Competitive bidding of solar and wind projects

By

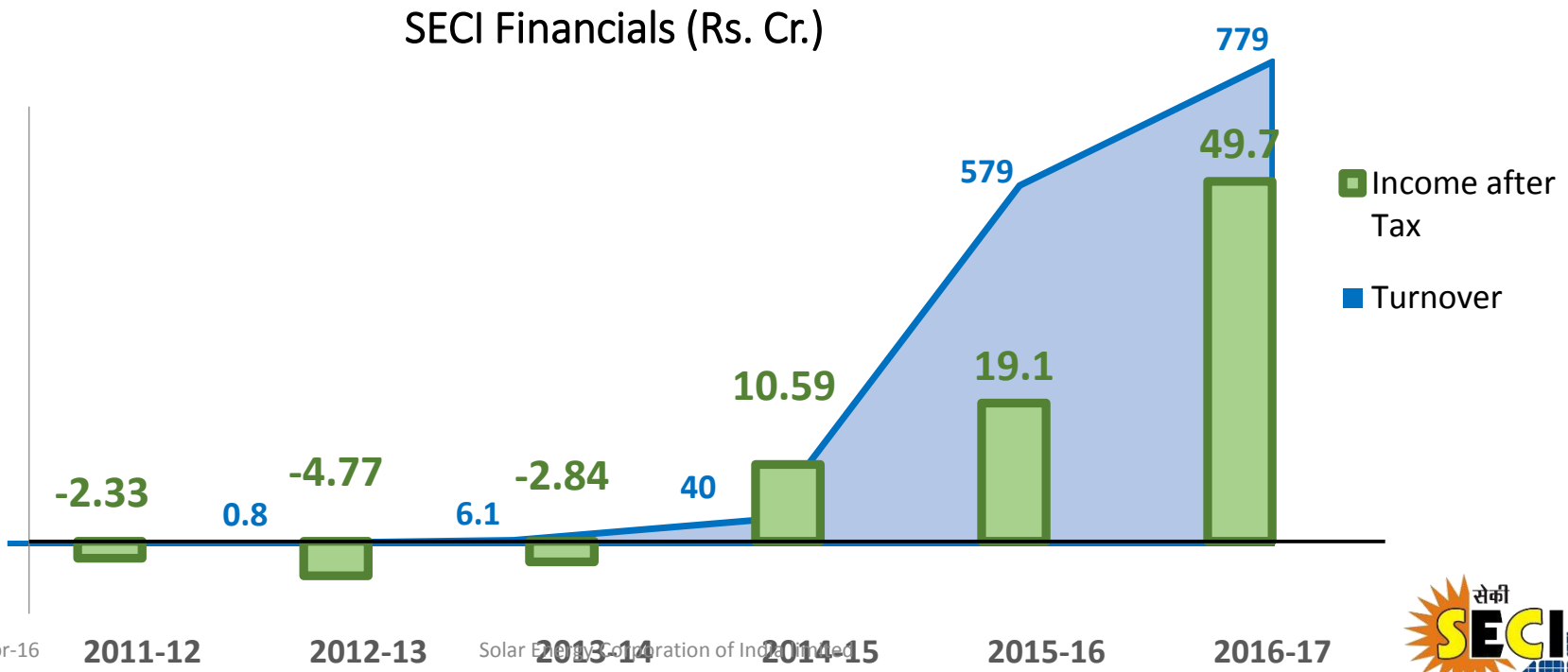
Solar Energy Corporation of India Ltd.

11th Dec 2017



About SECI

- Incorporated on 20th September 2011, as a not for profit organization.
- Converted to a Commercial Company on 9th Nov, 2015; Scope widened to cover all Renewable Energy.
- Authorized capital is Rs. 2,000 Cr. Paid up is Rs. 304 Cr.

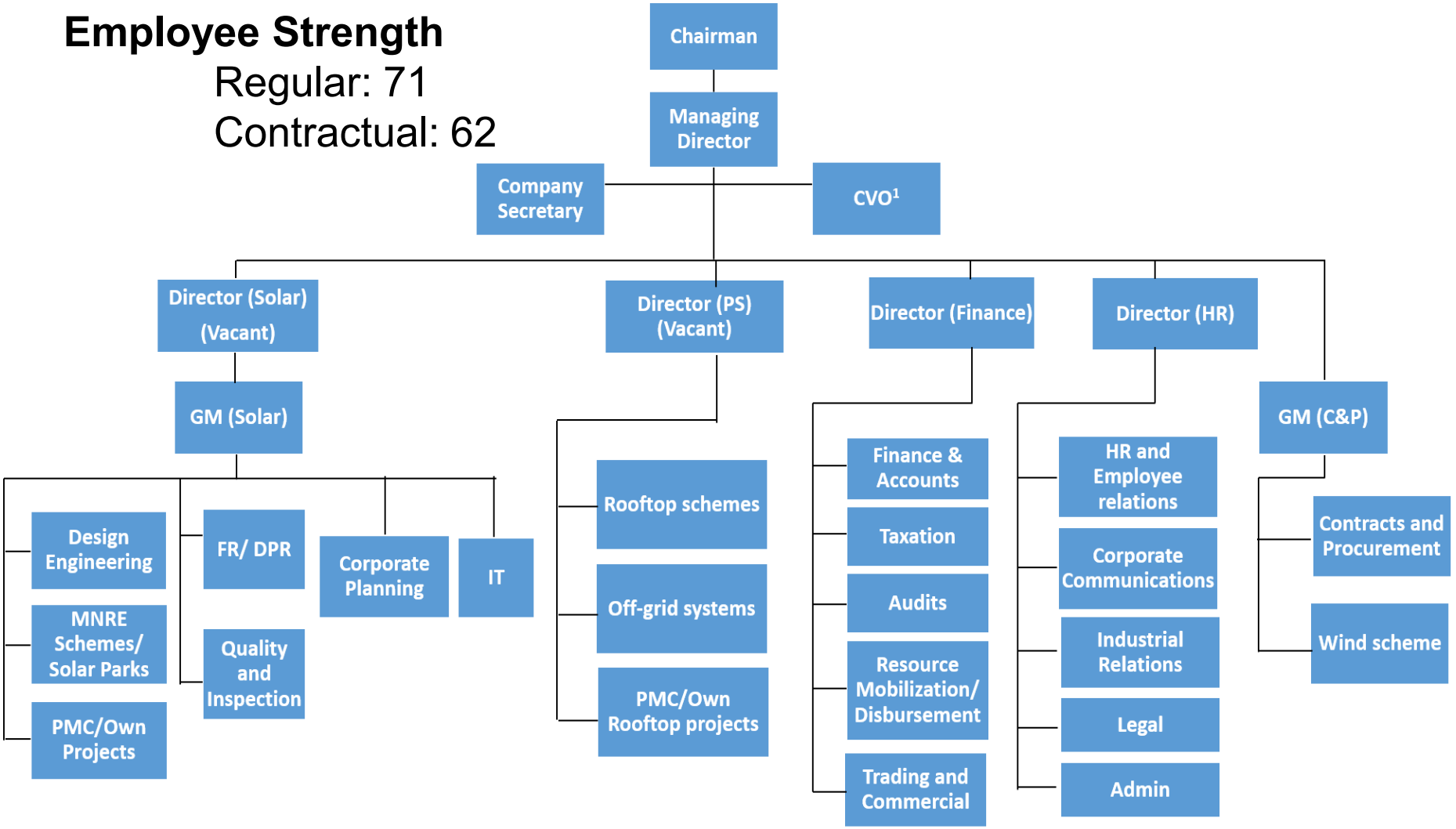


Organization Structure

Employee Strength

Regular: 71

Contractual: 62

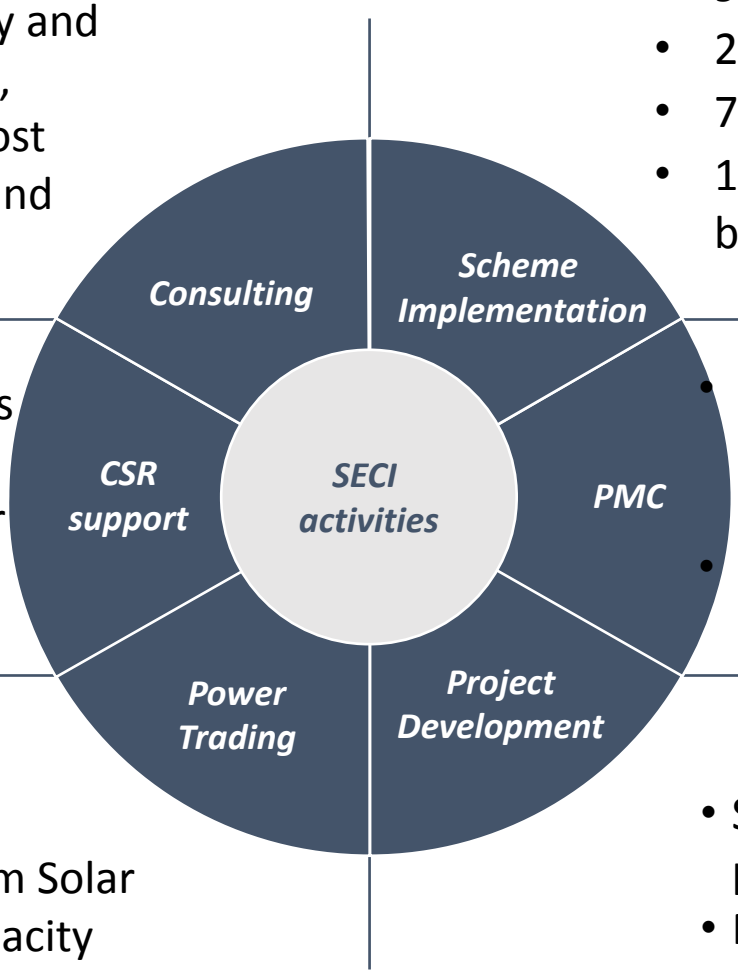


[1] Additional Charge by CVO, MNRE

SECI's Business Areas

- Preparation of feasibility and detailed project reports, resource assessment, cost engineering, technical and financial due diligence

- 9000+ MW VGF schemes
- 20,000 MW Solar parks
- 700+ MW Rooftop schemes
- 100 MW Canal top/canal banks scheme



- Mini/micro grid projects
- Solar street lights
- Supplying 600,000 solar lanterns in the rural areas

- PMC for several prestigious PSUs- BEL, BDL, GAIL, CIL,IREDA, THDC
- Capacity of almost 2000 MW under PMC work in pipeline

- Power trading licensee
- Trading solar power from Solar projects of 680 MW capacity
- Trading across 15 states: 1500+ MU transferred

- SECI has operational power generation assets
- Project pipeline of almost 200 MW

National Solar Mission

INDIAN ENERGY SCENARIO

- One of the fastest growing economies in the world
- Ranks third in total electricity generation after China and USA
- Low Per capita daily electricity consumption (2.76 kWh) compared to Canada (51.5kWh), USA (39.25kWh) and other developed countries.
- Third largest coal producer after China and USA , yet net importer of coal
- More than 25% of primary energy needs met from imports mainly crude oil and gas
- Accelerated development of energy sector to meet sustainable growth aspirations
- Endowed with vast renewable energy resources

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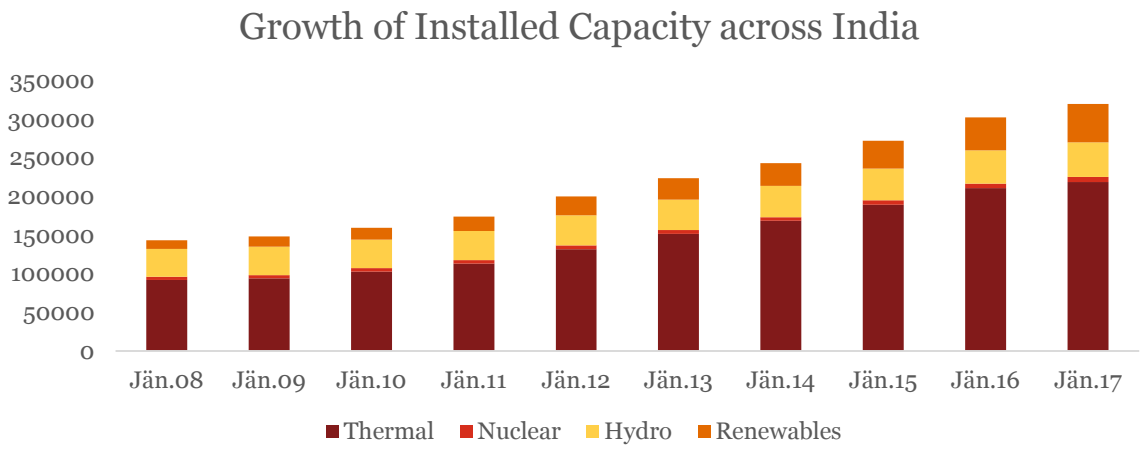
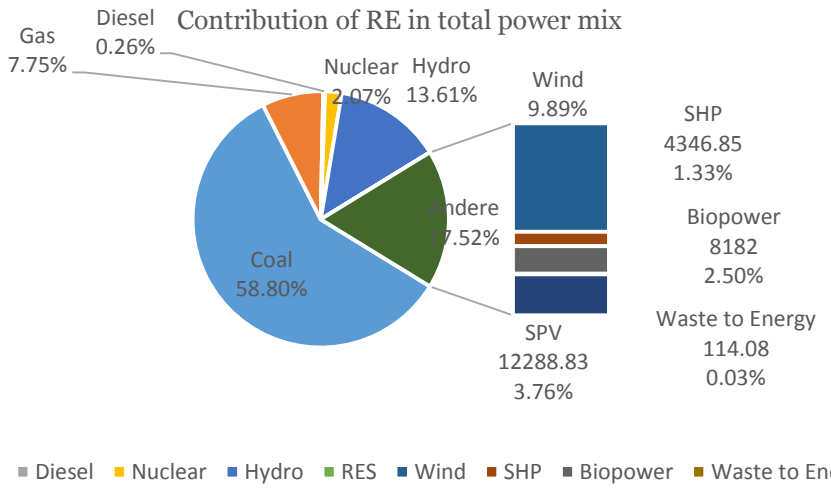
Introduction to India's Power Scenario



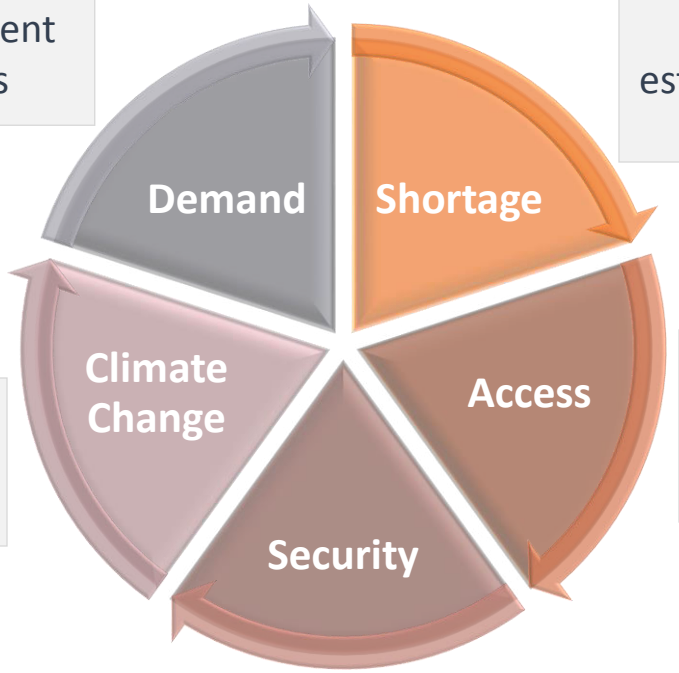


Overview

- India's installed capacity is 319 GW (As on April 2017).
- India's RE capacity has exceeded **52 GW** (as on April 2017) which accounts for 15% of the installed power capacity
- Current share of renewable (in **energy produced**) is ~**7.5%**
- Close to **65%** of the installed RE Capacity from Wind, but solar is expected to overtake wind in terms of yearly additions

India’s Energy Challenge

In next 12 years India’s electricity requirement to grow 2.5 times



Electricity shortage estimated at 25-35 GW

Millions of people still without proper access to electricity

India is dependent on oil imports for 80% of its demand

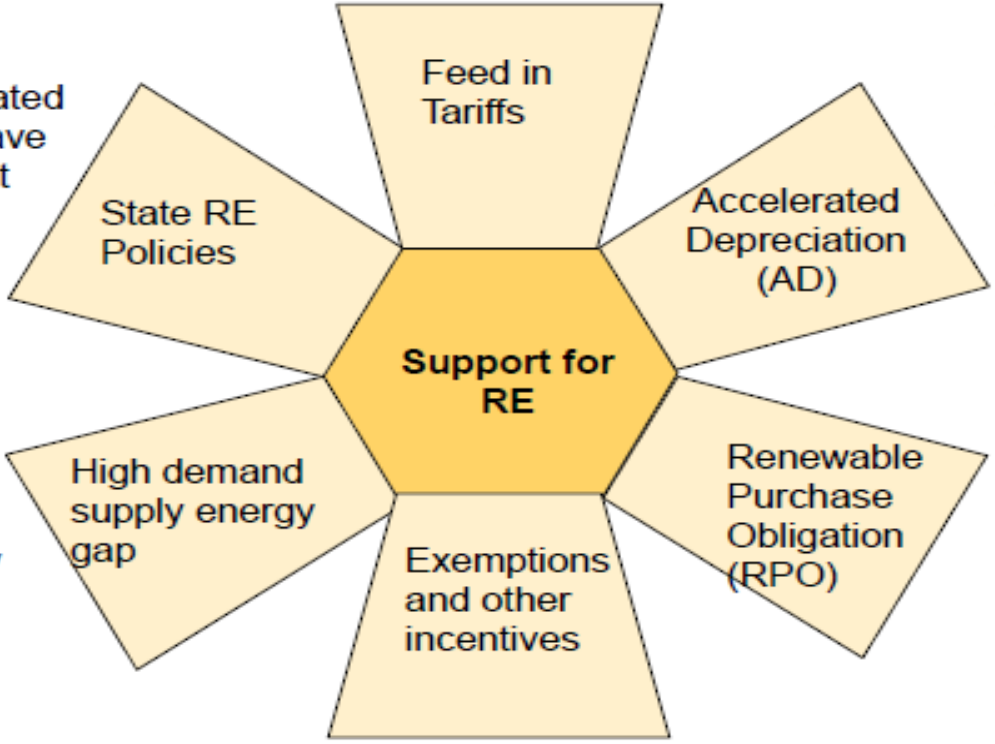
Climate Change is also an important issue

India's 175 GW Solar Target by 2022

Targets	
Source	**Targets till 2022 (GW)**
Solar Power	**100**
Wind power	**60**
Biomass Power	**10**
Other RE	**5**
TOTAL	**175**

Policy Support

Support Mechanism for Renewable Power In India

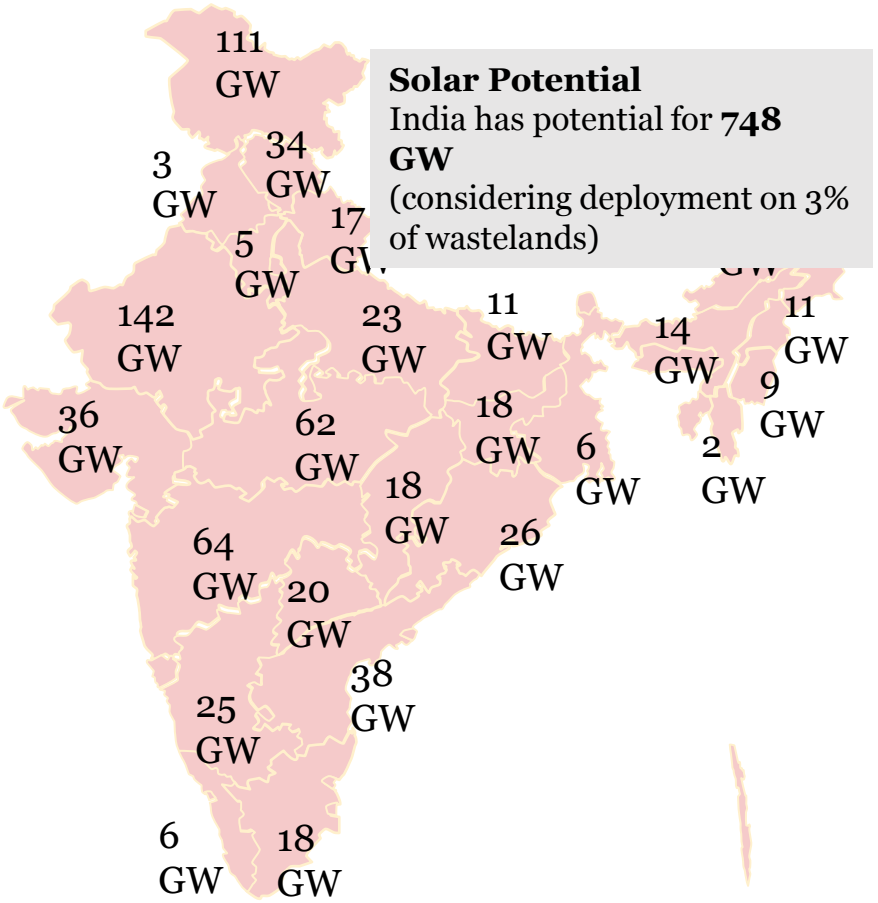


- Key instrument for success of wind
- Also exists for of solar, biomass projects

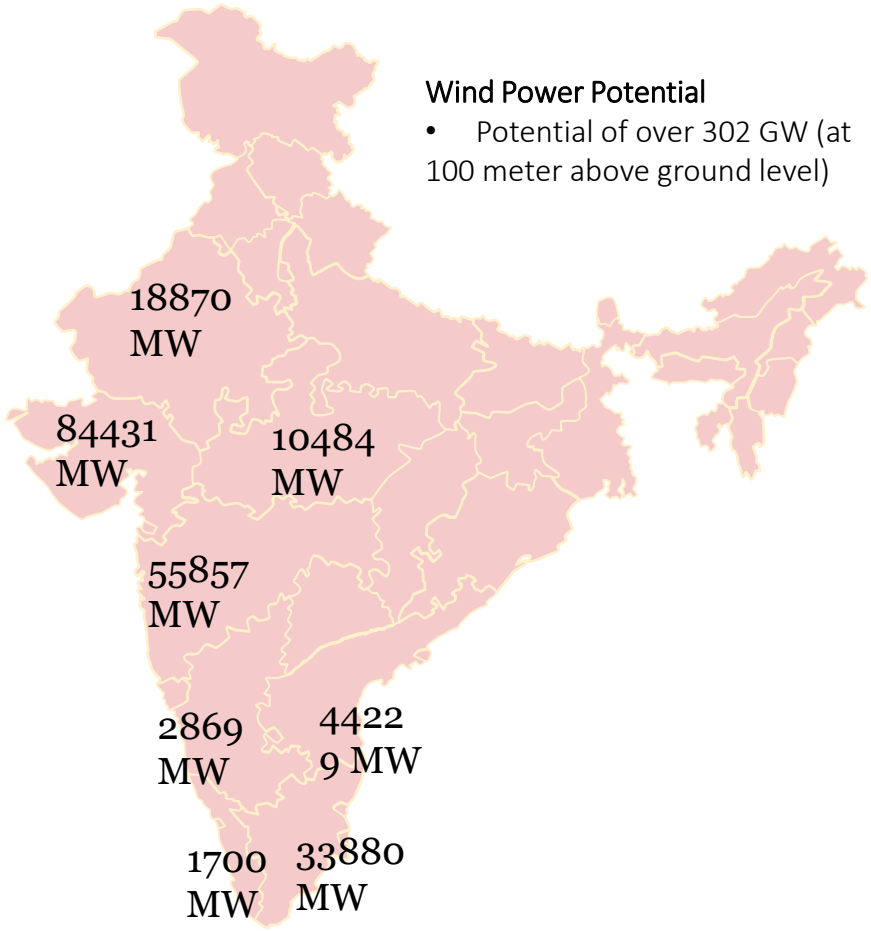
- RPOs mandated by the EA 2003 and National Tariff Policy
- REC mechanism launched to fulfill RPOs

- Excise & Custom duty exemptions for most of the Equipment, Machinery etc.
- 10 year tax holiday

Potential of Solar and Wind Power in India



Solar Potential
India has potential for **748 GW**
(considering deployment on 3% of wastelands)

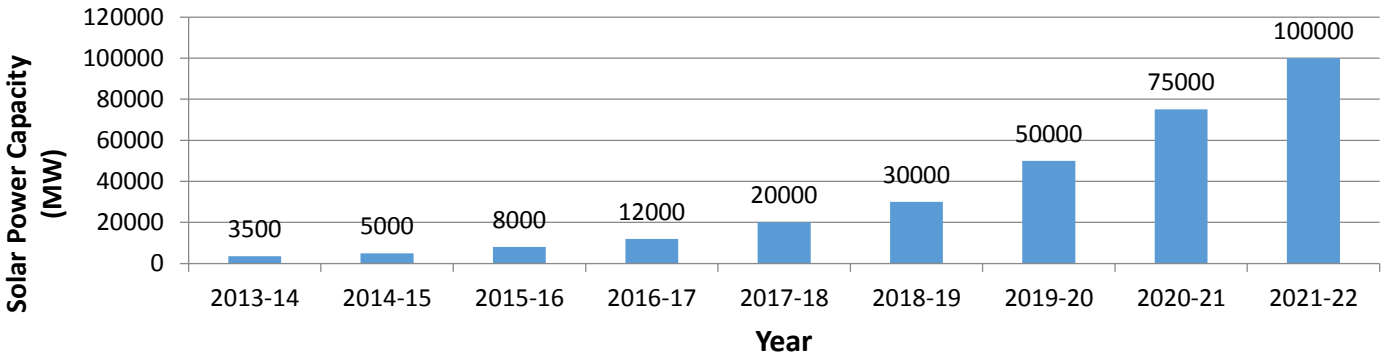


Wind Power Potential

- Potential of over 302 GW (at 100 meter above ground level)

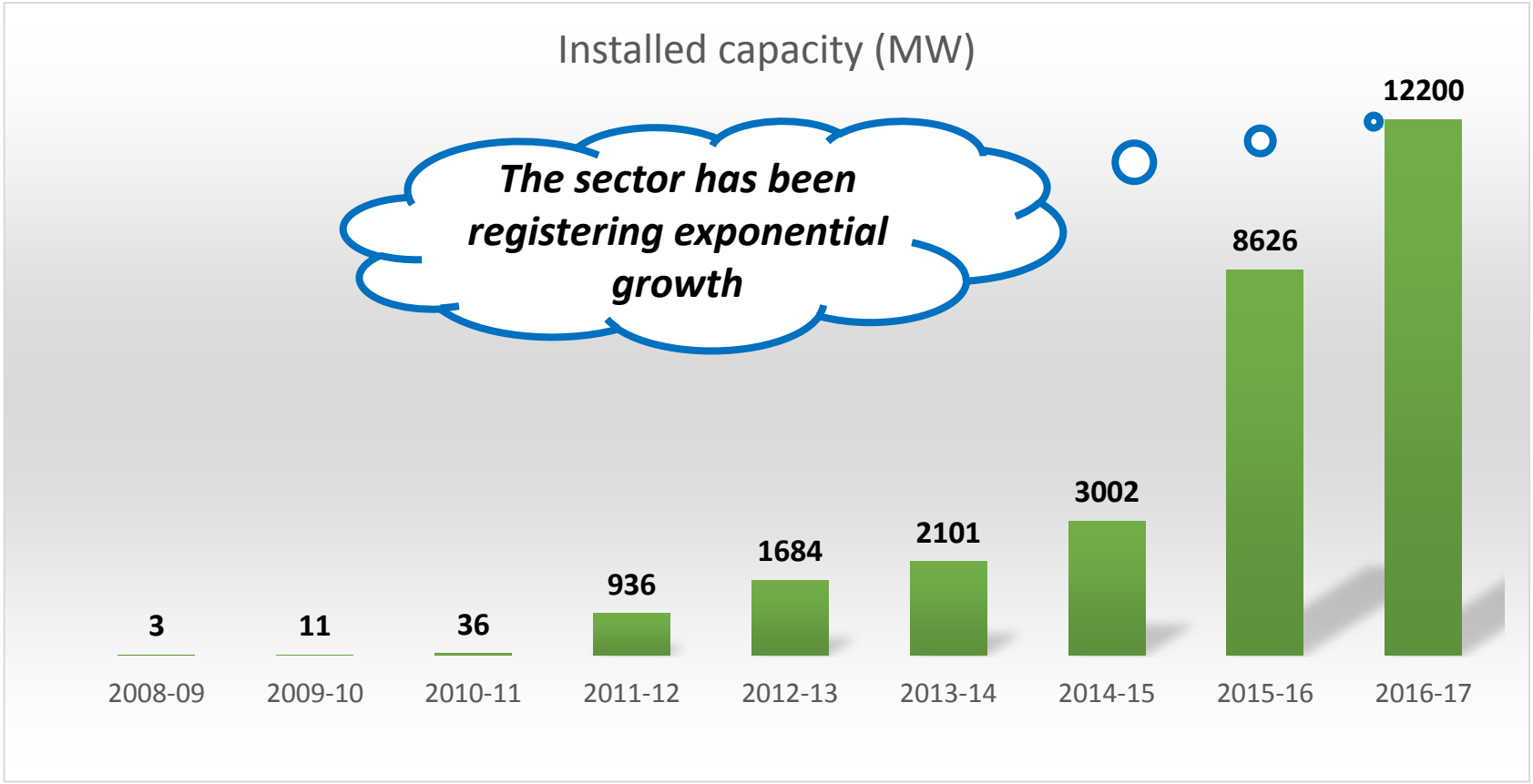
Revised target of Solar Power– 100 GW by 2022

Cumulative solar capacity targets (MW)



Category 1. Rooftop Projects (< 1 MW per project)	Category 2. Large scale Grid connected (1 MW – 500 MW project)	Category 3. Ultra Mega Power Projects (>500 MW)
40,000 MW	20,000 MW	40,000 MW

Growth of Solar Capacity in India



Four pillars of scale up of solar power plants: Land, Production capacity, PPA, Financing

Evolution of Bidding Processes

Solar Projects evolution in India

- Jawaharlal Nehru National Solar Mission was launched on the 11th January, 2010 by the honourable Prime Minister of India.
- Initial target was 20000 MW 2022.
- Rooftop PV & Small Solar Power Generation Programme (RPSSGP) was launched in 2010.
- Generation based Incentive scheme based on CERC bench mark tariff was provided. Rs. 17.0 (~ $0.33)
- Bundling mechanism with Cheaper Thermal Power was also launched based on reverse bidding on CERC tariff.
- Renewable Energy Certification (REC) Mechanism implemented through imposing Solar Renewable Power Obligation (RPO) to Utilities

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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.

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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 – 2.42/kWh
- Bundling scheme- Tariff of Rs 3.15 quoted

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 2000 MW wind power auctions.
- Received the record low tariff od Rs. 2.63/kWh.
- Another 2000 MW tender is about to release.

Govt of India Schemes 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.
  - **Indo-Pak Border Solarization Scheme**: 5 MW commissioned
  - **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
- **4000 MW scheme for Wind power plants:** Record-low tariff of Rs. 2.63/ kWh discovered. Another NIT for 2000 MW brought out.

Factors Impacting Solar & Wind Tariff

Project Structuring	Contract Structuring	External Conditions
• Stakeholder's Risk Assessment • Ring fencing of risks • Creditworthiness of the off-takers	• EPC Vs Package-Wise Contracting • Managing commercial risks • Mitigation of Technical Risks	• Policy Visibility • Change in Law • Economic conditions of the Host Country (inflation, growth) • Geo-political conditions

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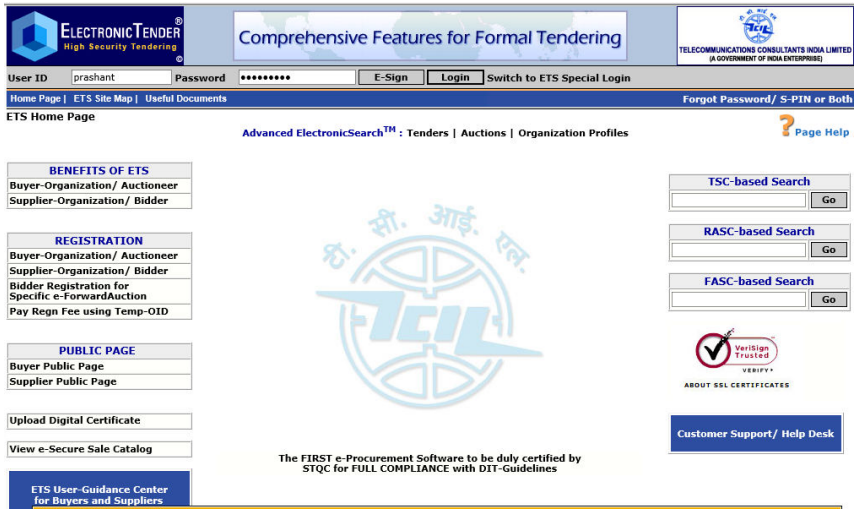
SECI's Tendering Process

- 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.



Other Factors

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

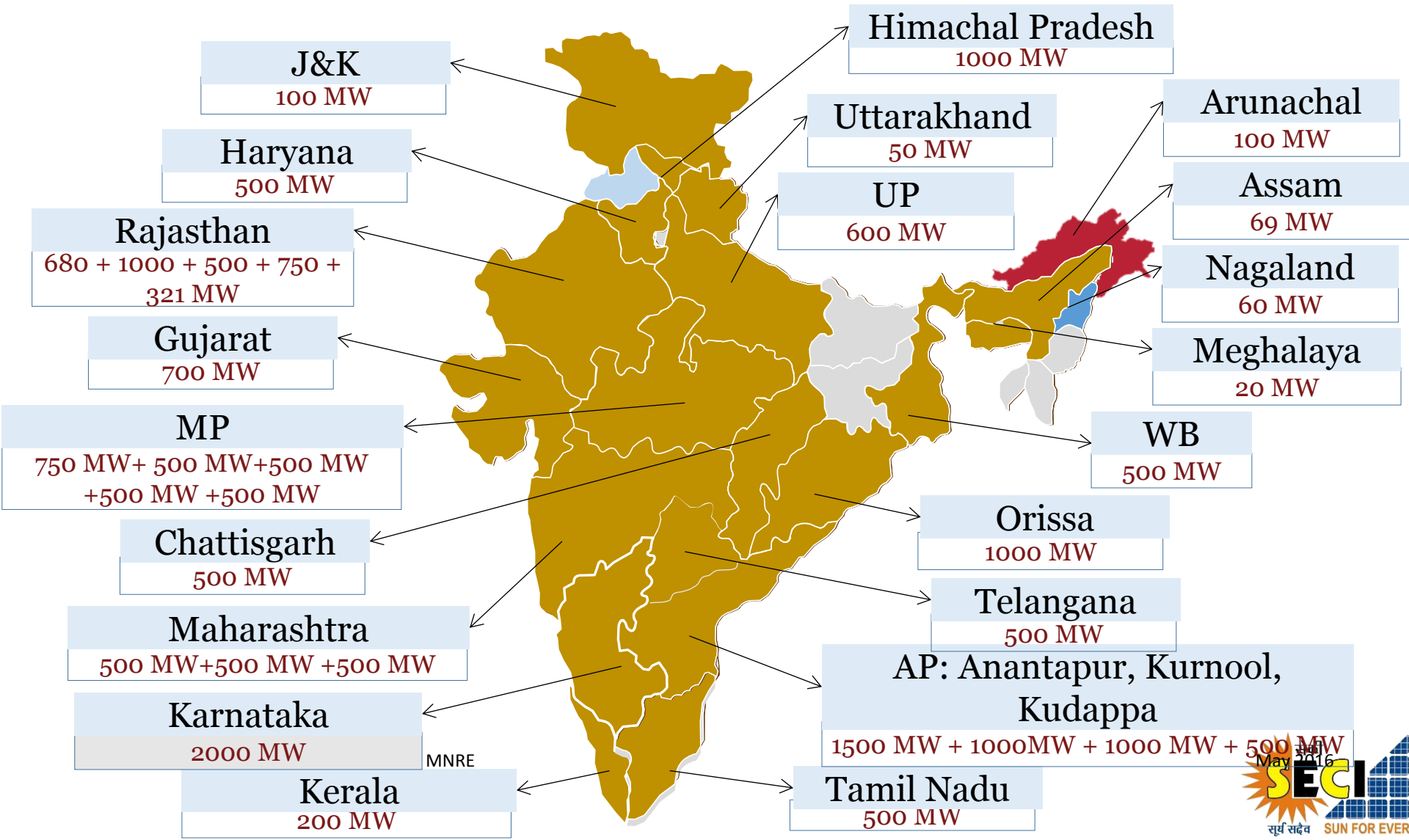
SOLAR PARKS

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



MNRE

Solar Parks Scheme

- **Category A parks (Work in Progress)**
  - Andhra Pradesh- 4,000 MW
  - Rajasthan- 680 MW (Bhadla Phase II)
  - Rajasthan- 1500 MW (Bhadla Phase III, Phase IV)
  - Uttar Pradesh- 440 MW
  - Kerala- 200 MW
  - Karnataka- 2000 MW
  - Madhya Pradesh- 750 MW (Rewa Solar Park)
  - Madhya Pradesh-500 MW (Neemuch-Mandsaur Solar Park)

- **Category B parks (Work likely to start in 3-6 months)**
  - Maharashtra- 1500 MW
  - Gujarat- 700 MW
  - Chhattisgarh- 500 MW
  - West Bengal- 500 MW

Category C parks (DPR and Land Under Finalization)

- Odisha- 1000 MW
- Tamil Nadu- 500 MW
- Telangana- 500 MW
- Haryana- 500 MW
- Arunachal Pradesh- 100
- Uttarakhand- 50 MW
- Assam- 69 MW
- Nagaland-60 MW
- J&K- 100 MW

1000 MW HP is under review

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Solar Parks and SECI in JV in Phase-1 of Solar Park Scheme

Solar Parks Approved : 34 Nos. in 21 States
Capacity : 20,000 MW

SECI in JV with State Designated Agencies:

1. Andhra Pradesh
2. Himachal Pradesh
3. Karnataka
4. Madhya Pradesh
5. Kerala
6. Uttar Pradesh

***Total capacity sanctioned in above states is 10550 MW**

ROOFTOP PROJECTS

Progress Status of Rooftop Solar in India

State/UT	(MW)	%
Tamil Nadu	**132**	**12.94%**
Gujarat	69	6.76%
Maharashtra	89	8.73%
Punjab	55	5.39%
Karnataka	51	5.00%
Rajasthan	46	4.51%
Uttar Pradesh	33	3.24%
Telangana	27	2.65%
Andhra Pradesh	32	3.14%
Haryana	57	5.59%
Delhi	35	3.43%
Chhattisgarh	16	1.57%
Others	378	37.06%
Total	**1020**	**100.00%**

Source: Bridge to India, as on 30th September 2016

- ✓ Solar Policy notified by 30 states
- ✓ Net Metering Policy in 18 states
- ✓ Emphasis by GoI to set state-wise targets and direction to all Ministries to set up Rooftop on Government/PSU Buildings

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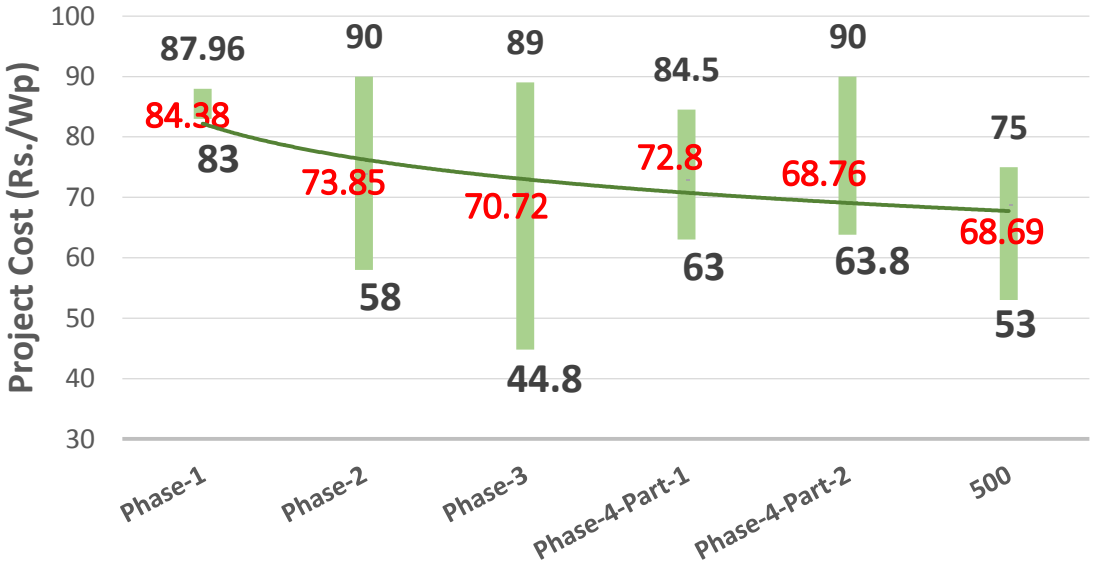
Rooftop Solar Systems

- 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 Rooftop projects with subsidy from MNRE

Upto 500kW capacity projects being set up in select cities

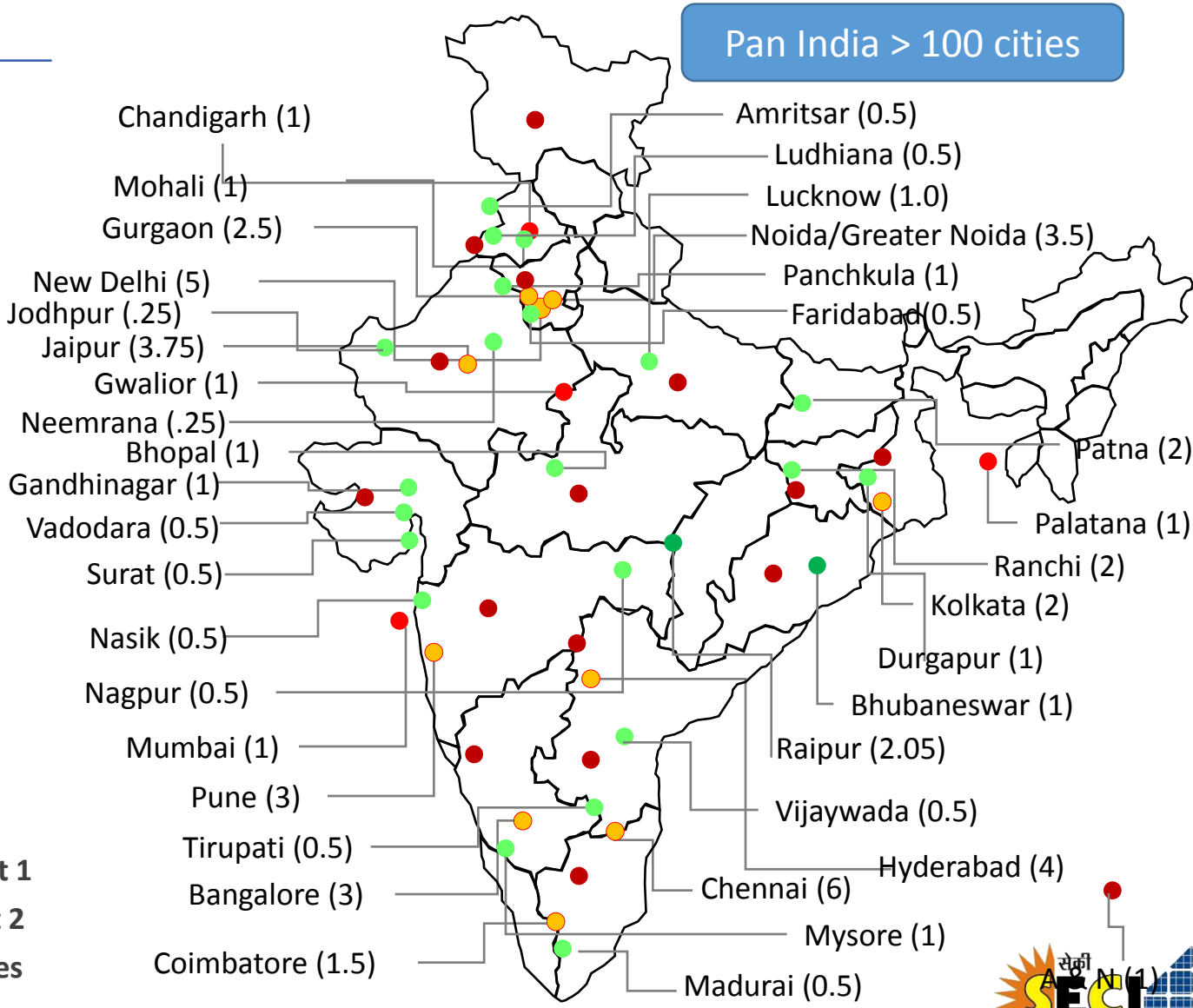
Phase I: 5.5 MW (4 cities)

Phase II: 11.3 MW (6 cities)

Phase III: 10 MW (9 cities)

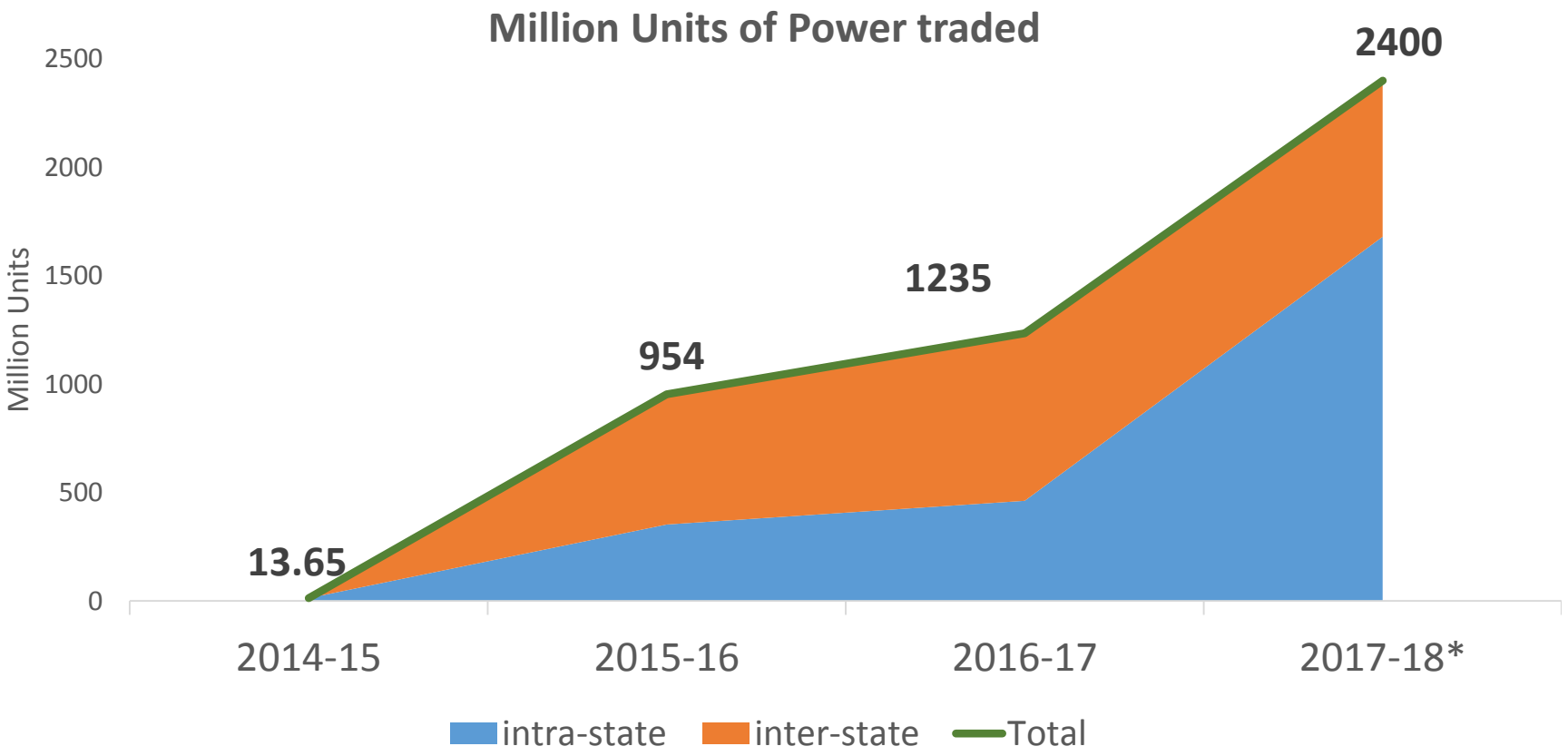
Phase IV -1:32.5 MW (29 cities)

Phase IV -2: 24 MW (17 States)



Solar Power Trading

- SECI is applying for a Category I trading license
- Trading solar power under VGF schemes



* 2017-18 figures are projected

Own Capex Projects

- **10 MW at Jodhpur, Rajasthan -** Commissioned
- **1 MW Rooftop Solar at Andaman & Nicobar-** Commissioned
- **150 MW Solar-wind Hybrid project in Andhra Pradesh-** Feasibility assessment done
- **2.5 MW Solar-wind-battery hybrid R&D project-** Under tendering
- **20 MW at DRDO, Karnataka-** Feasibility assessment done
- **50 MW at DRDO, Hyderabad-** Under discussion

Next Generation RE projects

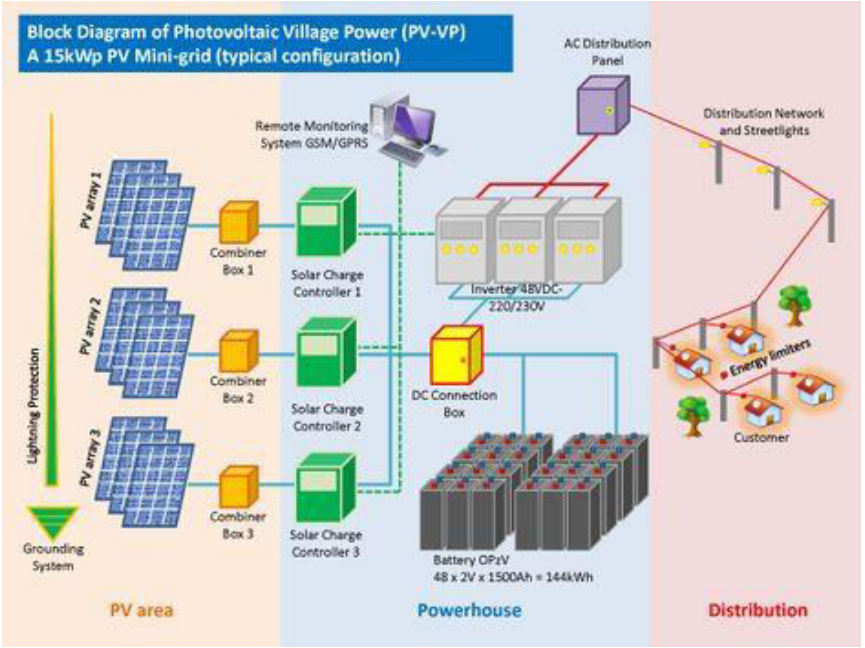
Issues in high penetration of Solar power

- 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 ??**
  - **Storage**



Source : Energypedia

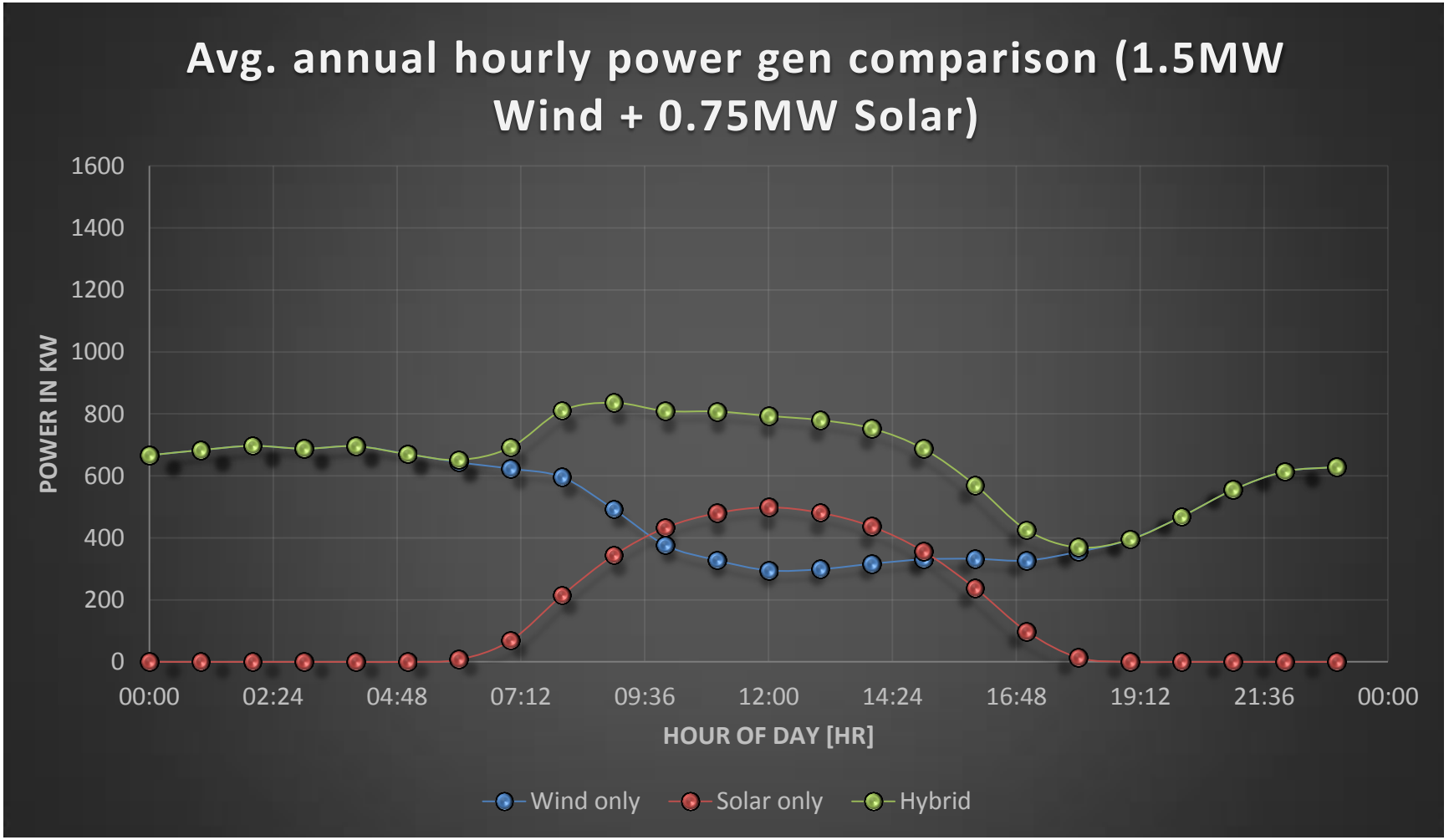
Solar PV storage Projects

- SECI realized the issues and started working on projects with storage.
- Working on following pilot projects at potential locations of huge capacities in future.
- 2MW Solar and 0.5 wind hybrid power plant along with 1 MWh battery storage a Kaza, Lahaul spiti Dirtrict of Himachal Pradesh (Approved)
    - Demonstrate the potential of large scale PV and wind power generation in Himalayan cold desert regions.
    - Hybridization of renewable sources.
    - Study the effectiveness of large scale battery storage.
- 1 MW solar projects with 3 MWh large scale storage facility at Chikten, Kargil
    - To mitigate diesel consumption in the Localized diesel grid.
    - To demonstrate the storage benefits in terms of stability of grid.
- 300 MW solar projects with storage are being developed for smooth solar power.

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 'True Hybrid' park more economical and easier due to common components and resources

Complementarity Generation



With Energy Storage out put can be firmed further

Source : Regentech

Solar wind hybrid projects

- SECI is planning to set up 150 MW solar+ wind hybrid projects
- The initiative is being supported by World bank.
- Firming projects sites, capacities is under progress in Andhra Pradesh.
- Procurement plans are being worked out.
- The project will employ Battery energy Storage system also.

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. 2.63 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' of the MNRE
- Village electrification project for 895 villages through stand alone Solar Home Lighting Systems and 4923 nos. Solar Street lights in Arunachal Pradesh under DDGUY scheme
- Undertaking 150 MW solar-wind hybrid project with World Bank Support
- 'Very Good' rating in its first MoU evaluation in 2015-16

Thank You

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