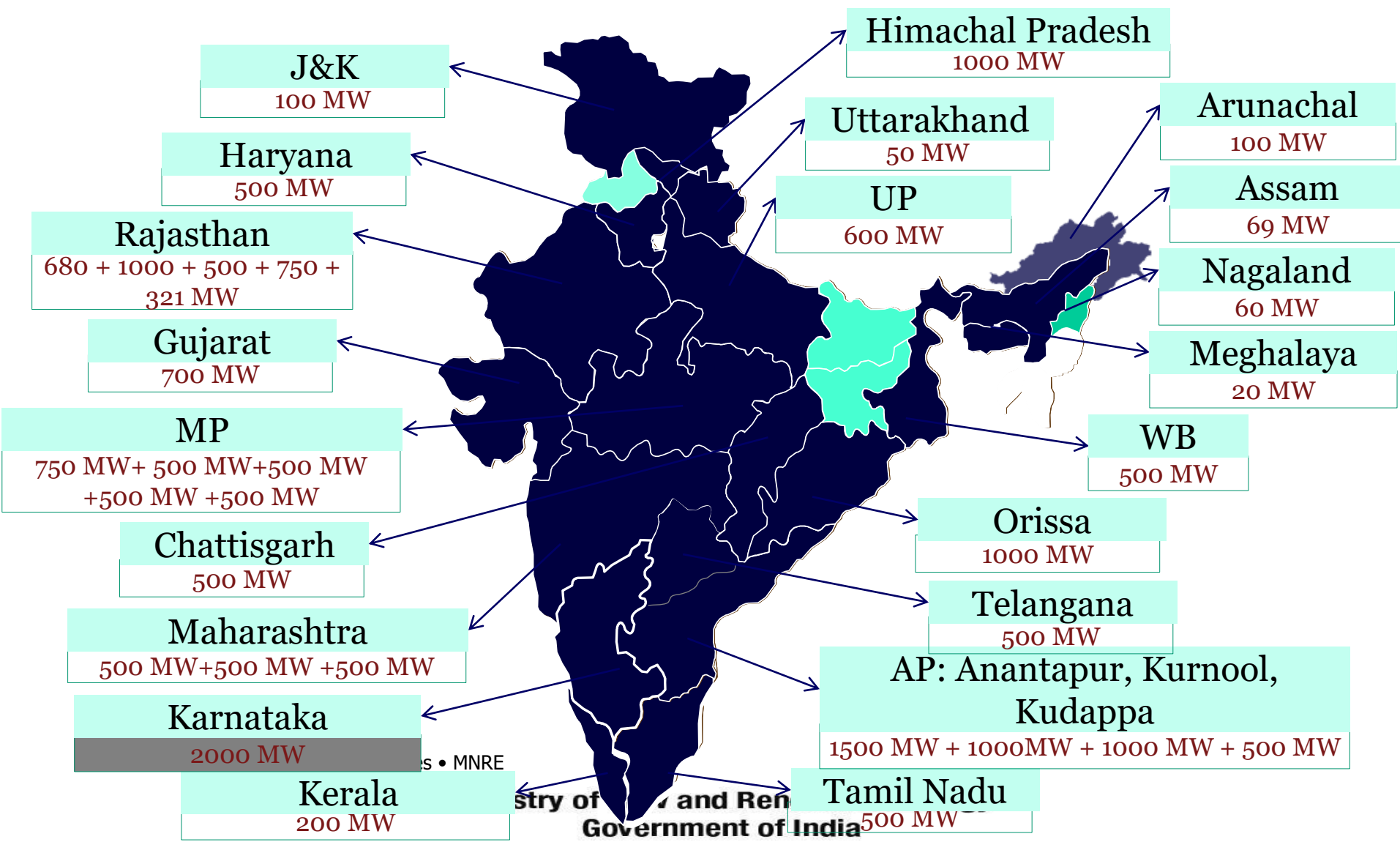


- ❖ **Enabling environment for developers.**
- ❖ **Quick turnaround time for projects.**
- ❖ **Common infrastructure and support services.**
- ❖ **Shared development costs.**
- ❖ **Lesser losses in evacuation.**
- ❖ **Can establish local manufacturing and support facilities.**
- ❖ **Local employment and generation.**



20 GW Solar parks

34 Parks (21 states) with capacity 20,000 MW approved





Solar Parks and Ultra Mega Solar Power Project



**Ministry of New and Renewable Energy
Government of India**



Kurnool Solar Park in Andhra Pradesh



**Ministry of New and Renewable Energy
Government of India**

Bhadla Solar Park in Rajasthan (680 MW)





ROOFTOP PROJECTS

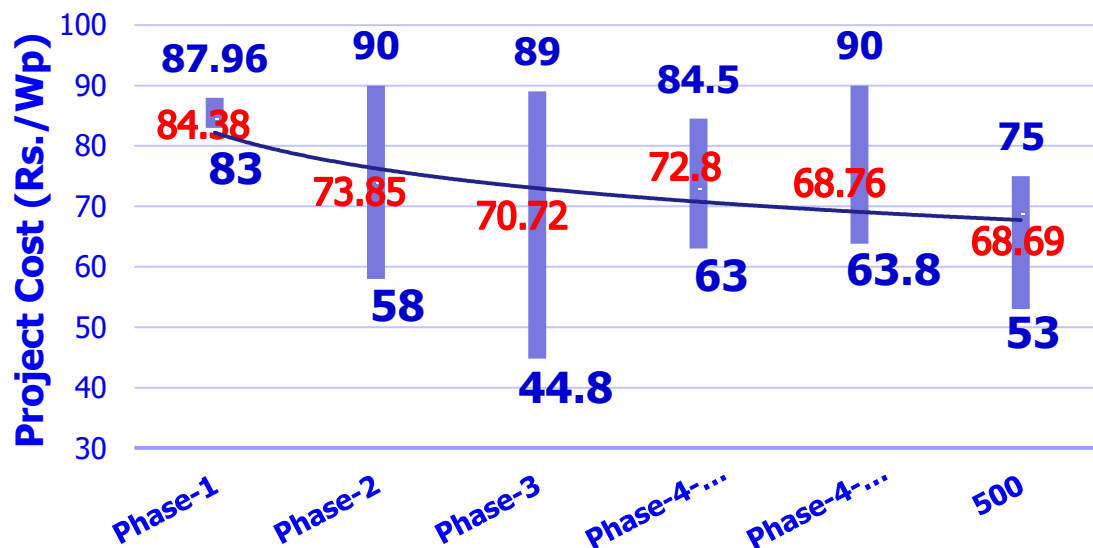


Rooftop Solar Systems

Pilot scheme was implemented in “city specific: mode, through competitive bidding in 2013.

- 26.6 MWp scheme - Year 2013
- 50 MWp scheme - Years 2014 & 2015
- 50 MWp scheme for CPWD - Year 2015-16
- 500 MWp for residential and not for profit institutions – Year 2016
- 500 MWp for Government buildings – Year 2017

❖ About 100 MW capacity installed





Rooftop SPV projects under SECI schemes



Implementing projects with subsidy from MNRE
Upto 500kW capacity projects being set up in select cities

Phase I: 5.5 MW (4 cities)

Phase II: 11.3 MW (6 cities)

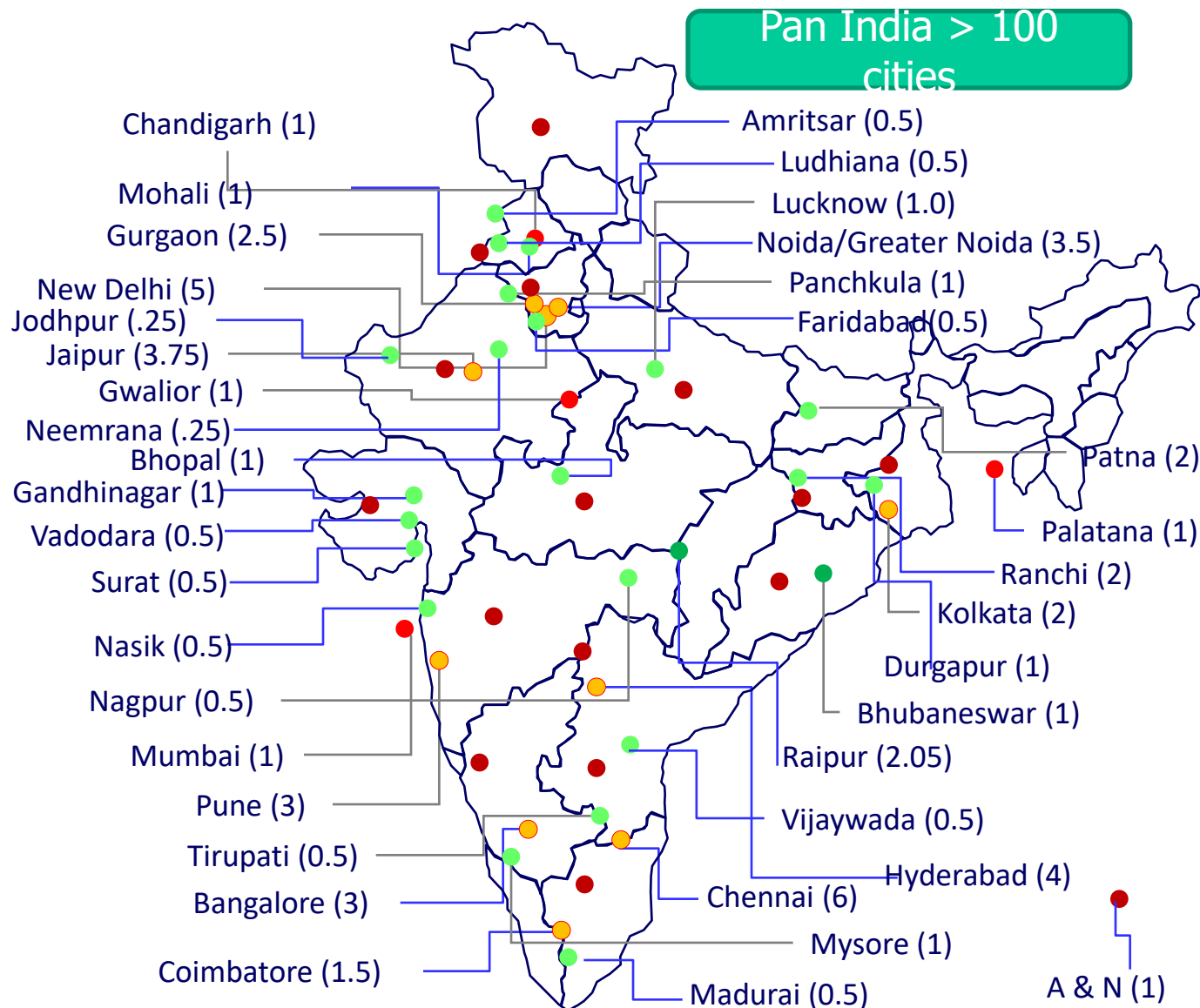
Phase III: 10 MW (9 cities)

Phase IV -1: 32.5 MW (29 cities)

Phase IV -2: 24 MW (17 States)

Legend

Phase I ●
Phase II ●
Phase III ●
Phase IV – Part 1 ●
Phase IV –Part 2 ●
Multiple phases ●





Next Generation RE projects



Issues in high penetration of Solar power



- ❖ **Solar power is intermittent/infirm in nature**
 - **Scheduling of associated energy sources becomes quite difficult**
- ❖ **Prone to fluctuations due to nature.**
 - **Cause instability in grid after exceeding some percentage of solar (especially in case of large installation and solar parks)**
- ❖ **Generation profile is not stable and not matches with load profile.**
 - **Leads curtailment of generation of solar projects/ thermal projects.**
 - **Viability of both the projects in trouble.**
- ❖ **Solutions ??**
 - **Forecasting.**
 - **Storage solutions**
 - **Hybrid power plants**



Solar storage projects



- ❖ **Solar is intermittent source and the generated power can be**
 - **Used locally**
 - **Transmitted to other locations**
- ❖ **Local Use**
 - **Generation not matches the load demand.**
 - **Stability of the local grid after exceeding some percentage of solar.**
- ❖ **Solution ??**
 - **Energy Storage**
 - **Hybrid projects**



Advantage of Solar Wind Hybrids



- Better land utilization – more power generated per unit area and better utilization of unused land available adjacent to the wind turbine
- Better use of evacuation – better utilization of transmission and shared electrical infrastructure
 - Better power generation profile – power output will be more stable compared to standalone generation.
 - Peak Demand matching: Solar addresses morning peak and wind power meets evening peak.
 - Lower operations and maintenance – O&M of 'Hybrid' park more economical and easier due to common components and resources.
 - First project of 160 MW (120 MW Solar + 40 MW wind) is being developed by SECI



Floating Solar projects

- SECI working on developing 10 GW of Floating Solar projects in India
- EoI issued for market sensitisation for Floating solar- good response received
- Potential for 2500 MW has been identified initially (Rihand- 500 MW, Omkareshwar- 500 MW, Indira Sagar- 1000 MW, Hirakud- 500 MW)
- NIT for 150 MW at Rihand reservoir issued



Floating Solar projects

Benefits

- Land savings
- Reduction of water evaporation loss
- Higher generation efficiency due to lesser module temperature
- Better utilisation of Existing Power Evacuation facility (in hydro power reservoirs); Power generation in Lean Hydro seasons
- Retards Algae formation



500 kWp FSPV Power Plant at Banasura lake, Kerala



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Government of India**



Milestones Achieved

- Lowest ever solar tariff of Rs. 2.44 per Unit in Rajasthan bid without any VGF
- Introduction of competition in procurement of wind power and trend setting tariff of Rs. 2.44 per unit in a recently concluded CTU connected wind power scheme.
- Bringing in competitive mode in roof top solar projects from 2013 which is continuously driving down the cost and hence the 'benchmark cost'.



Thank You