



India Energy Storage Opportunities

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President, India Energy Storage Alliance

Chair, Global Energy Storage Alliance

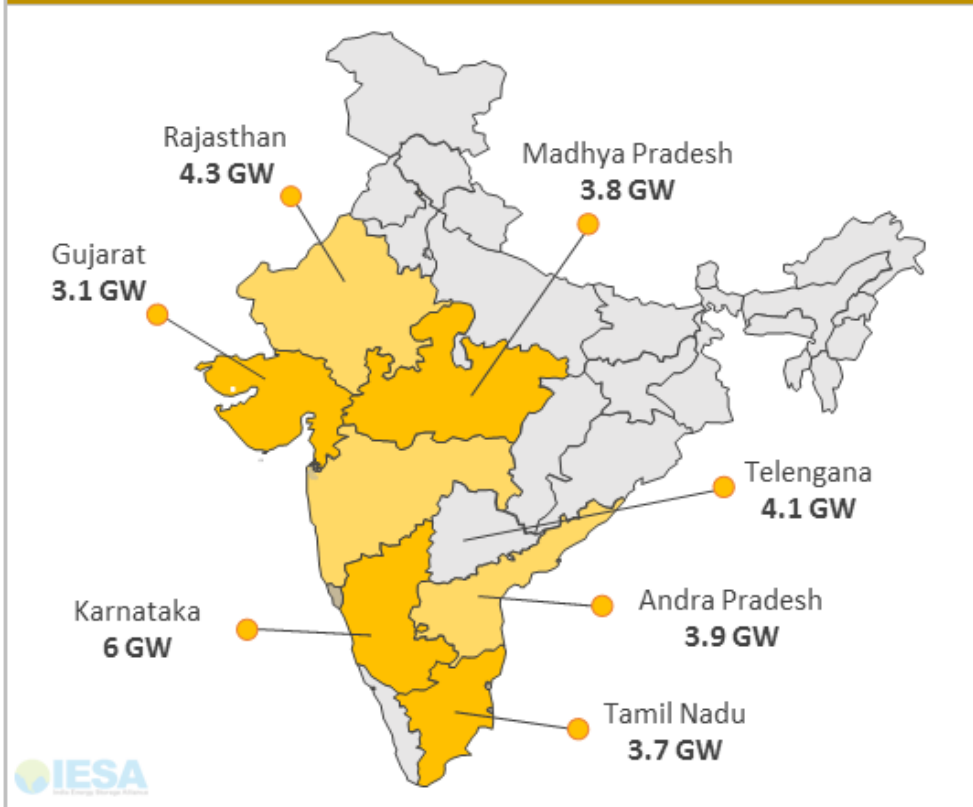
President & MD, Customized Energy Solutions (India)



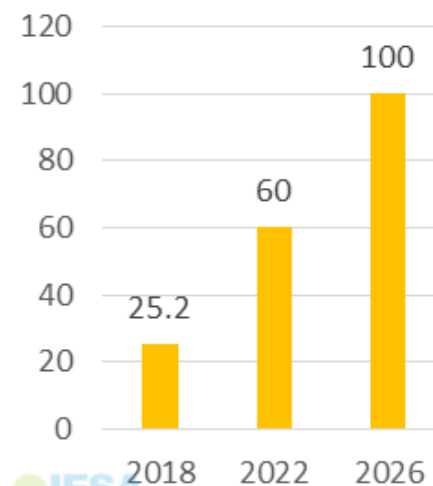
GRID-SCALE SOLAR POWER CAPACITY PROJECTION

Top Grid-Scale Solar Power Generating States, India, 2019

Total Installed capacity 33 GW

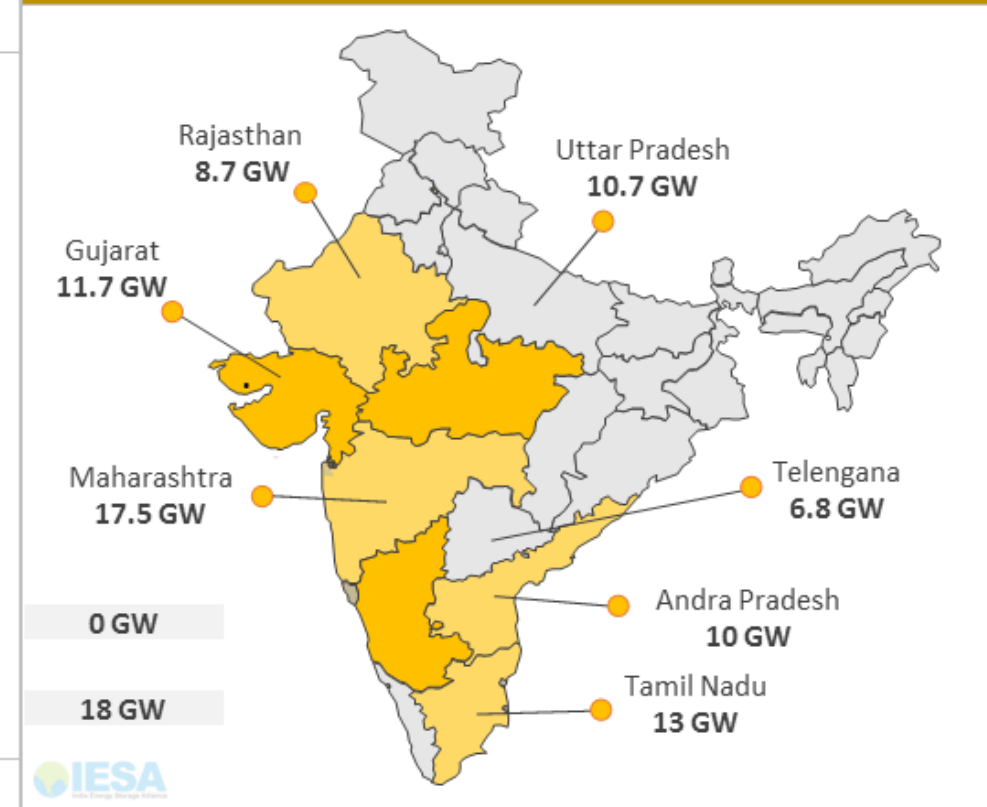


India Cumulative Grid-Scale Solar Addition, 2018-2026



Top Grid-Scale Solar Power Generating States, India, 2026

Total Installed capacity 100 GW

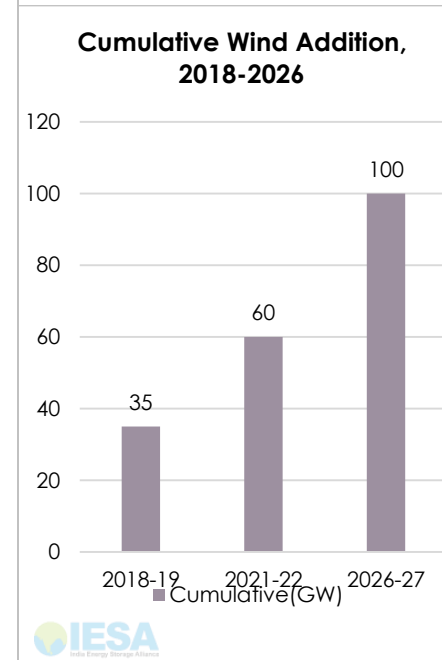
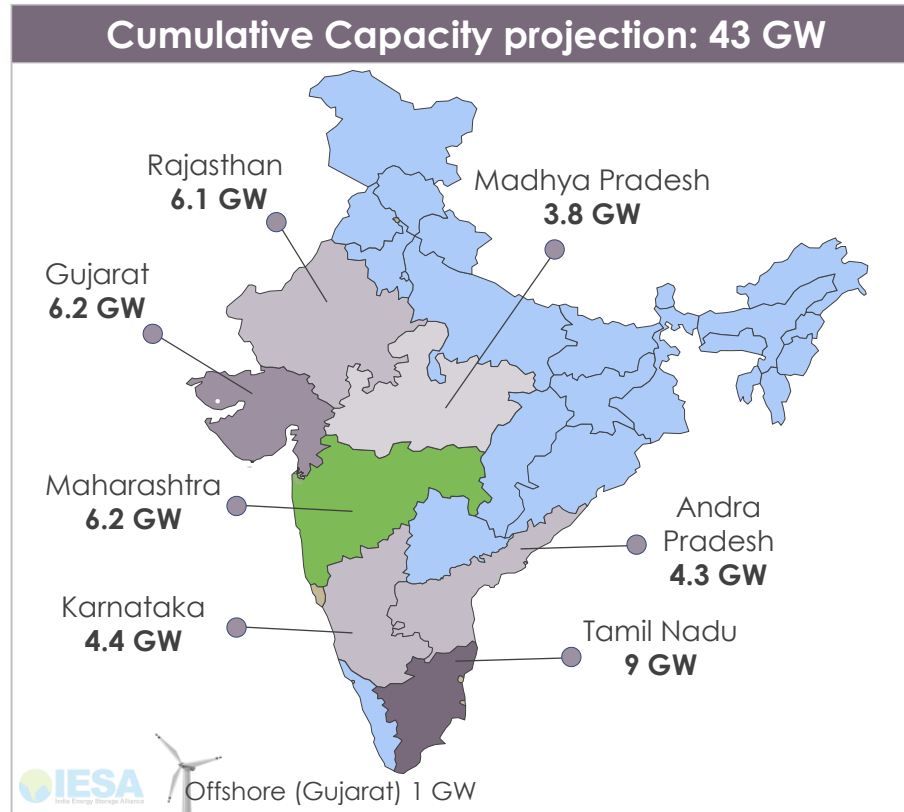


In 2018, 6.6 GW of Grid-Scale solar projects were added to the grid. However, it was lesser than what was anticipated and additions were lower than that of 2017. 40GW of tenders were floated in 2018 and nearly 12 GW were cancelled due to high tariffs quoted by the developers. During 2019 and 2020 nearly 10 GW of tenders are to be floated according to MNRE.

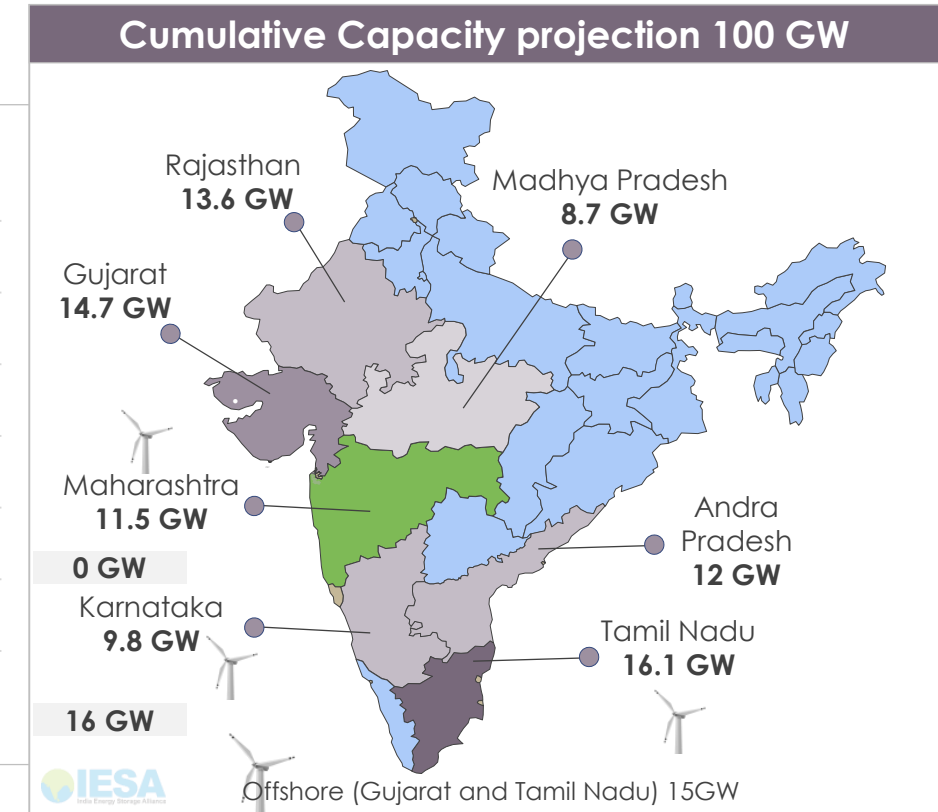
* Source: MNRE/Gol, 19th EPS, CES Analysis Dec, 2018

WIND CAPACITY PROJECTION 2019 AND 2026

Top wind power generating States, India, 2019

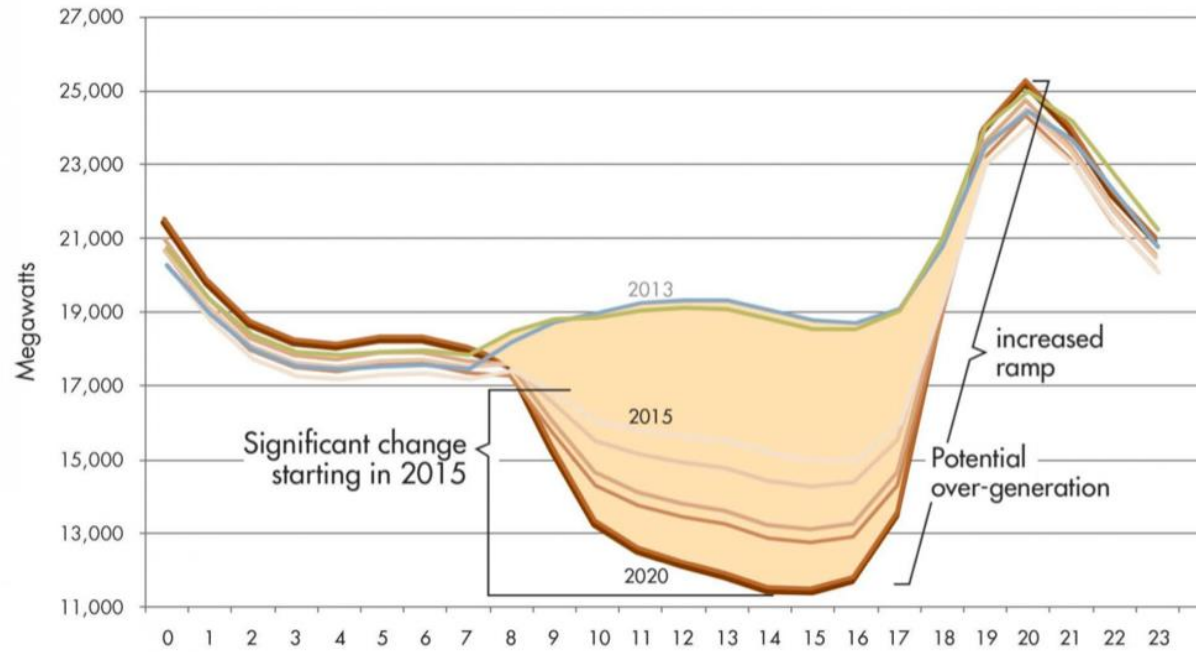


Top Wind power generating States, India , 2026

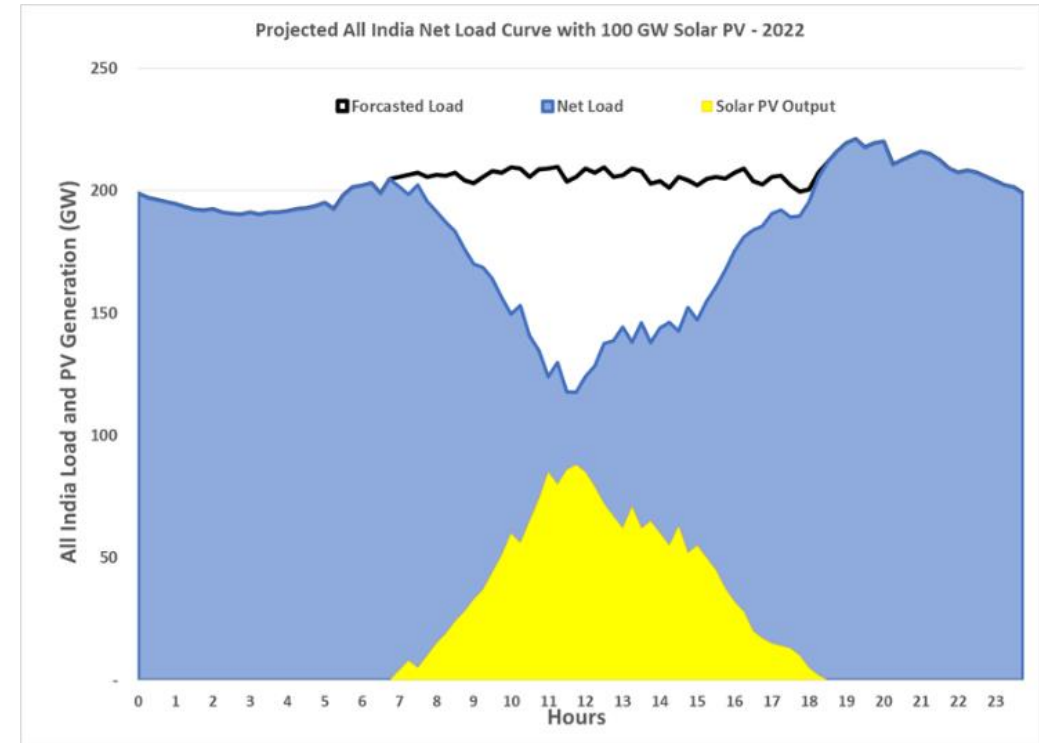


In 2018 MNRE announced tenders for nearly 6.9 GW, of which 1.2 GW was cancelled. During 2019 and 2020, nearly 10 GW of Wind projects will be tendered as per MNRE. Going forward, it is assumed that at least 8GW of wind tenders will be released annually till 2026 to achieve country's 2026 target of 100GW of wind power. MNRE announced EOI for developers interested in offshore wind energy projects. In 2019, total wind power projects opening for tender will be 10 GW of which offshore projects contribute to 1 GW.

A need for flexible generation with growing solar penetration



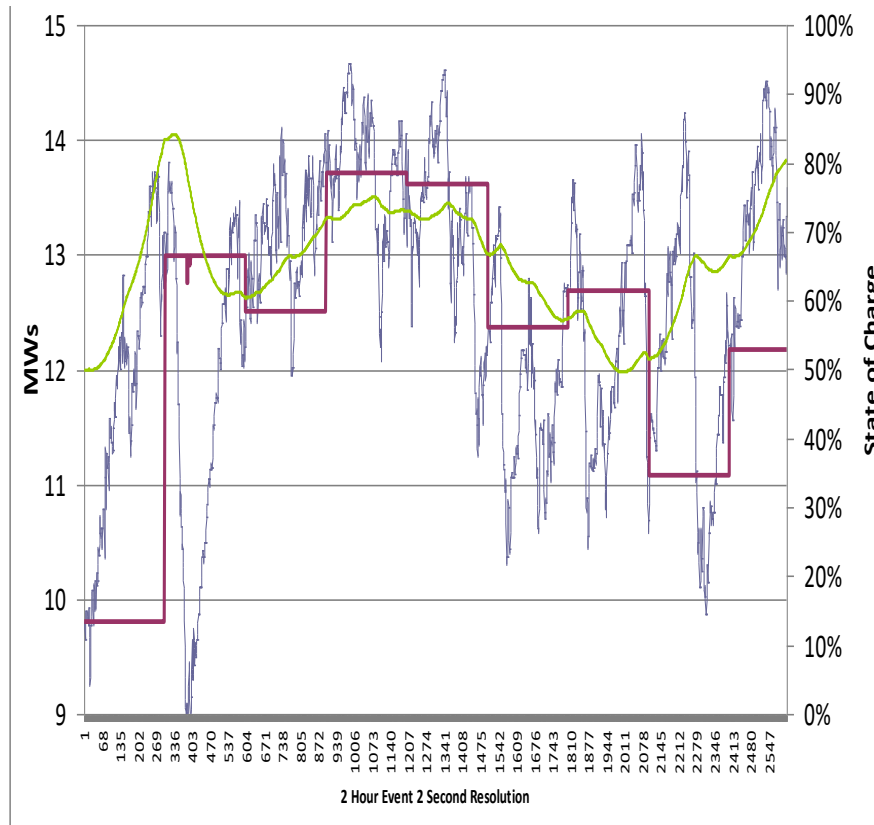
Original California Duck Curve (2020)



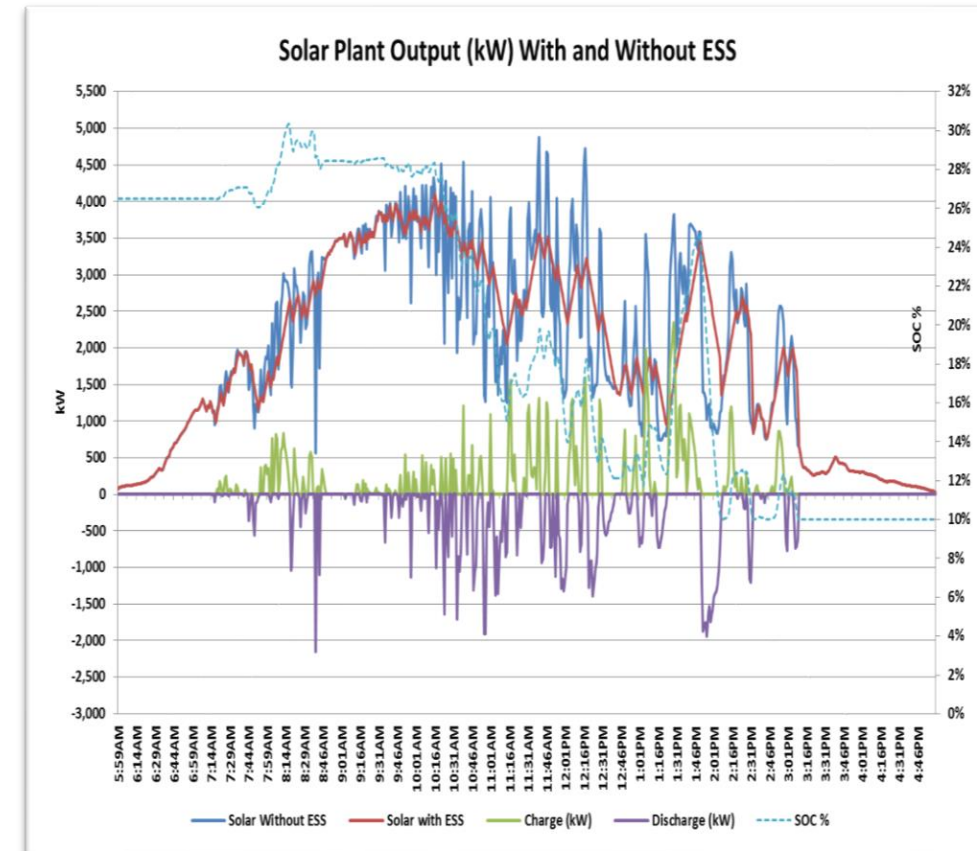
Anticipated India Camel Curve (2022) with 100 GW solar

Energy Storage :

Renewable Smoothing & Scheduling and Ramp Rate Control



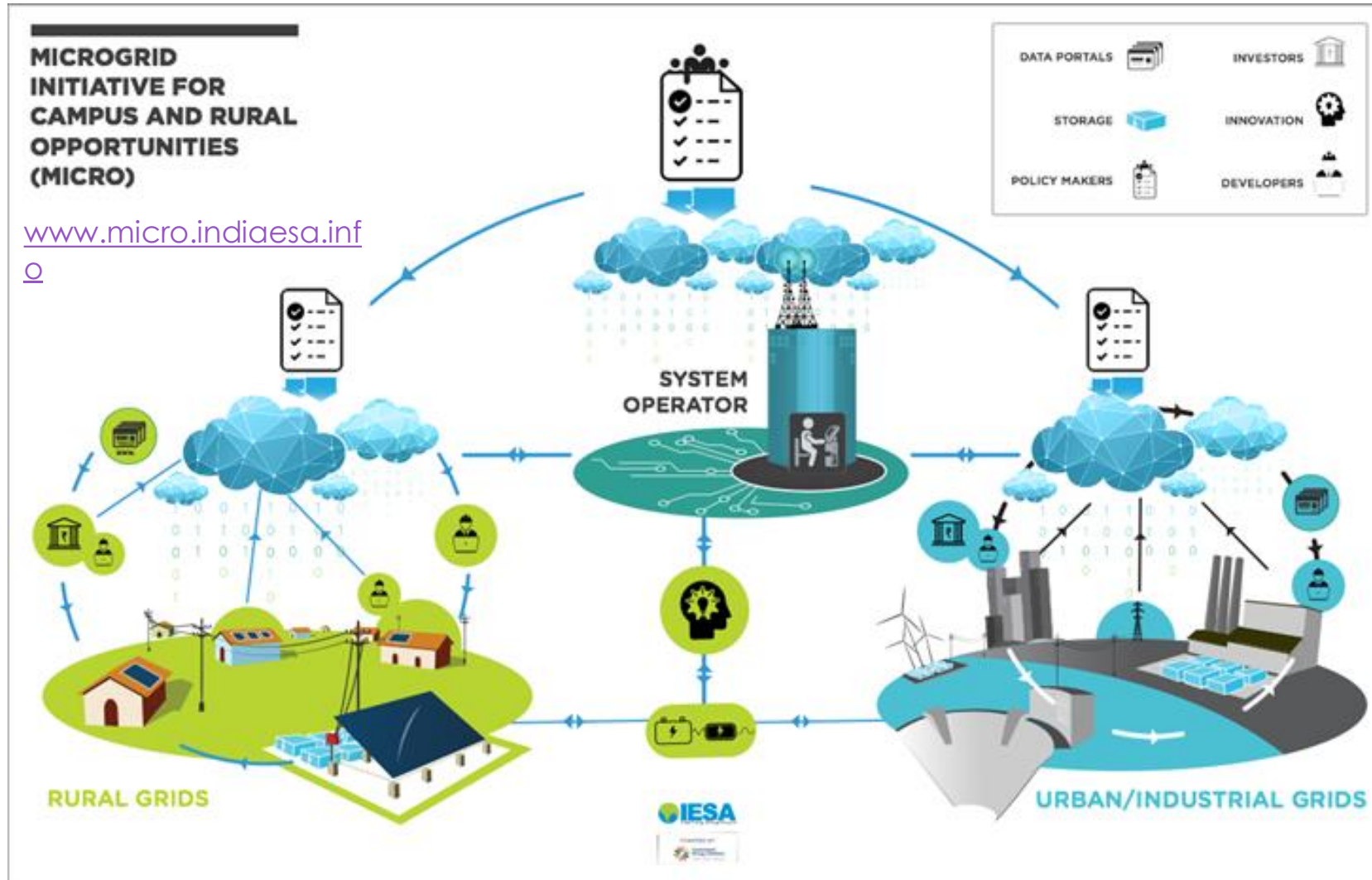
Potential smoothing of 18 MW wind farm with a 4 MW – 1 MWh ESS to help with forecasting errors under Deviation Settlement Mechanism



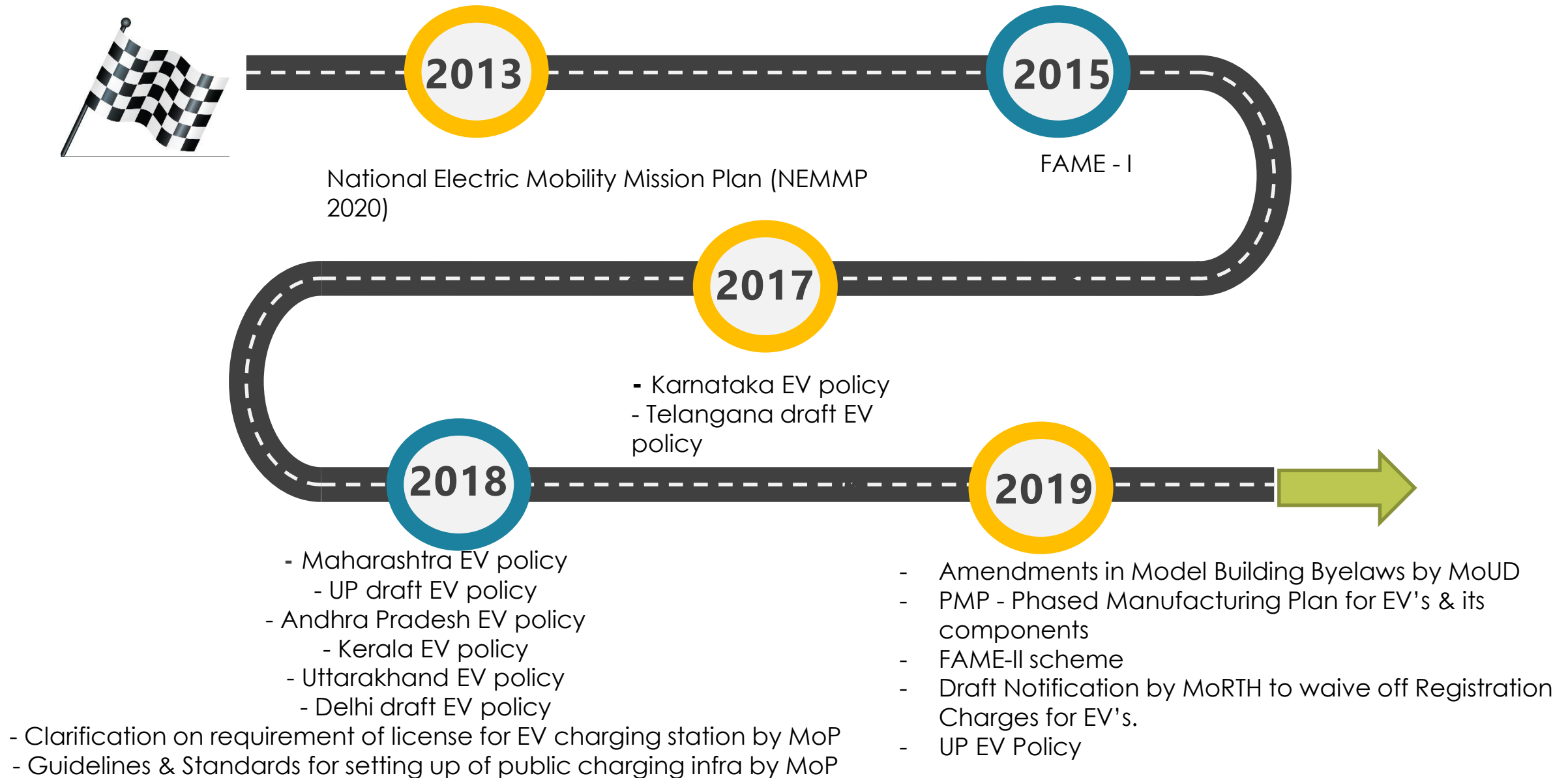
Potential smoothing of 5 MW solar farm with a 2 MW – 1 MWh ESS to help with ramp rate control in island grid

Microgrid Initiative for Campus & Rural Opportunities (MICRO)

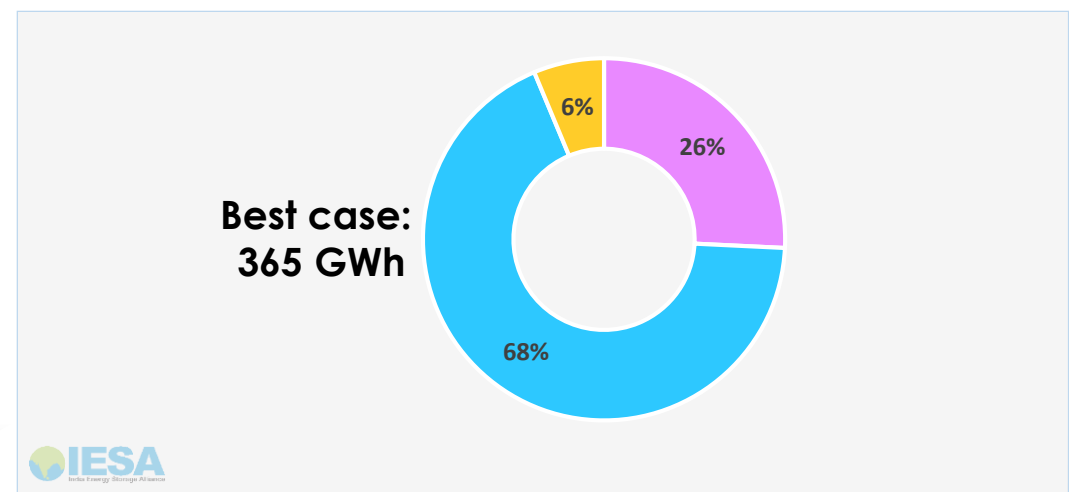
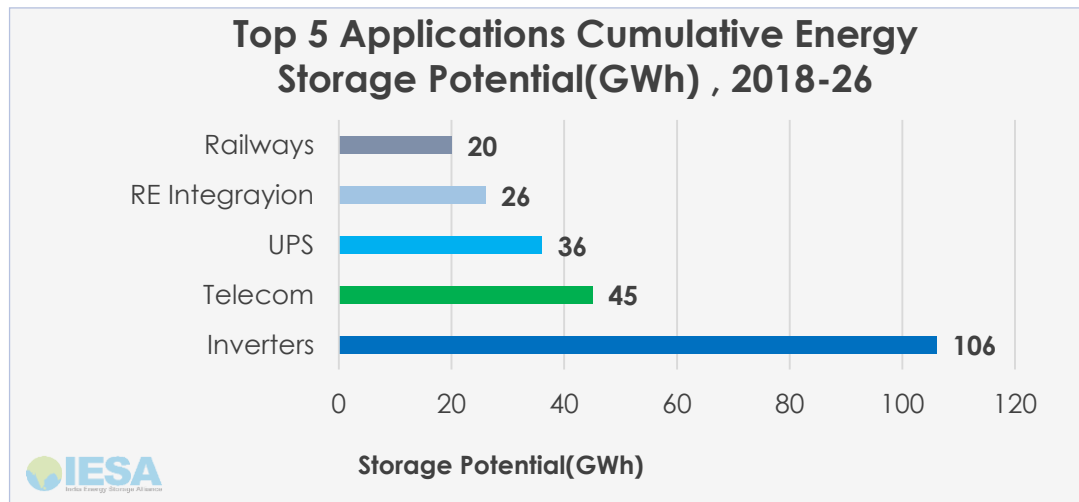
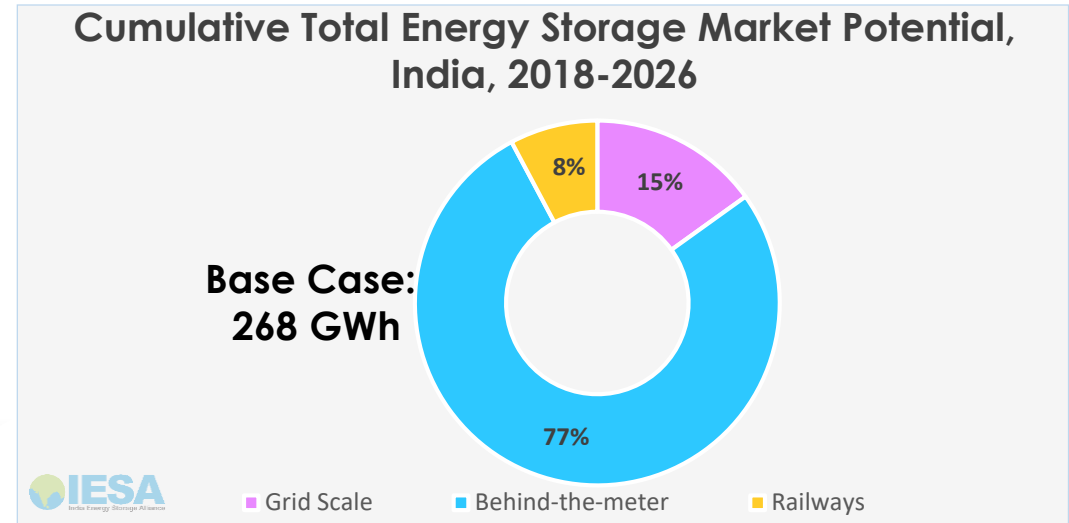
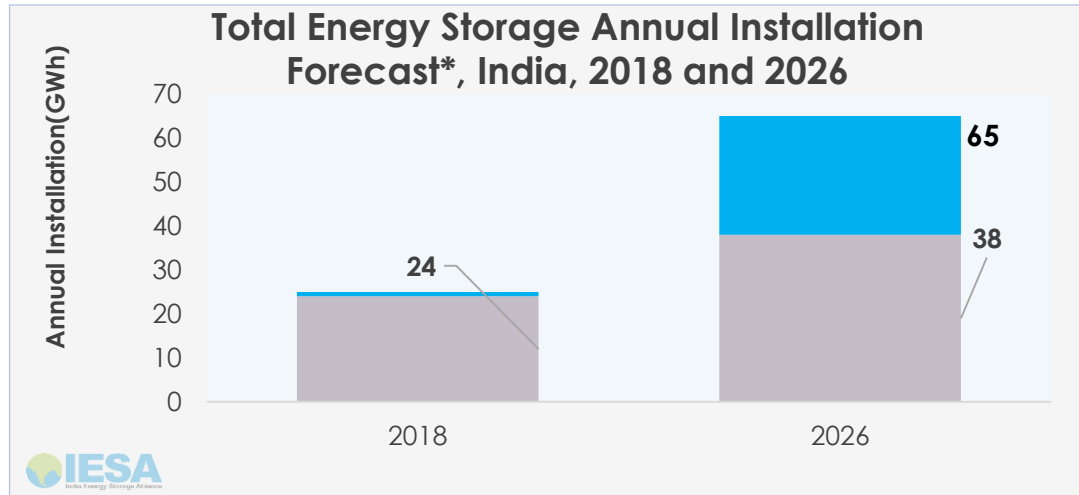
Campus Microgrids and Smart Cities



Developing EV Policy Scenario in India



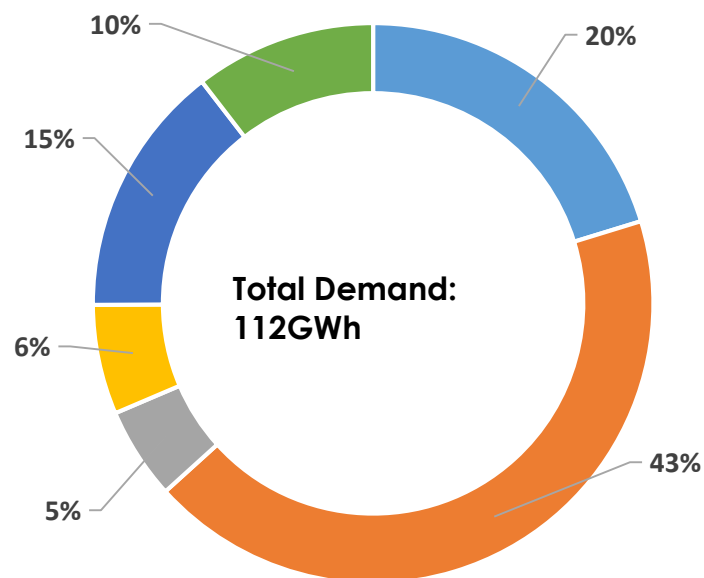
STATIONARY ENERGY STORAGE MARKET 2018 - 2026



Battery Market Outlook for EV's in India

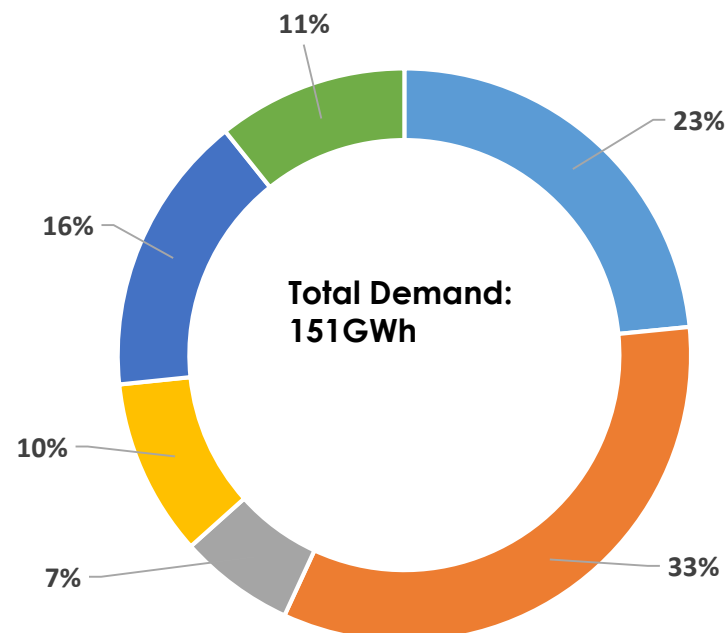
The battery market for EV's in India is expected to grow at a CAGR of 25% over a period of 2018-2026 in case of BAU scenario whereas in case of NEV scenario, it is expected to grow at a CAGR of 32%.

BAU Scenario, Battery Demand, 2018-26



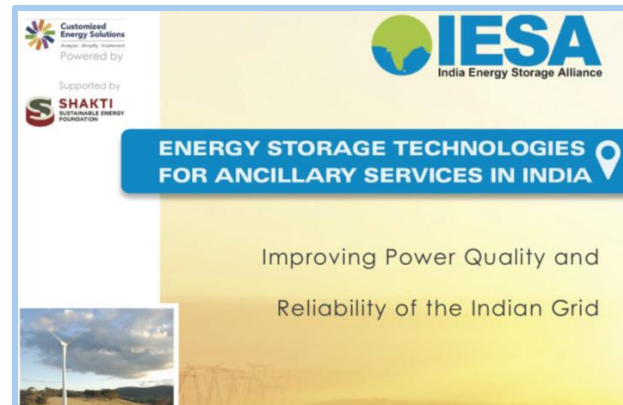
■ E2W ■ Low Speed E3W ■ High Speed E3W (L5M)
■ E4W (Personal) ■ E4W(Fleet) ■ E-Buses

NEV Scenario, Battery Demand, 2018-26



■ E2W ■ Low Speed E3W ■ High Speed E3W (L5M) ■ E4W (Personal) ■ E4W(Fleet) ■ E-Buses

The evolving policy framework for adoption of Energy Storage in India



MOP and CEA taskforce
on Integration of Large
Scale renewables in India
2013

Creation of MNRE
Standing Committee on
Energy Storage to
develop Energy Storage
Roadmap
2014

IESA releases report on
the role of energy
storage for providing
ancillary services in India
Dec 2014

CERC issues Ancillary
Services Operations
Regulation (August 2015)
and Roadmap to
operationalise Reserves
in the country (Oct 2015)

CERC Staff Paper on ESS-
Jan 2017

National Energy Storage
Mission and National
Mission for Transformative
Mobility
2019



October 2012



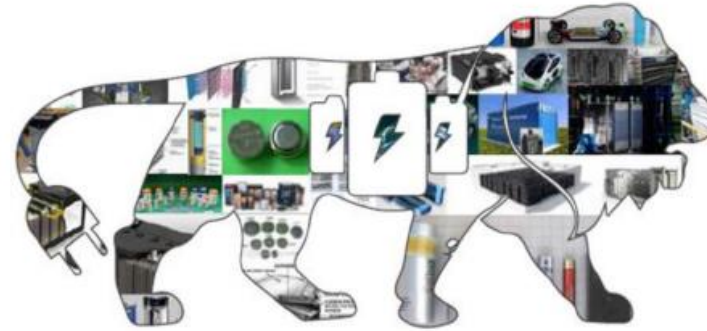
December 2014

Energy storage need of the hour: Hon. Prime Minister Modi, 2nd Oct 2018



Inaugurating the first assembly of International Solar Alliance, Prime Minister Narendra Modi said **“Under the National Energy Storage mission, the government is focusing on demand creation, indigenous manufacturing, innovation and energy storage,”**

Why Domestic 'Giga'-Scale Battery Manufacturing is Critical for India?



MAKE IN INDIA

(Emphasis on Value Capture & Economy of Scale)

GLOBAL COMPETITIVENESS

(Global Policy Benchmarking)

STRATEGIC REASONS

(Energy Security)



ENVIRONMENT SUSTAINABILITY

(Negligible Emission)

YoY DEMAND NUMBER OF GIGA (10GWh) STORAGE PLANTS IN INDIA		
Scenario	2025	2030
Conservative Scenario	5	11
Base Scenario	8	23

YOUR GATEWAY TO
**ENERGY STORAGE
& EV MARKETS**



LEADERSHIP
COUNCIL



IESA MEMBERS



32



18



12



17



06



04

LEADERSHIP CIRCLE	
 Customized Energy Solutions Analyze · Simplify · Implement	 Exicom
 INNOLITH	 SB Energy SoftBank Group
GOLD	
 AMARA RAJA The high-technology battery manufacturer	 AMCO SOFT
 APPLIED MATERIALS	 BOSCH
 CLP INDIA The power of new standards	 CUMMINS
 EATON	 Fortum
 Himadri	 STATCON ENERGIAA
 GE	 AICL
 STERLING & WILSON	 OKAYA Chatt Raha Yeh Zindagi
 SUJATA	 RENEW TRANSFORMING ENERGY
 SECI SUN FOR EVER	 vikram solar
 WARTSILA	 HERO FUTURE ENERGIES planet positive power
 Bry-Air	 infineon
 AVAADA	 mi solar
 NantEnergy FLUIDIC ENERGY	 Parker
 SWELECT ENERGY SYSTEMS LTD	 SunSource ENERGY SOLAR FROM THE CORE
 MathWorks	 NEC NEC ENERGY SOLUTIONS
SILVER	
 ATHER	 ACS=FN
 AutoGrid	 BOUNCE
 COSLIGHT	 ecoult energy storage solutions
 EUCLION	 future LINKUM TECHNOLOGY
 GENSOL	 GALLO ENERGY
 GREENFUEL	 i-EM Innovative Energy Management
 GRINTECH	 LI ENERGY
 PLUSS TECHNOLOGY FOR A BETTER WORLD	 R CUBE Global Energy System
 SEMCO GROUP	 SUMITOMO ELECTRIC
 SUN GROUP	 SUN SHOT
 SLE	 SHREENATH SMART TECHNOLOGIES PVT. LTD.
 QUANZEN	 Vision Mechatronics
 6energy	 FLOW TECH
 QUANTUM ENERGY SOLUTIONS	 XNRGI
 Twarit Mobility	 VNT
 NAVITAS	 HERO FUTURE ENERGIES
BRONZE	
SPECIAL MEMBERSHIP	
 adani Electricity	 ARAI Progress through Research
 BSES BSES Rajdhani Power Limited	 BSES Yamuna Power Limited
 KARPAGAM	 TATAPOWER-DDL
 Savitribai Phule Pune University	 Veermata Jijabai Technological Institute (VJTI Mumbai)



90+ MEMBERS



LEADERSHIP
COUNCIL



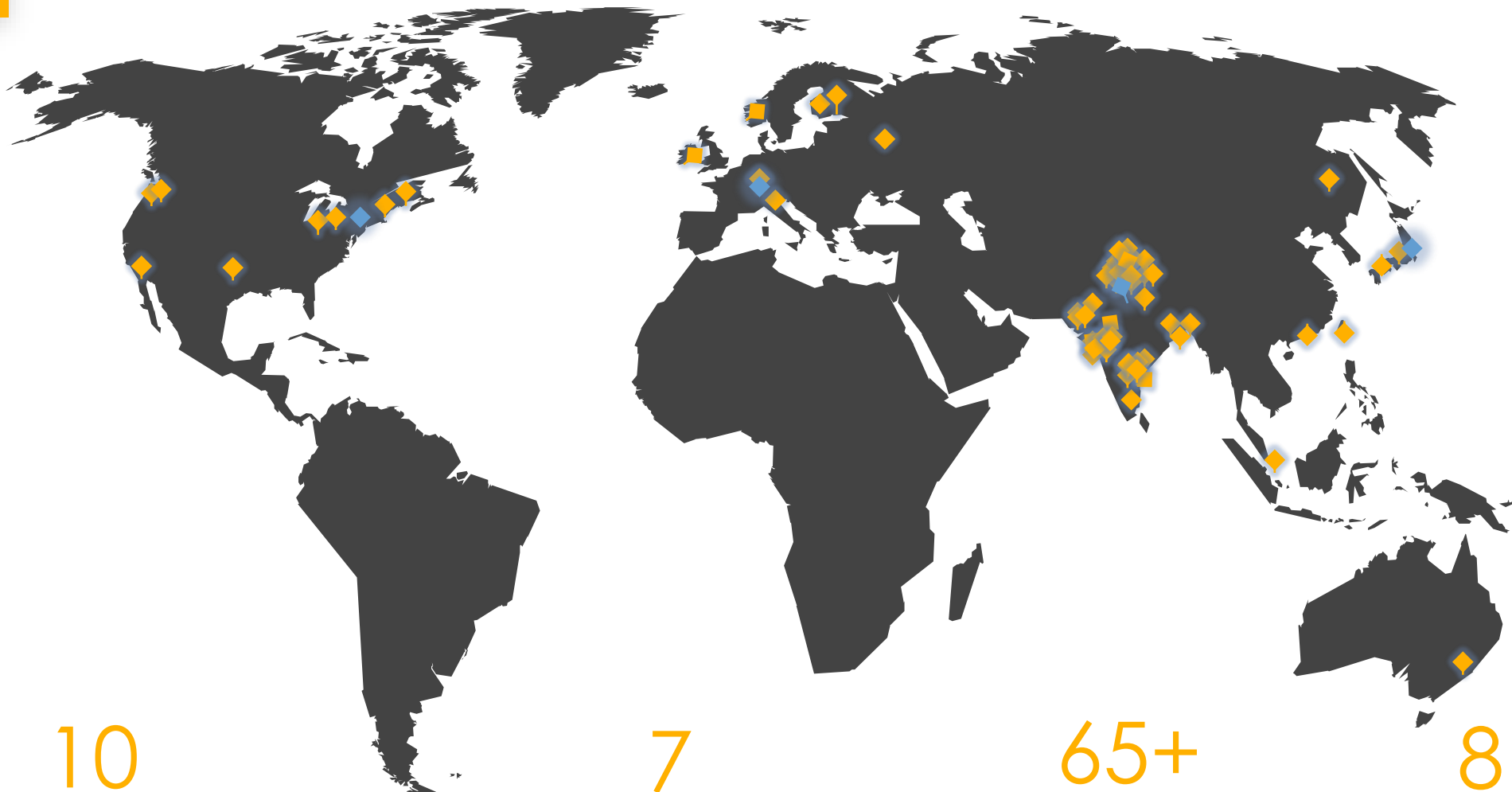
Customized
Energy Solutions



SB Energy
SoftBank Group



INNOLITH



10



7



65+



8

APAC &
OCEANIA

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