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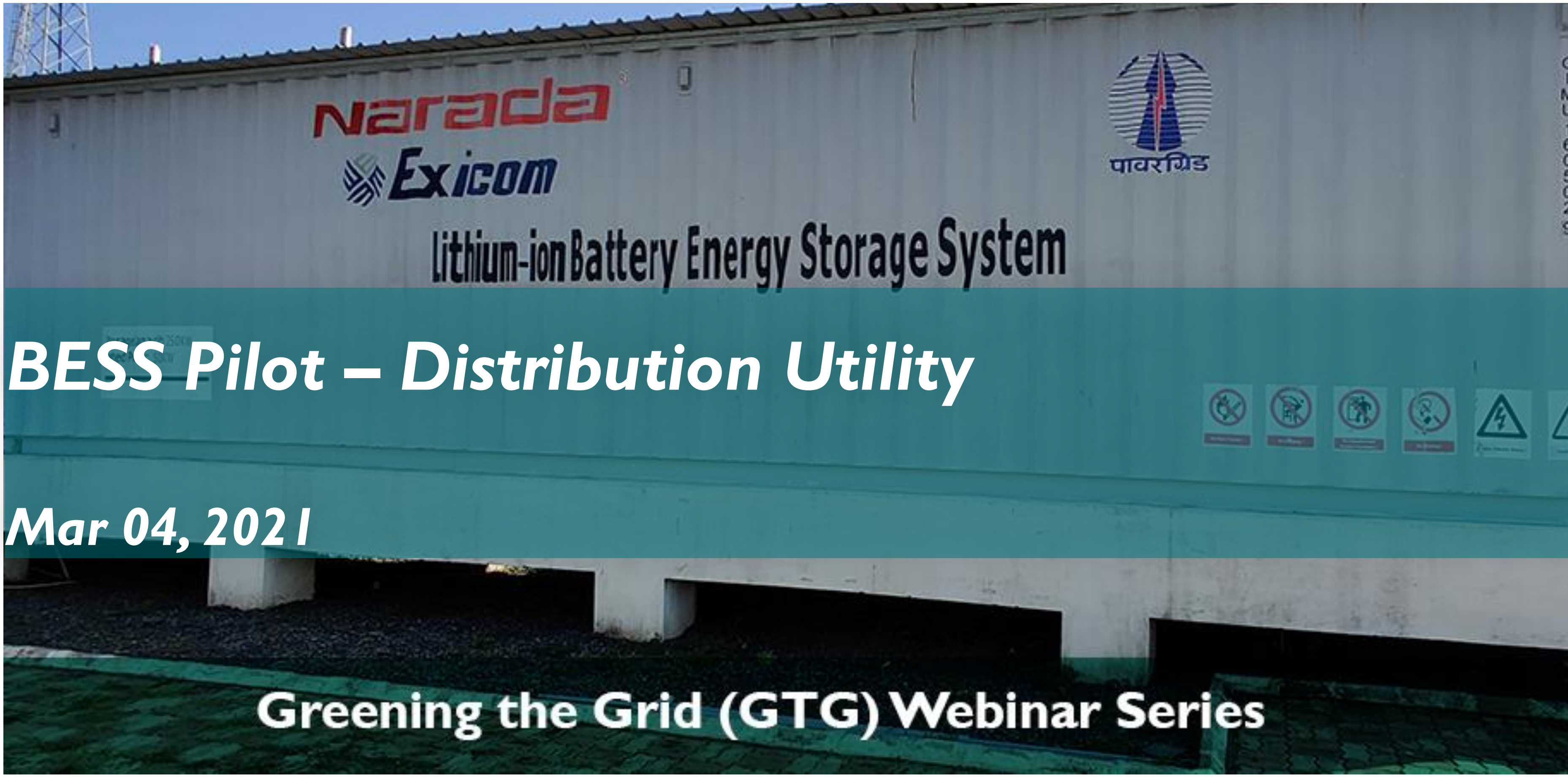
BESS Pilot – Distribution Utility

Mar 04, 2021



Greening the Grid (GTG) Webinar Series

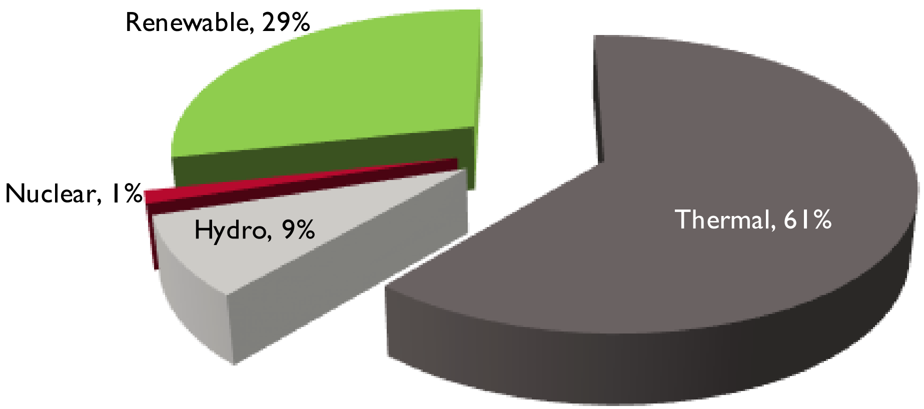
Renewable Integration and Sustainable Energy (RISE) Initiative
Greening the Grid (GTG) Program
A Joint Initiative by USAID and Ministry of Power

Context – pre pilot situation

- BRPL would be adding ~ 1200 MW of variable RE capacity by FY22.

- In view of studying the impact of such high RE share on the network and real-time scheduling (in order to adhere to Grid codes), BRPL has requested USAID to conduct a study in assessing the economic feasibility of deploying BESS in their distribution network

BRPL Power Capacity Tied Up by FY 2021-22



Pilot Design on Grid Connected BESS in Distribution Network

Establishing business case for a distribution utility in Delhi for its 20 MW BESS

Conceptualization & Pilot Implementation

- Stacked economic benefit assessment of 20 MW BESS deployment in Distribution system
- Develop Market Framework for BESS in Distribution

Market & Regulatory Framework

- Preparing a business case for deployment of BESS in distribution
- Business model formulation and SLA conditions
- Business case approval from DERC

Key Questions

- What are the various benefits that BESS is going to provide and how do you value those?
- What would be the optimal capacity for the BESS to be deployed?
- Is there a economic feasibility/ business case for deployment of BESS in the distribution network of BRPL?

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Benefits of BESS – Use cases

Economic value levers of BESS which could be monetized

Ramping Support 1 — Battery system is used for ramping support when the RE (solar resources) generation reduces during the evening time

Energy Arbitrage 2 — BESS will enable energy arbitrage by charging when the energy cost is low and dispatch during peak hours.

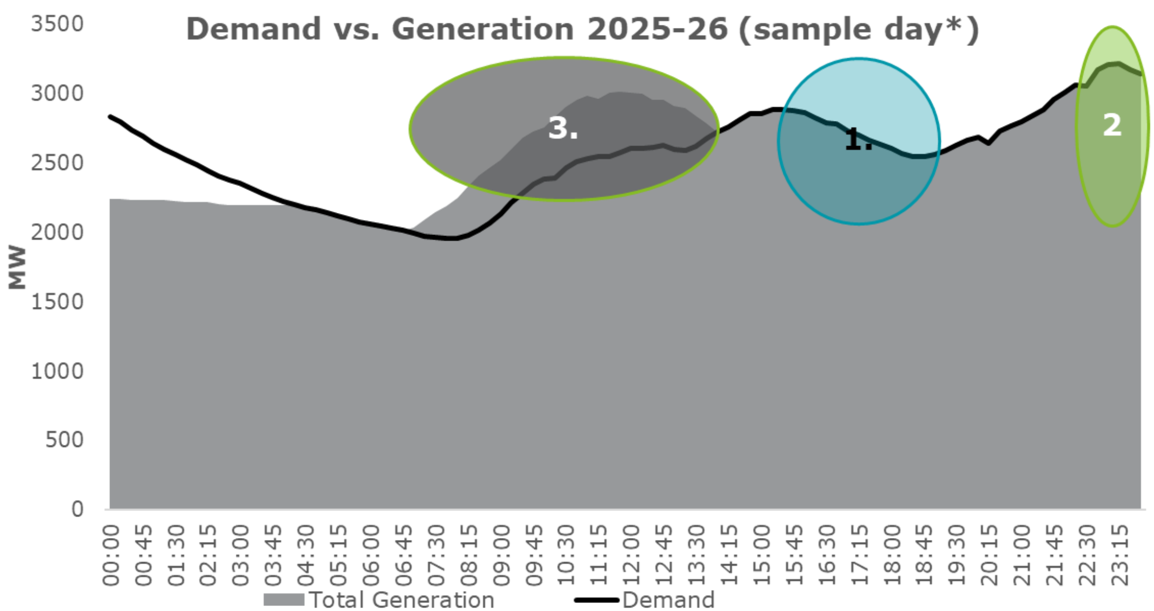
Capacity Deferral 3 — The battery system is used for deferring distribution capacity enhancements

Benefit streams for BESS

Additional benefits include reduction in Transmission loss charges and reduction in outages

Benefits of BESS – uses cases illustrated

Illustrative example for Benefits Accrued from BESS



1. **Benefits from Ramping Support:** Inability of thermal generators in the portfolio in supporting rapid decline in RE / uptake in demand.

   BESS can discharge quickly to "even out" the generation.

2. **Benefits from Energy Arbitrage:** BESS will run at slots with peak demand and help in peak reduction. The BESS will charge when the energy cost is low and dispatch during peak (high cost)

3. **Excess Generation:** As the country shifts to more RE generation, there will be excess of generation which can be used to charge the BESS at lower cost

Other Benefits

4. **Capacity Deferral:** The battery system is optimally located to defer distribution capacity enhancements.

5. **Reduction in Transmission loss:** Using battery system, we can prevent transmission losses to the extent of battery usage

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Assumptions used to Evaluate Financial Viability of BESS

Battery Assumptions

Parameter	Assumption
Battery Charging Efficiency	85%
BESS lifespan	15 years
BESS Degradation (by end of life)	70% (7,000 cycles)

Demand / Energy Cost / Generation Assumptions

Parameter	Assumption
Cost of peak energy supply	₹ 7.03/kWh
Cost of charging before peak	₹ 3.63/kWh (average)
Cost of charging before 0500 hrs	₹ 2.81/kWh (average IEX ACP)
Ramping benefit rate	₹ 8/kWh (max. DSM charge)
Increase in energy charges (y-o-y)	3% p.a.

Capacity Deferral Assumptions

Parameter	Assumption
Transformer cost	₹ 13,00,000 / MVA
Interest Rate	11% p.a.
Land Requirement	20 m^2 (500 m^2 for 25 MVA)
Land cost	₹ 20,000/ft^2

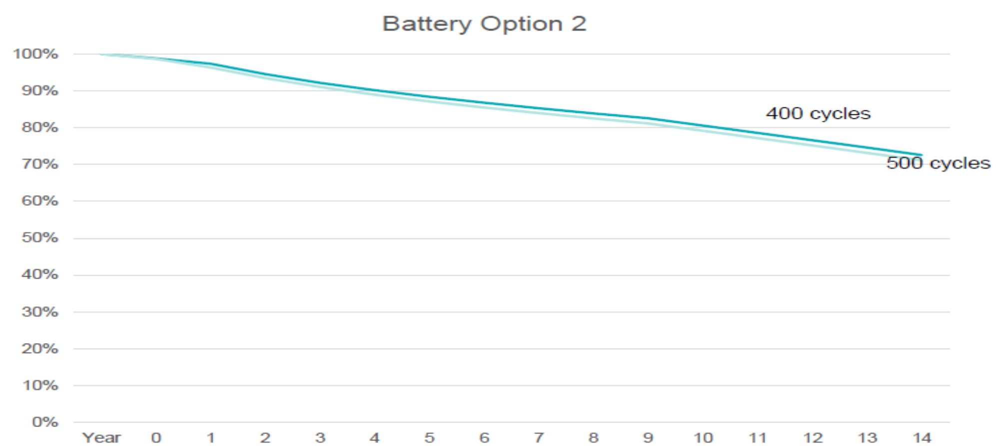
Budgetary Quotes - BESS

Parameters	1 hour	2 hour
4000 cycles	₹ 4,00,00,000	₹ 6,00,00,000
5000 cycles	₹ 4,27,00,000	₹ 6,40,00,000
7000 cycles	₹ 5,63,00,000	₹ 6,78,00,000

All figures in INR/MW

20MW 2 Hr System – Peak Shifting, Ramp Support Application

Year	400 Cycles/Year	500 Cycles/Year
0	100%	1
1	99%	99%
2	97%	96%
3	95%	93%
4	92%	91%
5	90%	90%
6	88%	87%
7	87%	85%
8	85%	84%
9	84%	83%
10	83%	81%
11	81%	79%
12	79%	77%
13	77%	75%
14	75%	73%
15	73%	71%



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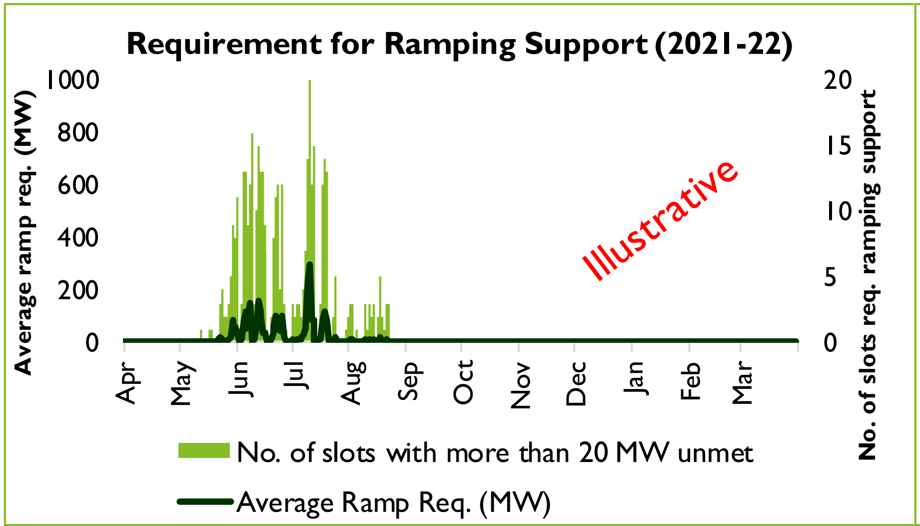
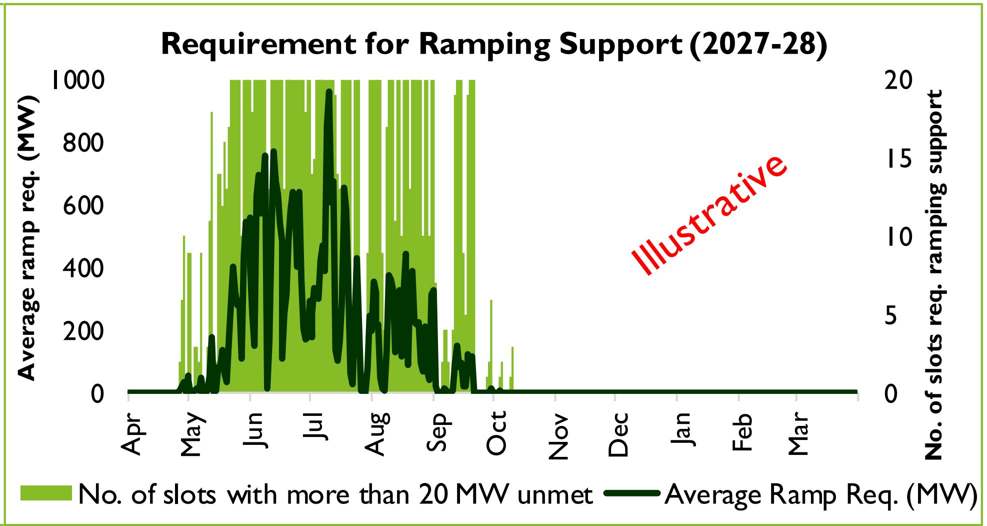
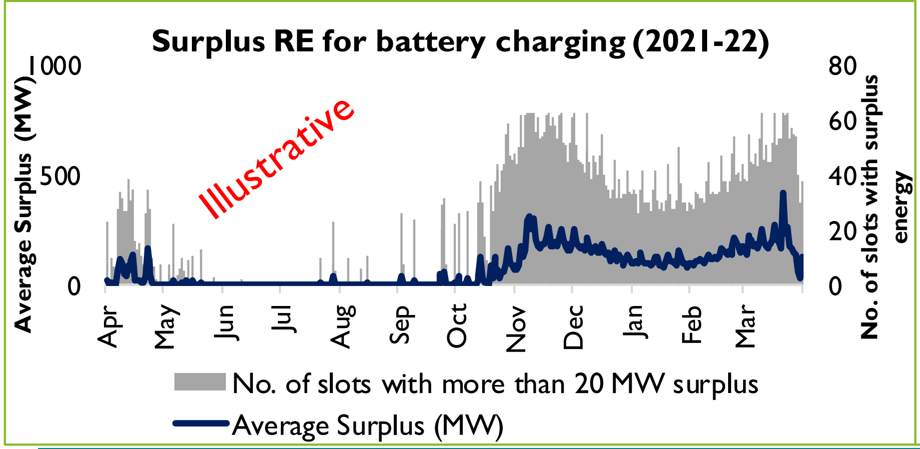
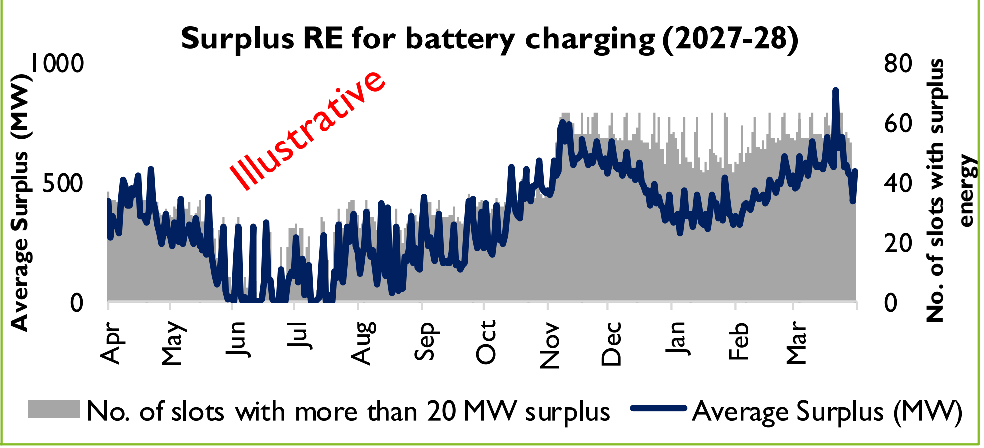
Use Cases – explained through data analysis

Illustrative example for Benefits Accrued from BESS









Levelised Annual Benefits from ramping support, energy arbitrage, loss reduction, capex deferral and avoidance of outages over the lifetime of BESS was compared with annual levelised cost of BESS

Key findings of the study

- Based on budgetary quote of Rs 6.78 cr/MW and an evacuation cost of Rs 0.25 cr/MW, a levelised Annual Fixed Cost for a 7000 Cycle 2 hour BESS is calculated
- Benefits from ramp, arbitrage, capex deferral and T&D loss reduction are stacked and compared
- Boundary conditions for BESS becoming viable have been calculated
- 30% - 40% cost reduction on the budgeted costs could make BESS viable for the uses cases analysed

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