

Business Unit

Policy Landscape for Solar-Wind Hybrid

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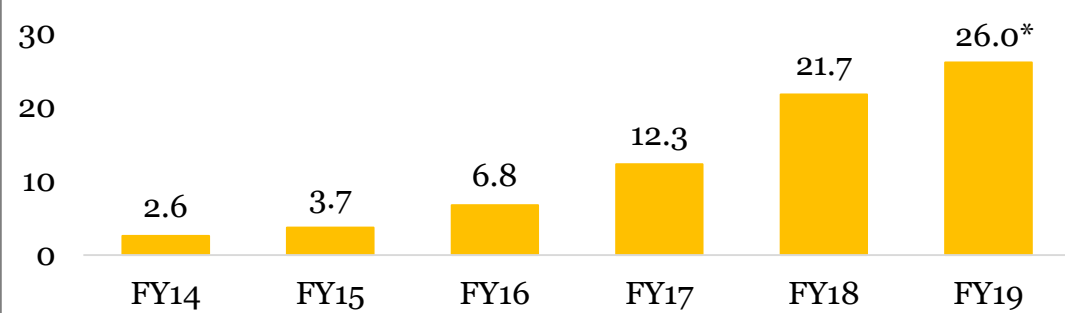
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Current Status of Solar and Wind Installed Capacity

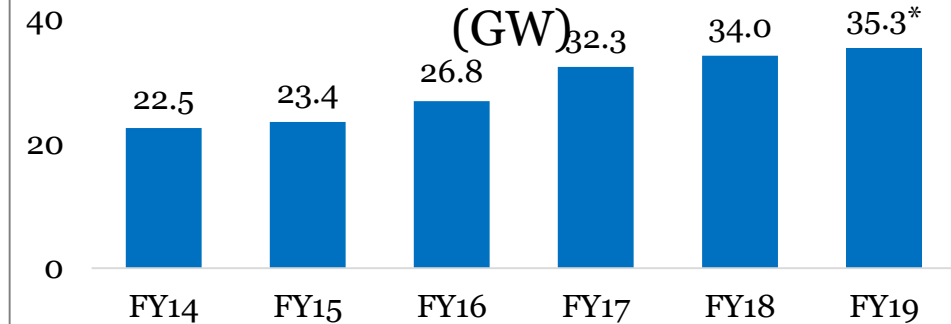
Solar energy trends

Installed capacity in solar energy (GW)

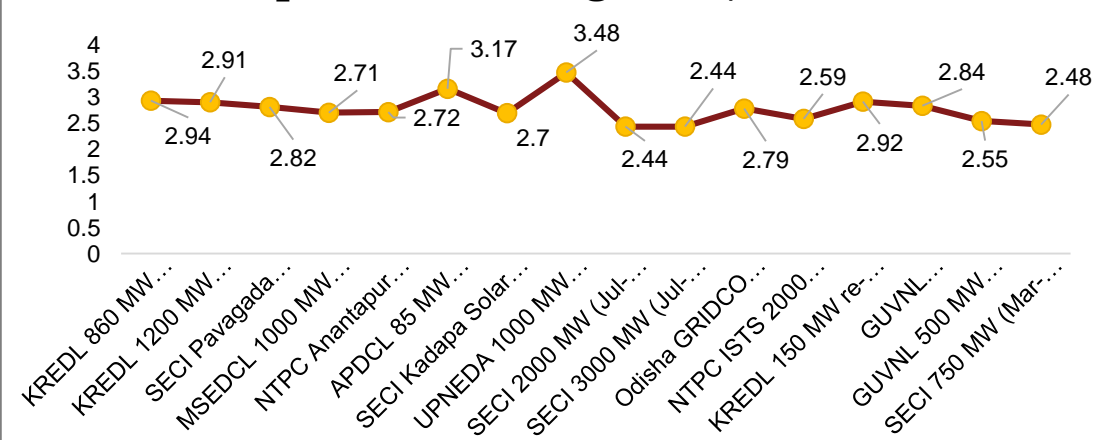


Wind energy trends

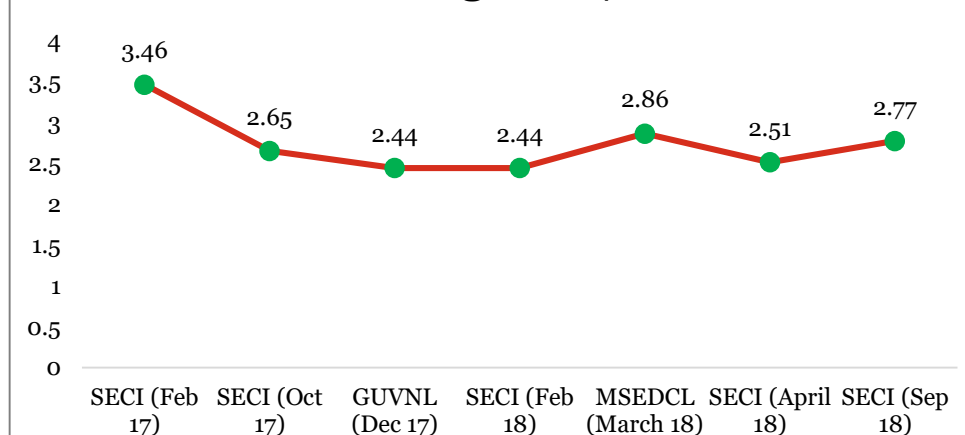
Installed capacity in wind energy (GW)



Lowest discovered solar tariffs in competitive bidding (INR/kWh)



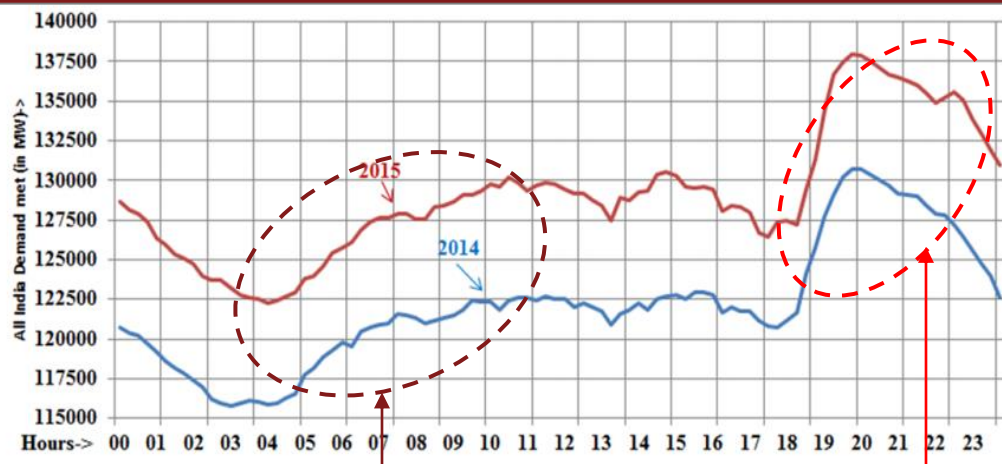
Wind tariff trends in competitive bidding (INR/kWh)



High ramping requirement with solar generation

However, solar generation profile causes the well known duck curve, leading to very high ramping

Curve for all India power demand met in 2014 and 2015



With addition of 20,000 MW solar...



Expected duck curve in Indian scenario

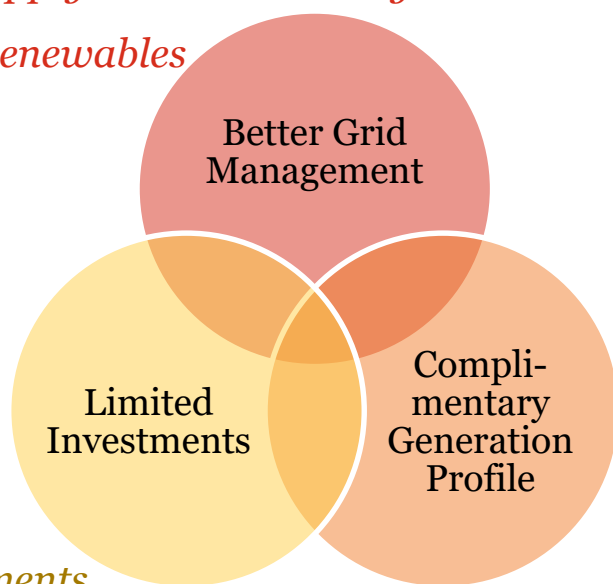


- The demand curve has one morning peak and one evening peak
- Morning ramp up rate is ~140 MW/minute
- Evening ramp up rate is ~200 MW/minute

- With addition of 20,000 MW of solar, a higher ramp rate of ~ 300 MW/minutes is expected in Indian scenario
- With 100 GW solar addition, this ramp rate is expected to multiply significantly

Solar-Wind hybrid: A solution to smoothening generation profile

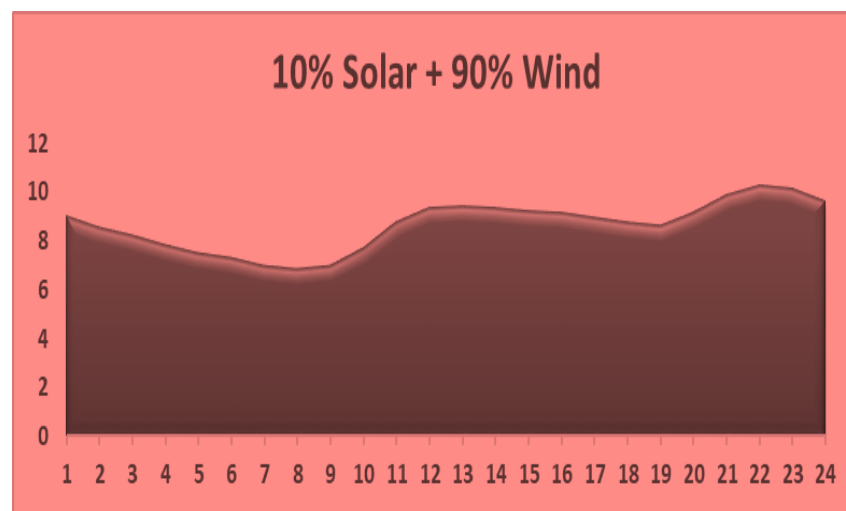
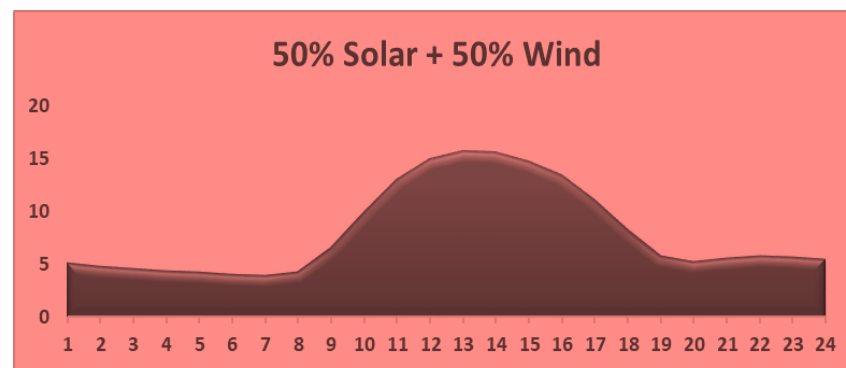
Hybrid combination provides flexibility of altering solar-wind capacity configuration thereby allowing reduction in demand-supply mismatch arising due to intermittent nature of renewables



Reduced capex requirements per MW of capacity installation due to synergies arising out of common land, equipment and transmission infrastructure.

Wind generation peaks in morning and night time blocks when solar generation is negligible.

Indicative generation profile for solar wind hybrid plants



National Solar-Wind Hybrid Policy- (1/2)

Objective

- Framework for promotion of large grid connected wind-solar PV hybrid system for efficient utilization of transmission infrastructure and land
- Reducing the variability in renewable power generation and achieving better grid stability

Key features

- Integration of wind and solar energy sources at AC or DC level.
- **Rated power capacity of one resource to be at least 25 per cent** of the rated power capacity of other resource
- Power from new hybrid plants or hybridized existing power plants may be used for:
 - (a) Captive purpose;
 - (b) Sale to third party through open access;
 - (c) Sale to DISCOMs at tariff determined by SERC/transparent competitive bidding
 - (d) Sale to DISCOMs at APPC under REC mechanism and avail RECs
- **Fulfilment of solar RPO & non-solar RPO** in proportion of rated capacity of solar and wind power from new hybrid projects

National Solar-Wind Hybrid Policy

Hybridization of existing wind/solar plants

- No additional transmission capacity charges to be levied if already granted transmission connectivity is being used
- Transmission charges applicable for additional transmission capacity granted as per existing regulations
- If **capacity margins available** at the receiving transmission sub-station, **additional transmission capacity allowed** subject to technical feasibility
 - **Any transmission augmentation** required up to the receiving transmission sub-station will be the **responsibility of project developer**

Battery Storage

- Policy permits use of battery storage in hybrid project for optimizing output and further reduce variability
- **Bidding parameters** for wind solar hybrid plants with battery storage may include **minimum firm power output throughout the day** or for defined hours during the day

Regulatory Requirements

- Policy mandates regulatory authorities (CEA/CERC) to **formulate necessary regulations** for wind-solar hybrid systems

Incentives

- All fiscal and financial incentives **available to wind and solar power projects** will also be made available to hybrid projects

Gujarat Solar-Wind Hybrid Policy (1/2)

Operative Period

- Policy to remain in operation for a period of five (5) years from date of issuance (20/June/2018)
- Incentives applicable for period of 25 years for projects established during operative period of policy

Projects

- **Type A** - Conversion of existing/under construction into Hybrid project
- **Type B** - New wind solar hybrid project for which evacuation permission not granted till date of issuance of policy
- The choice of capacity mix between wind and solar to be at the discretion of the Developer

Integration strategy

Existing project

- Only AC integration permitted
- AC output of both wind & solar shall be integrated at the pooling/of hybrid project

New projects

- **In the absence of common RPO and tariff**
 - ✓ Only AC integration permitted
 - ✓ Separate electrical lines to be laid for wind & solar till the pooling substation
- **In the presence of common RPO and tariff**
 - ✓ AC or DC integration shall be allowed
 - ✓ Common electrical lines may be used up to pooling substation of the hybrid project

Tariff for Sale to DISCOMs

- Sale and purchase of power from new hybrid capacity at tariff discovered through **competitive bidding**

- Purchase of power to be at tariff discovered through **competitive bidding separately for wind and solar** until a common tariff mechanism and RPO is evolved
- Once common hybrid tariff has been evolved, the DISCOM to conduct **reverse bidding on a single common hybrid tariff**

Gujarat Solar-Wind Hybrid Policy (2/2)

Metering

- Energy generation from wind/solar capacity shall be measured separately at the pooling substation on 15 minute time block to cater to separate RPOs
- For commercial settlement & energy accounting, metering shall be at the receiving end sub station

Energy Accounting

- Energy generated set off against consumption during consumer billing cycle
- Surplus energy purchased by Discom at APPC of the year of the commissioning of the project

Group Captive

- 100% of equity to be invested by captive users and to consume entire generation in the ratio of their equity amount invested with variation not exceeding 10%

Sale of power from Hybrid plants to Captive/3rd party (within state)

Parameter	Captive	Third Party
Transmission Charges & Losses	No concession	No concession
Wheeling Charges & Losses	50% concession	No concession
Cross Subsidy Surcharge (CSS)	No concession	50% concession
Additional Surcharge (AS)	No concession	50% concession
Electricity Duty	Exempted for 25 yrs	Exempted for 25 yrs
Contracted Demand	Up to 50% of Contract Demand	Up to 50% of Contract Demand
Wheeling for more than one location	Rs. 0.05/unit paid to Discom	

Restriction

Second hand WTG's / Solar modules not be eligible under this policy

AP Solar-Wind Hybrid Policy

Objective

- To provide framework of promotion of large grid-connected solar-wind hybrid system for optimal and efficient utilization of transmission infrastructure and land, reducing variability in RE generation , achieving better grid stability
- Target to achieve 5000 MW hybrid capacity at desired CUF

Operative Period

- Policy applicable for 5 years from date of issuance and/or until new policy is issued or this policy is withdrawn
- Incentives to commissioned projects shall remain applicable for a period of 10 years

Key Features

- Minimum 40% CUF to be achieved from each 1 MW solar wind hybrid system
- The hybrid power generated may be used for a) captive purpose; b) sale to third party through open access; c) sale to DisCom either at project specific tariff determined by APERC or at tariff discovered through transparent bidding process or at APPC under REC mechanism and avail RECs
- Power procured may be used for fulfilment of solar and non-solar RPO

Energy banking & Drawal

- 100% banking of energy permitted throughout the year based on feasibility and prior approval of APTRANSCO/ APDISCOMs
- Banking adjusted in kind @5% of energy delivered at point of drawal
- Banking year shall be from April to March; Energy settlement shall be done on monthly basis
- The unutilized banked energy shall be considered as deemed purchase by Discoms at 75% of the APPC as determined by the APERC for the applicable year.
- The payment for deemed purchase of un-utilized banked energy shall be capped to 10% of total banked energy during the applicable year.

AP Solar-Wind Hybrid Policy

Nodal Agency

- NREDCAP designated as the nodal agency for this policy implementation
- For Regulatory Requirements:
 - ❑ The APERC, CEA, CERC shall formulate necessary standards and regulations including metering, methodology and standards, forecasting and scheduling regulations, REC mechanism, grant of connectivity and sharing of transmission line, etc.

Incentives to developers

- Following incentives are applicable:
- **Transmission and Distribution** charges exempted upto 50% of applicable charges for wheeling of power generated from these Projects within the State; no transmission charges for connectivity to the nearest CTU via STU network
- 50% of applicable **Electricity duty** shall be exempted for captive consumption, sale to DISCOMs and third party sale provided the source of power is from wind - solar hybrid power projects set up within the State.
- 50% of **Cross subsidy surcharge** shall be paid for third party sale provided the source of power is from these Projects setup within the State.
- **Supervision Charges** to APTranco/ DisCom in case of transmission of power from STU to CTU shall be exempted
- Generation of electricity from these projects shall be treated as **eligible industry** under the schemes administered by the Industries Department and applicable incentives shall be available to the Wind solar power producers subject to the payments from the Energy Department.
- **Deemed Public-Private Partnership Status, Deemed Non-Agricultural status for land** shall be provided
- “**MUST RUN**” status provided and shall not be subjected to ‘**Merit Order Dispatch** principles’
- **Single Window Clearance** applicable

Current status of solar-wind hybrid tenders

- SECI announced the **first Solar-Wind Hybrid tender (Tranche-I) in December 2018** for a **2500 MW** capacity, which was later reduced to **1200 MW**
- The tender was undersubscribed by **150 MW**, of which **80% was allotted**. The results of the same are :

Agency	Capacity Won (MW)	Tariff		Ceiling Tariff (Rs./kWh)
		Tariff (Rs./kWh)	Tariff (\$/kWh)	
Soft Bank (SB Energy)	450 MW	2.67	0.0379	2.70
Adani	390 MW (Initially 600 MW)	2.69	0.0382	

- In the second phase, SECI has announced bidding for another **1200 MW ISTS-connected Solar-Wind Hybrid Power Projects (Tranche II)**, bidding for the same is still awaited!!

Key Policy & Regulatory measures to incentivize solar wind hybrid

- Formulation of regulations and technical standards by CEA and CERC for solar-wind hybrid
- Concessionary open access charges as an initial promotional measure to incentivise development of solar wind hybrids
- Allowing banking of energy from solar-wind hybrid plants
- Allowing battery storage technologies as a part of solar wind hybrid
- Allowing existing wind or solar projects to convert to solar-wind hybrid projects
- Development of common RPO mechanism that allows obligated entities to claim fulfilment of solar RPO and non-solar RPO from solar-wind hybrid plants in the ratio of installed capacity of solar and wind energy
- Development of common tariff mechanism for solar wind hybrid plants

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