Energy Storage in South Asia: Regulatory, Technical, and Economic Considerations – *Setting the Context*

Pankaj Batra
Project Director, SARI/EI program, IRADe
& Ex-Chairperson, CEA

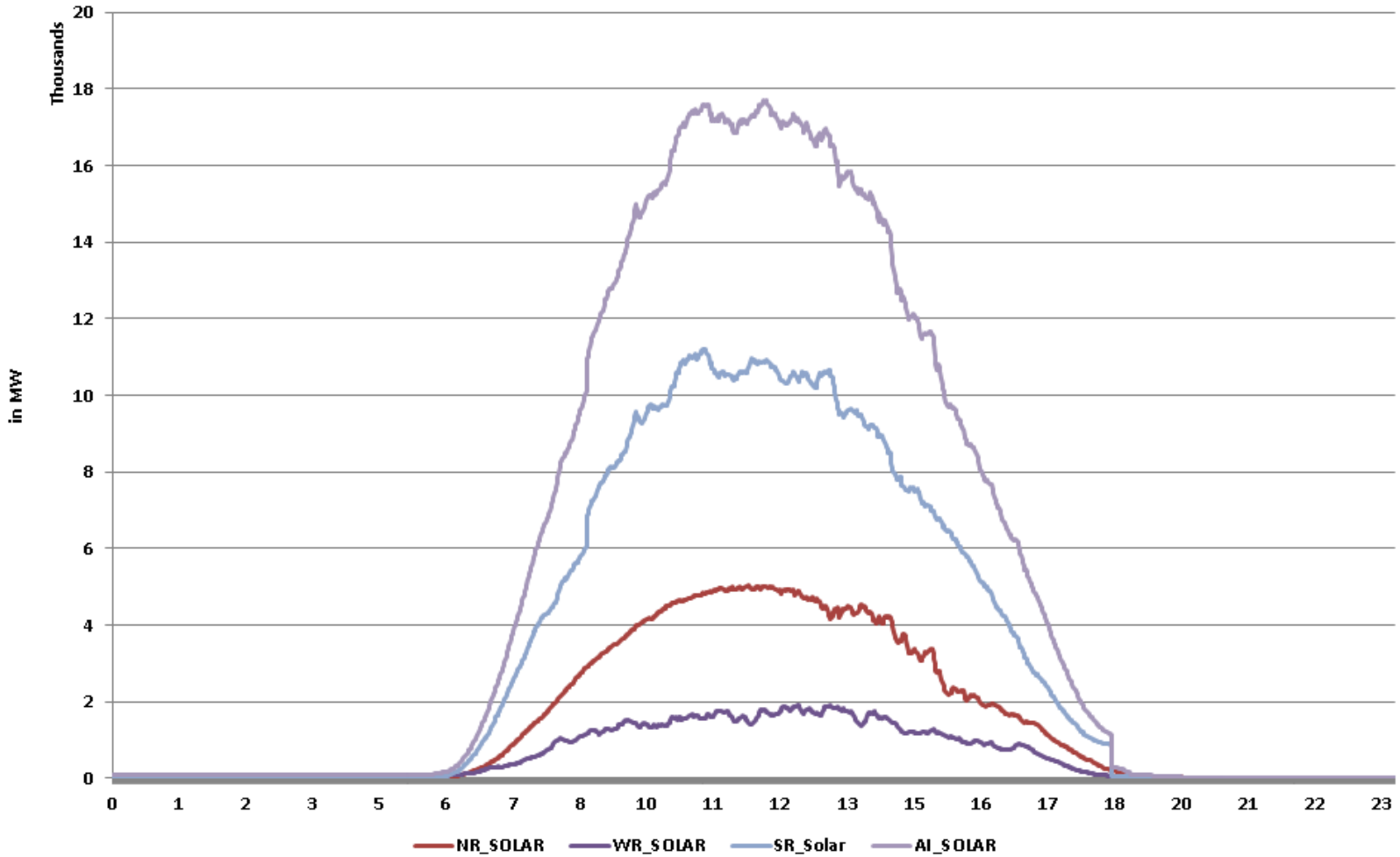
USAID FROM THE AMERICAN PEOPLE

SARI/EI

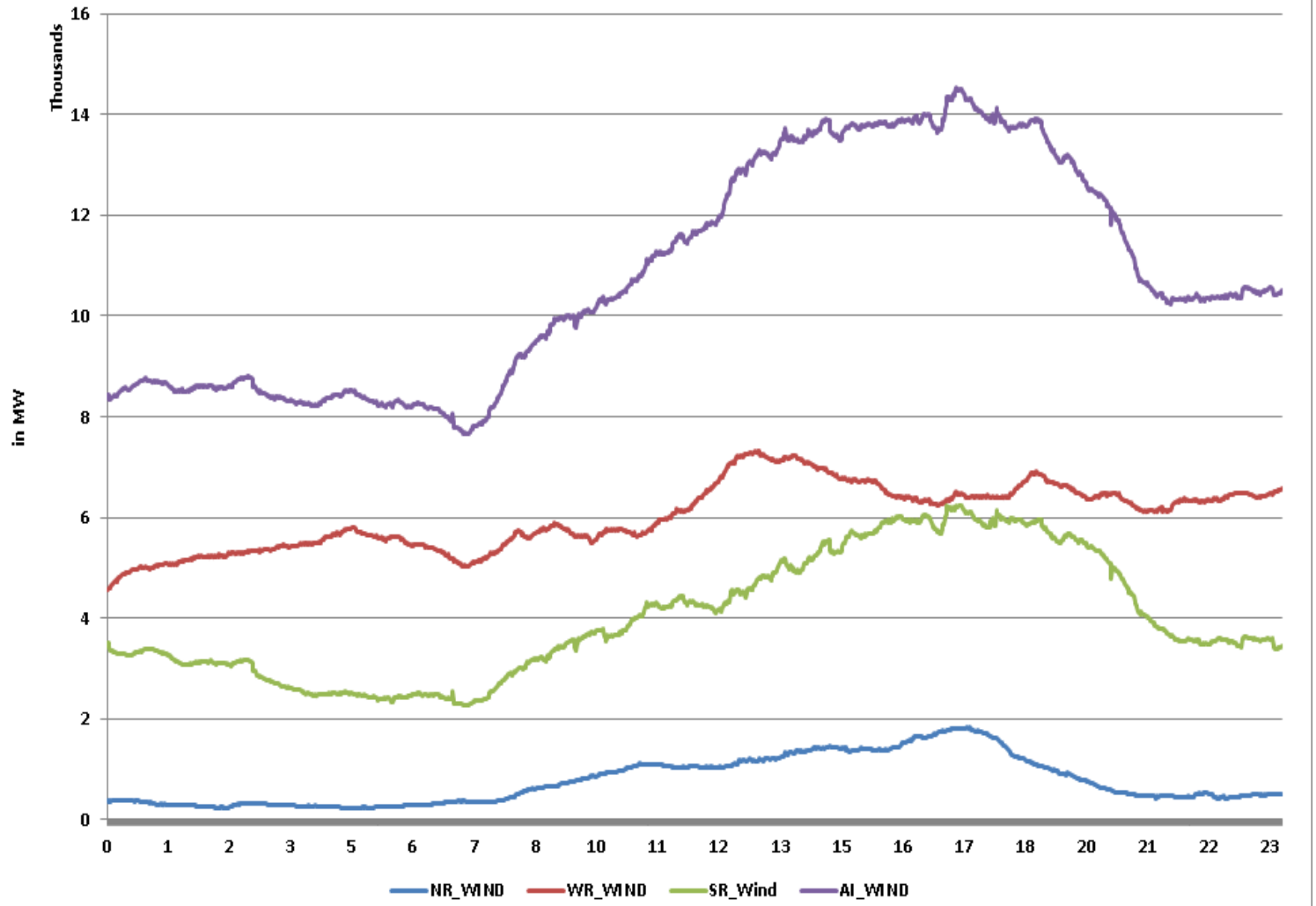
IRADe Integrated Research and Action for Development

NREL NATIONAL RENEWABLE ENERGY LABORATORY

All India and Regional SOLAR Generation



All India and Regional WIND Generation

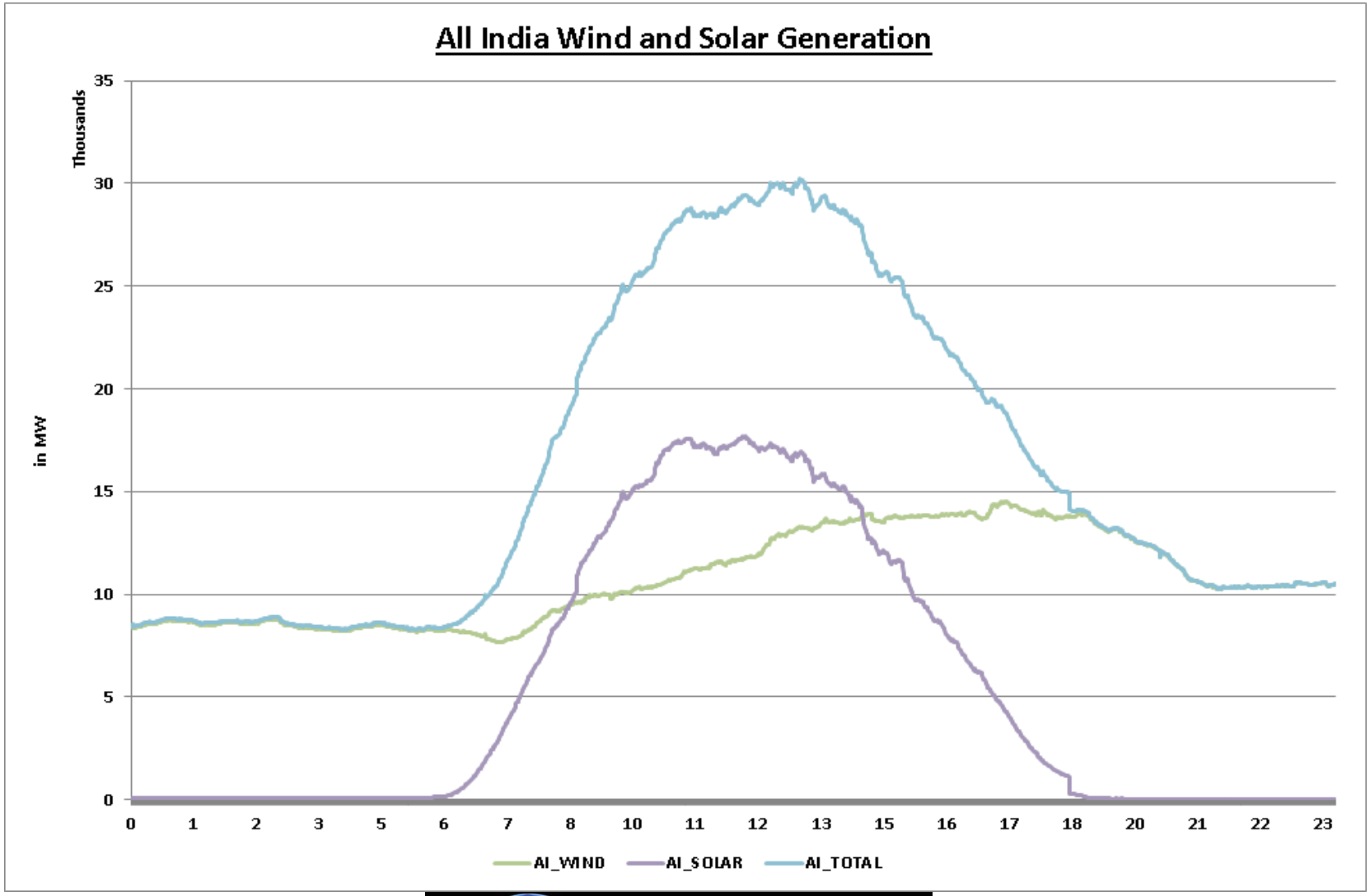


USAID FROM THE AMERICAN PEOPLE

SARI/EI

Integrated Research and Action for Development

NREL NATIONAL RENEWABLE ENERGY LABORATORY



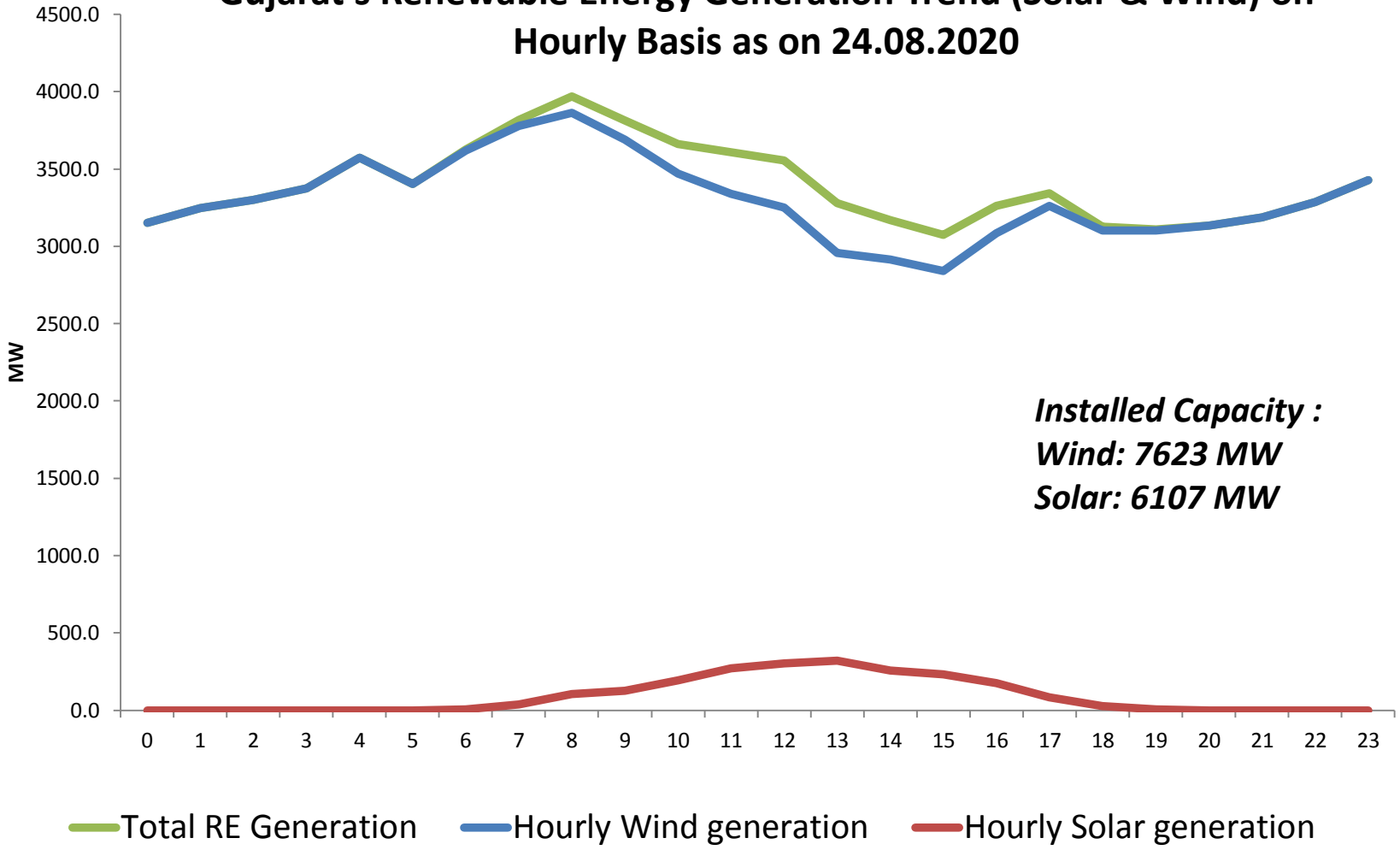
USAID FROM THE AMERICAN PEOPLE

SARI/EI

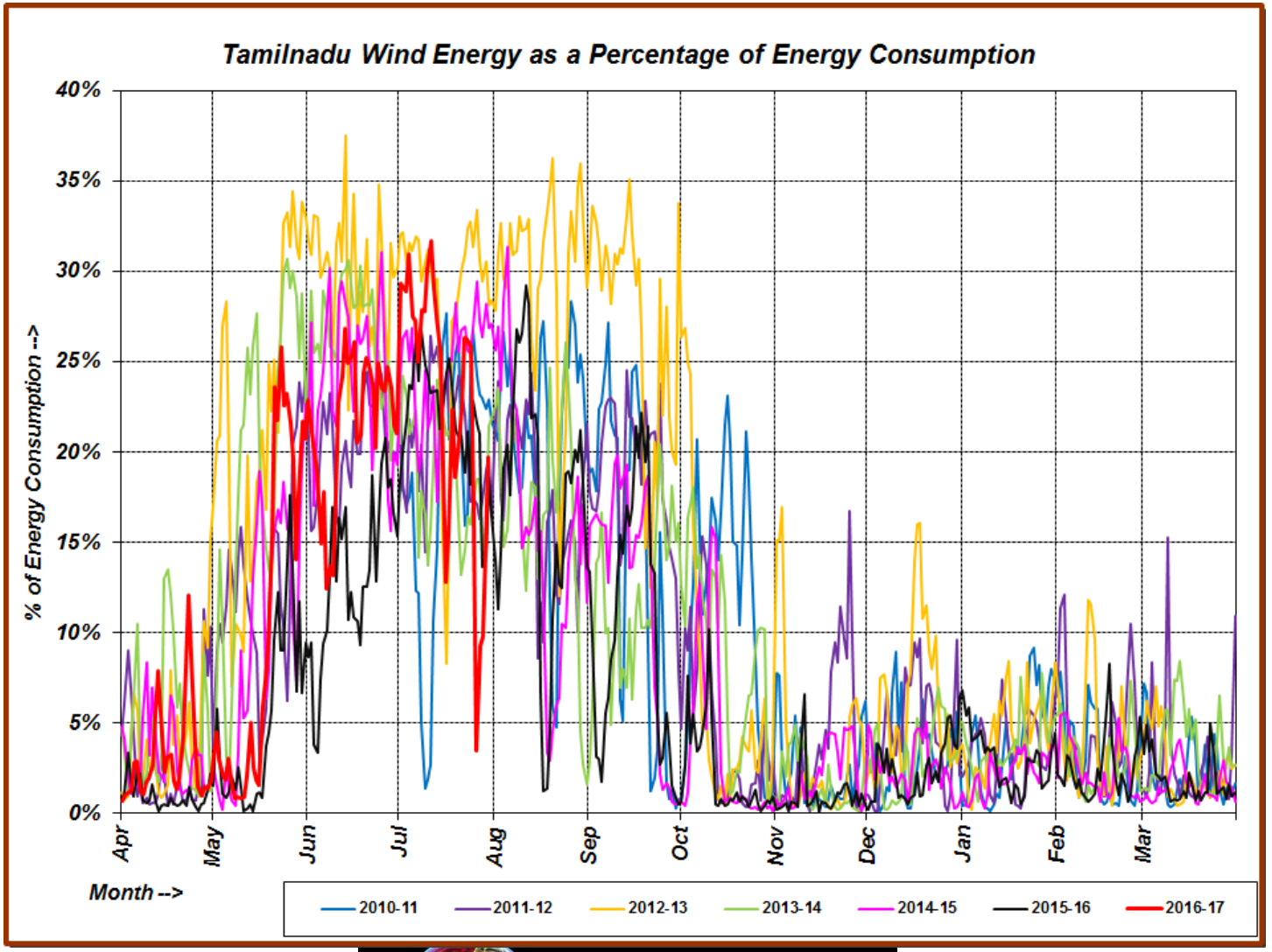
Integrated Research and Action for Development

NREL

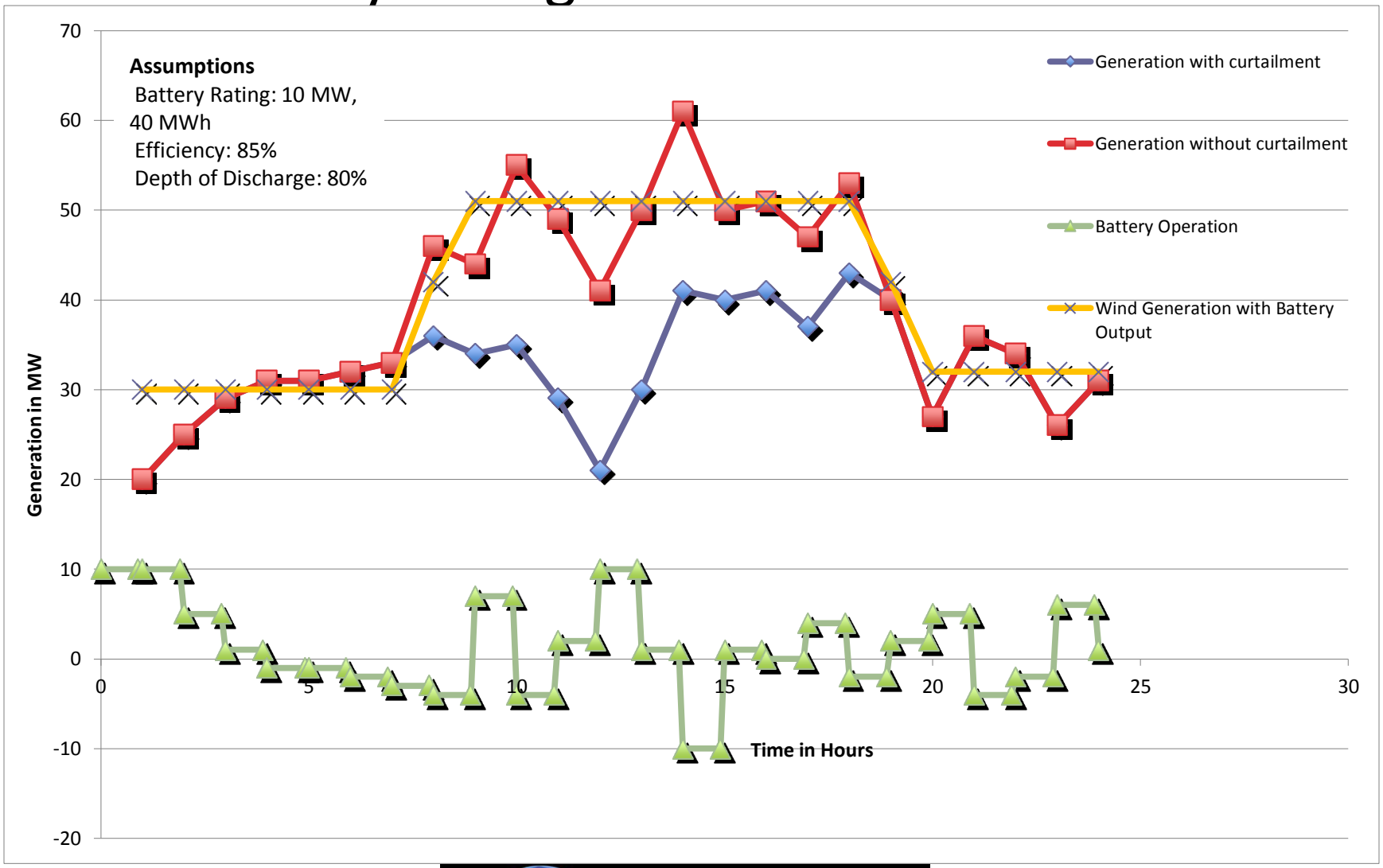
Gujarat's Renewable Energy Generation Trend (Solar & Wind) on Hourly Basis as on 24.08.2020



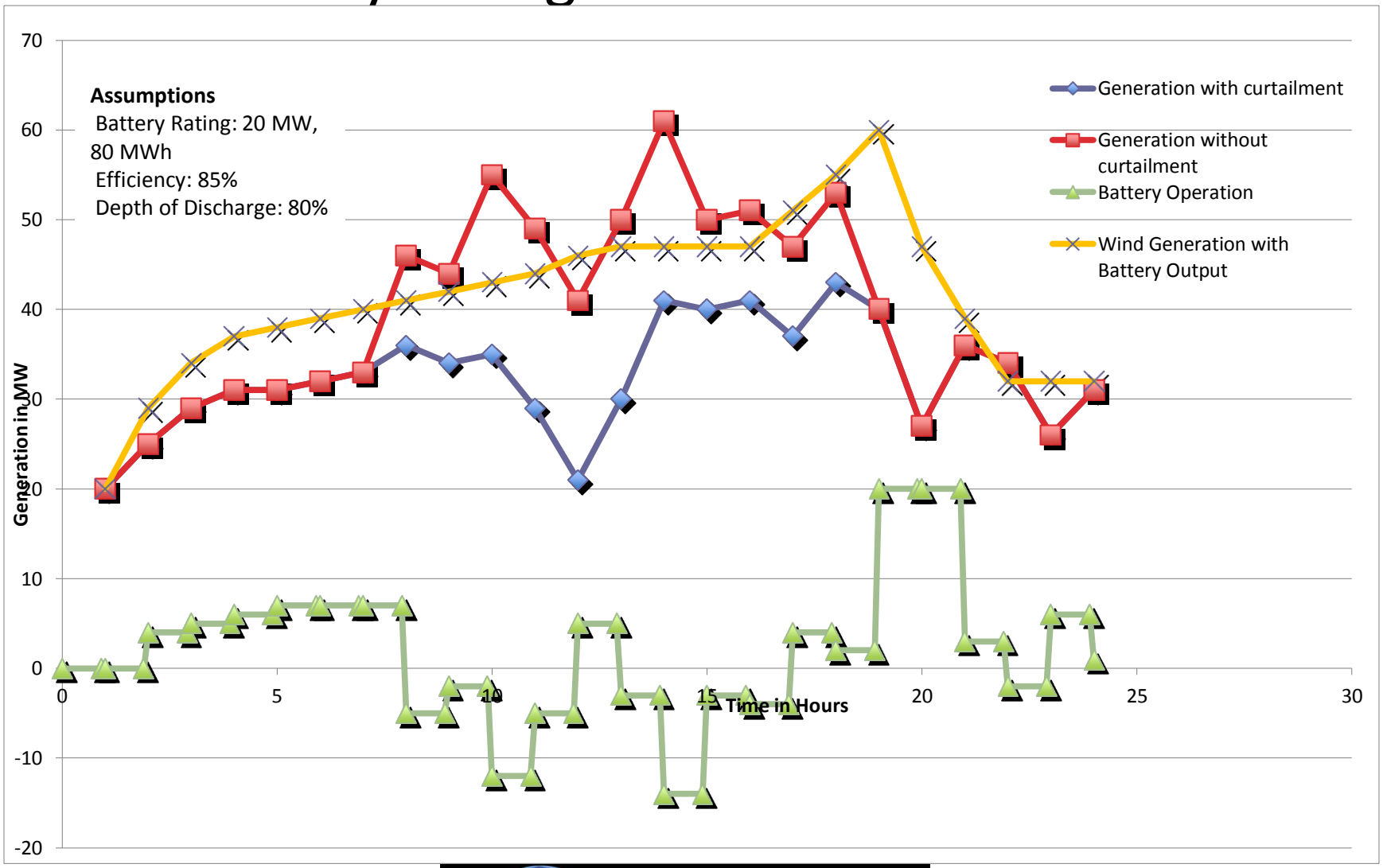
Seasonal variation of wind generation in Tamil Nadu



Use of battery storage in wind farm in Tamil Nadu



Use of battery storage in wind farm in Tamil Nadu



Enhanced Frequency Response (EFR) bid out in UK in 2016

- Battery storage has dominated the outcome of the National Grid's 200MW Enhanced Frequency Response (EFR) tender, with the technology to be used for balancing services at grid scale for the first time in the UK.
- The majority of the bids were for battery assets and of the 64 unique sites taking part, 61 are for this technology, while just two are for demand reduction and one from thermal generation.

Enhanced Frequency Response (EFR)

- The winning tenders were awarded to:
- EDF Energy Renewables (40MW)
- Vattenfall (22MW)
- Low Carbon - two projects (10MW & 40MW)
- E.ON UK (10MW)
- Element Power (25MW)
- RES (35MW)
- Belectric (10MW)
- Contracts were awarded on a four year term which National Grid says will give providers the certainty that they need to develop the technology.

UK National Grid Project findings

Tender Summary

- On the 15th July 2016 the first EFR tender round closed. National Grid received tenders from 37 different Providers, across 64 “sites”.
- The cost benefit analysis showed that under the Gone Green future energy scenario, by 2020 and with the implementation of the EFCC project, the potential cost saving to consumers would be approximately £200m per annum and the investment in battery storage plus solar PV is in the order of £69k to £656k.

Key Lessons Learned

- Fast frequency response has many nuances
  - Transient period, oscillations, faults etc.
- Robustness in algorithms is critical
  - Data is never 100% guaranteed
- Limitations on protocols
- Trade off between speed and reliability is difficult to manage
- Greater understanding of behaviour during a frequency event
  - Also in the equipment used to measure frequency
- WAMs has been instrumental in delivering this project
  - Archive of test data, evaluation, quickly collecting post-event data for analysis

Neoen - Tesla Hornsdale

Project overview: key stakeholders

Partly contracted with the South Australian Government:

- 70MW/10MWh are dedicated to providing services for the grid and SA Government
- 30MW/119MWh can participate freely in the NEM (Australian Electricity Market).

Services provided by the battery:

- Energy (arbitrage)
- FCAS regulation (Lower and Raise REG)
- FCAS contingency (6sec, 60sec and 5min services)
- Participation in SIPS

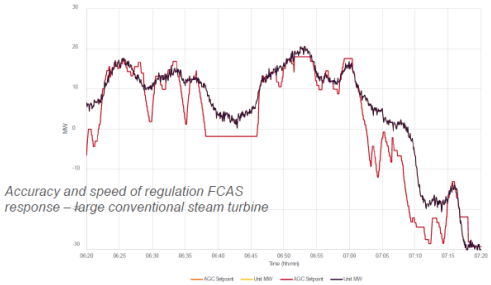
Government Sponsor: Government of South Australia

Approvals: AEMO, ESSENTIAL SERVICES COMMISSION of South Australia

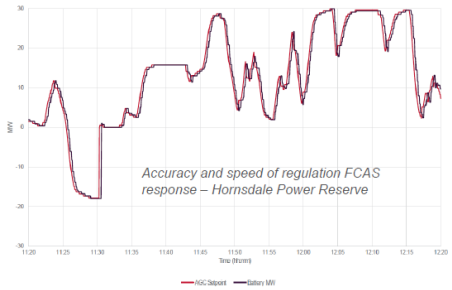
Hornsdale Wind Farm
Hornsdale Power Reserve
NEOEN

Performances:

- HPR is the first FCAS regulation provider using another technology than conventional synchronous generation
- Compared to conventional generators, the battery's response is both quicker and more precise:



Accuracy and speed of regulation FCAS response – large conventional steam turbine



Accuracy and speed of regulation FCAS response – Hornsdale Power Reserve

French renewables developer Neoen has reported the first-quarter 2020 revenue of €95.8 million ($104.6 million), an increase of 61% compared to the same period last year. While the key factor behind the surge was the early generation revenue from its assets commissioned in 2019, another major factor was an unprecedented increase in storage revenues earned in Australia.In the March quarter, Neoen's total storage revenue came to €21.6 million ($ 23.6 million) – almost all of it from the Hornsdale Power Reserve in South Australia (SA) – up from €4.2 million ($ 4.6 million) in the first quarter of 2019. After a tornado in late January pulled down the Heywood interconnector between SA and Victoria, SA was islanded from the rest of the Australian grid for 18 days. Upon the request of the Australian Energy Market Operator (AEMO), Neoen's Hornsdale big battery and two other smaller batteries in the state – Dalrymple ESCRI and Lake Bonney – assumed critical roles during this period in maintaining the grid's reliability while keeping electricity costs down for consumers.

Thank You