Variable Renewable Energy and BESS: The Case of the Philippines

ACEF 2025 Deep Dive Workshop
Energy Storage – Accelerating Clean Energy Transition in Asia – The Role of BESS and ENABLE Platform

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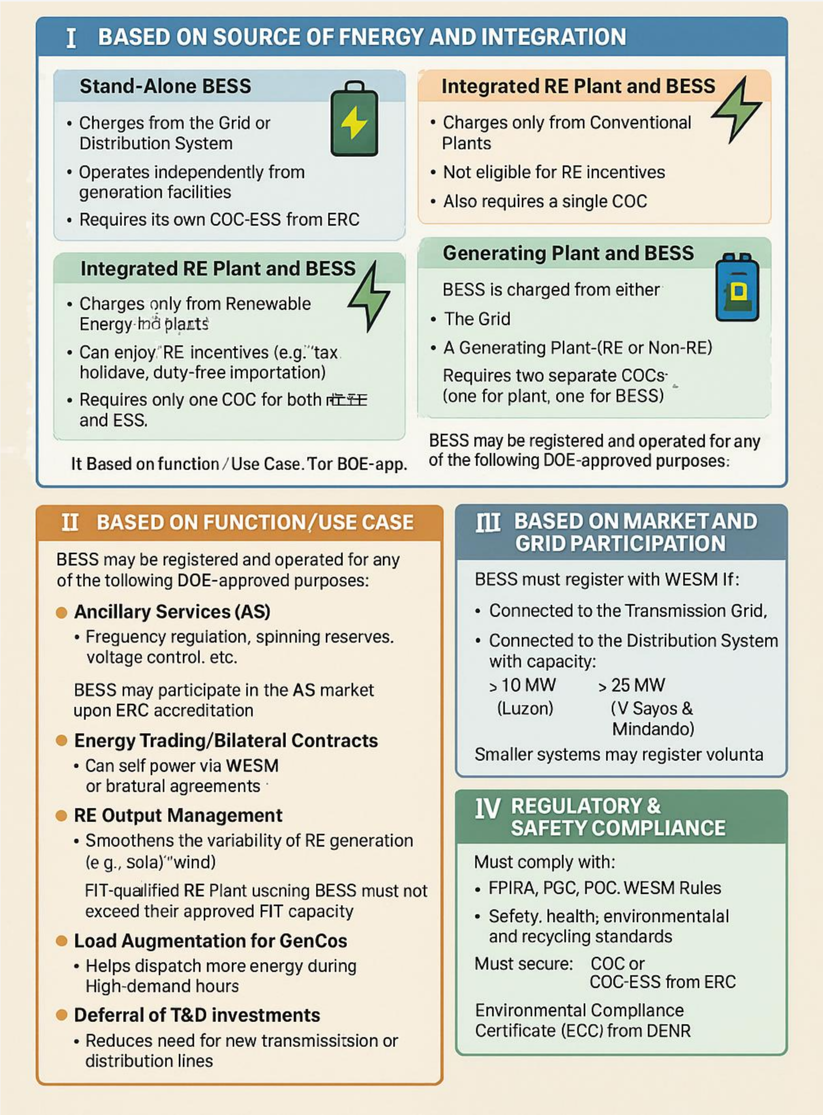
1. Philippine ESS Policies

Evolution of ESS Policies

1) **DOE DC2019-08-0012. Providing a Framework for Energy Storage System in the Electric Power Industry.** Laid the groundwork, acknowledging ESS as an emerging solution for energy reliability and flexibility.
2) **DOE DC2023-04-0008. Prescribing the Policy for Energy Storage System in the Electric Power Industry.** Marked a mature policy shift, formally integrating ESS into market rules and grid operations through technical classification and operational restrictions.

- **Statistics (DOE)**
  - 436 MW (2023)
    - Most of these projects are operated to provide Ancillary Services

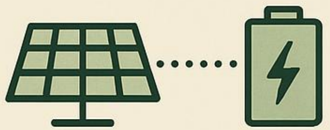
ESS Classification under DC-2023-04-0008



6. Green Energy Auction – Round 4

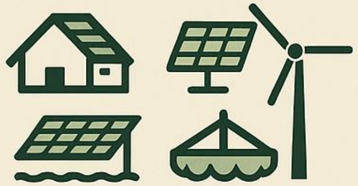
The Philippines' Department of Energy (DOE) has launched the fourth round of its Green Energy Auction (GEA-4), aiming to add 9,378 megawatts (MW) of renewable energy capacity between 2026 and 2029. This round introduces the integration of solar power plants with Battery Energy Storage Systems (BESS), marking a first in the nation's renewable energy program

Integrated Renewable Energy and Energy Storage Systems (IRESS)



For the first time, auction includes 1.100 MW of solar capacity paired with energy storage systems

Diverse Renewable Technologies



Auction covers ground-mounted solar, rooftop sonlar, floating solar, and onshore wind projec s

20-Year Supply Contracts

Winning bidders to secure 20-year contracts, payments to commence upon commercial operation

Performance Bonds

Developers required to post 5% of project's capex, down from 20% in earlier rounds

Strategic Implications of IRESS in GEA-4

- Drives Investment in dispatchable renewables
- Boosts interest from (PPs: foreign investors. a BESS providers
- Helps DOE optimize RE output for grid reliability. not just peak solar generation
- Encourages BESS costinnovation through competitive bidding

TECHNOLOGY	PRELIMINARY GEAR PRICE (₱/kWh)
Rooftop Solar	₱4.7679
Ground-Mounted Solar	₱4.1480
Floating Solar	₱5.9515
Onshore Wind	₱6.5134
Solar with Battery Energy Storage	₱5.2835

GEA-4 Capacity Targets

Year	RE Capacity (MW)	Solar + BESS (Capacity (MW)
2025	2.744	200
2027	2.362	200
2028	2.766	350
2029	1.506	350
Total	9.378	1.100

Technical Standards for IRESS Projects

- minimum 4-hour storage duration
- inverter ratio of at least 0.2 relative to solar capacity
- round-trip efficiency of 85 %

2. Technical Challenges of VRE Expansion

1) Grid Congestion and Limited Grid Capacity

- *Challenge*: Many VRE potential areas are located far from demand centers.
- *Impact*: **Grid congestion leads to curtailment of VRE output or delays in interconnection**

2) Intermittency and Lack of Grid Flexibility

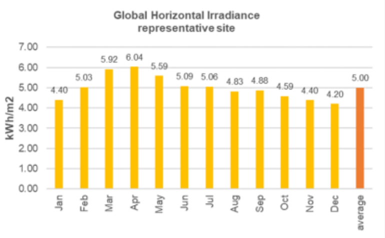
- *Challenge*: Solar PV output is variable, and the current Philippine grid lacks the flexibility to integrate high shares of intermittent energy.
- *Impact*: **Without energy storage or flexible generation, solar penetration is capped to maintain system stability.**

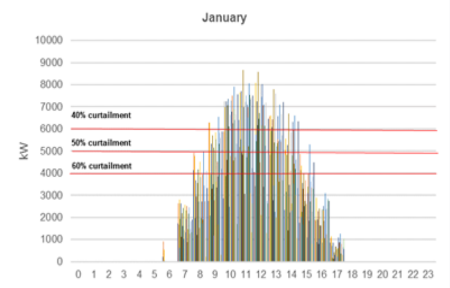
3. Key Drivers of VRE Curtailment

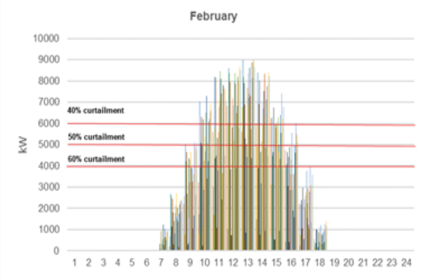
- **GEA Projects.** Some Green Energy Auction (GEA) solar projects are facing output caps due to lack of timely grid upgrades.
- **DU Interconnection Caps.** Distribution utilities limit solar injection to avoid reverse power flow or transformer overload.
- **Visayas & Mindanao Bottlenecks**. Solar growth is concentrated in regions with weak or saturated transmission infrastructure.
- **WESM Dispatch Rules.** Solar plants without preferential dispatch can be cut back during overgeneration scenarios.

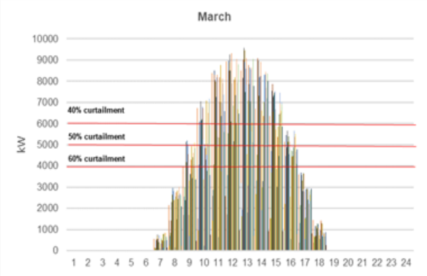
- **Technical Curtailment**
  - Occurs in regions like Visayas where substations are saturated.
- **Contractual Curtailment**
  - Some GEA-awarded projects face caps in their offtake agreements.
- **Economic Curtailment**
  - Emerging as WESM allows real-time market signals that may deprioritise solar.
- **Regulatory Curtailment**
  - Utilities may curtail VRE during grid emergencies for system security.

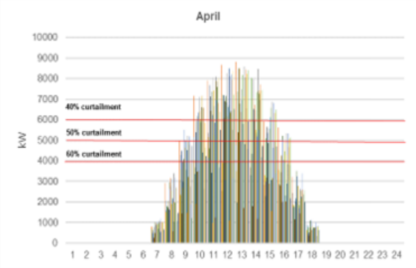
4. Discussion Paper commissioned by ETP-UNOPS
Solar PV Generation Variability

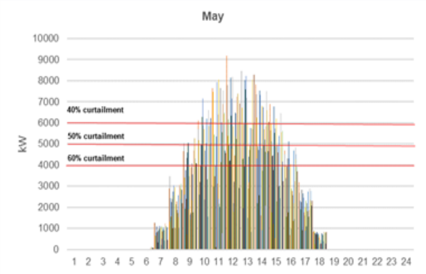


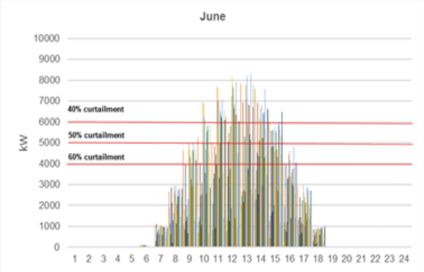


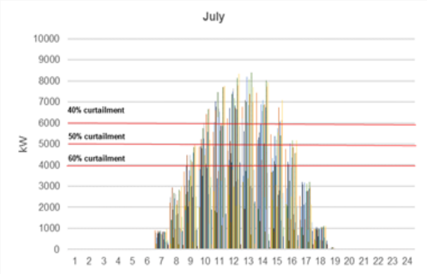


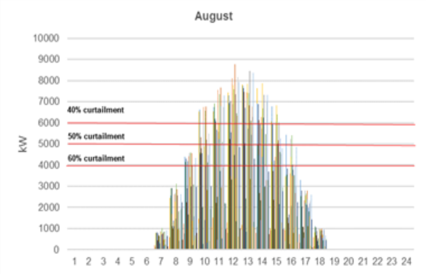


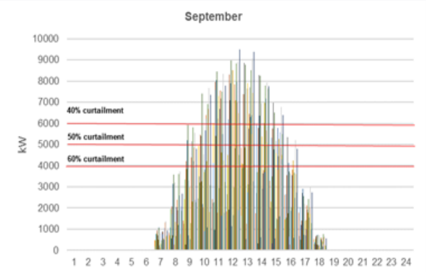


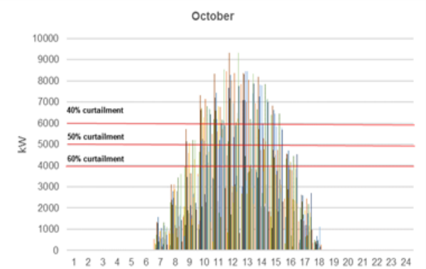


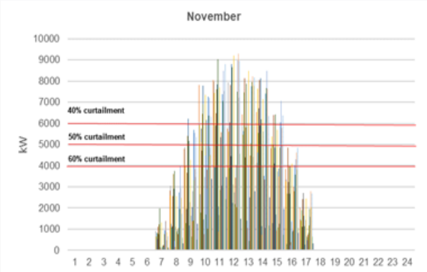


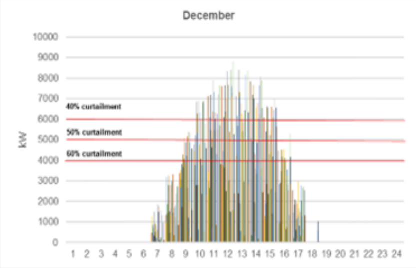






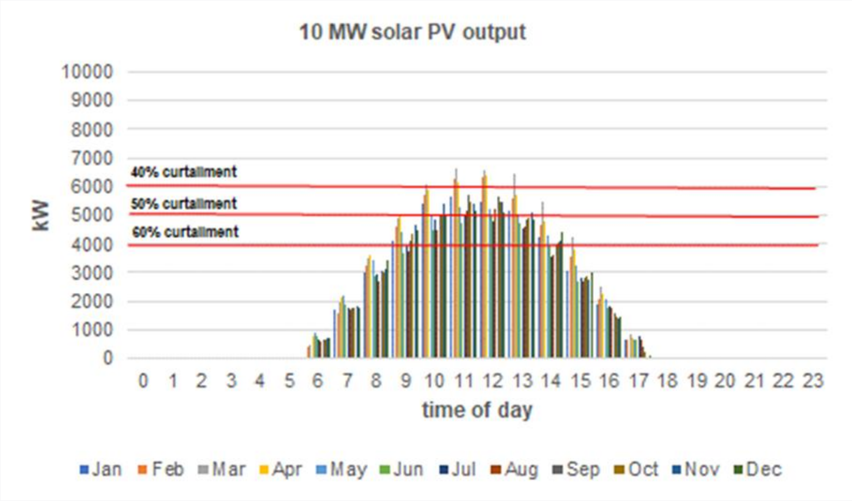






5. Discussion Paper commissioned by ETP-UNOPS

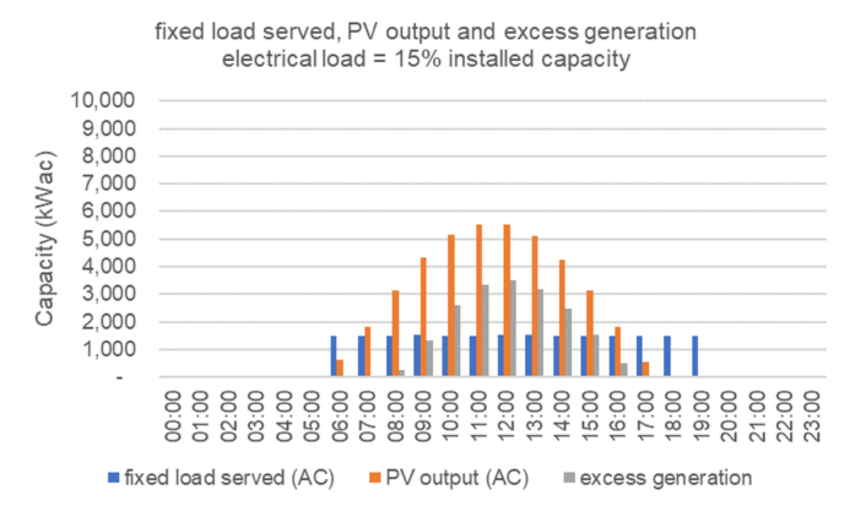
Curtailment and BESS Sizing

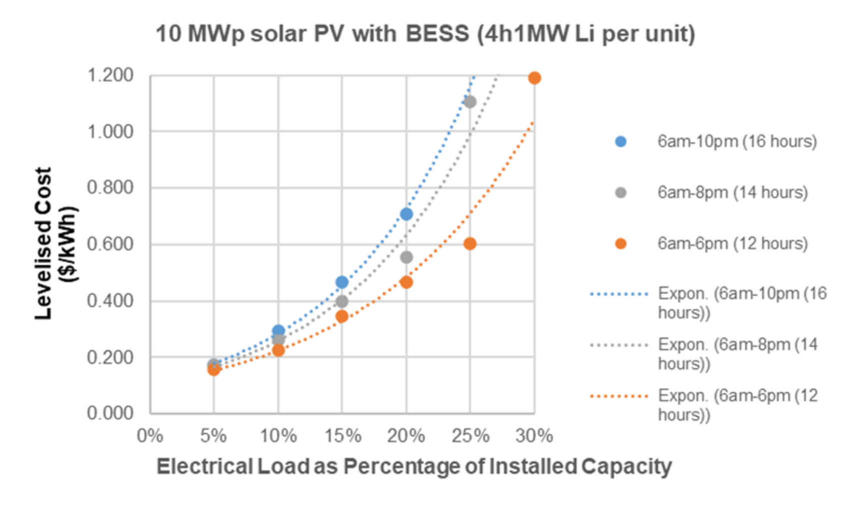


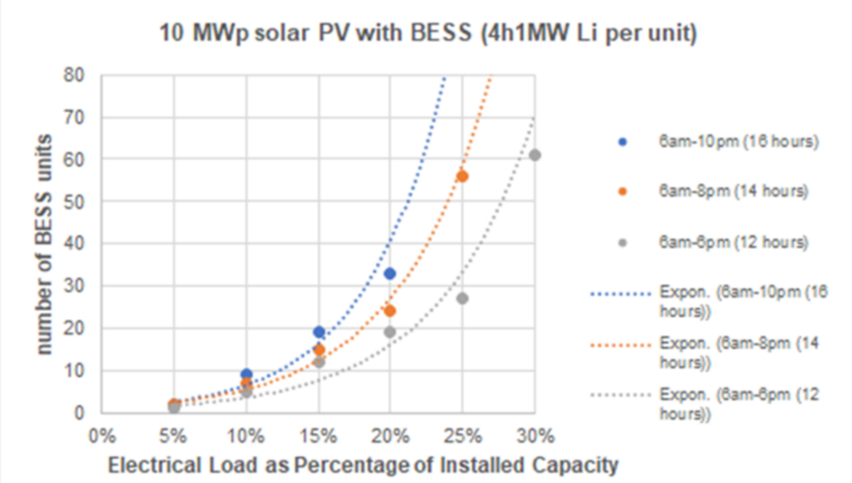
	Curtailment		
	60%	50%	40%
BESS units (1 cycle per day)	number of units		
4h 1 MW	2.0	1.0	1.0
2h 1 MW	5.0	3.0	2.0
1h 1 MW	9.0	6.0	3.0
	Curtailment		
	60%	50%	40%
System Levelised Cost (10 MW solar PV + BESS)	US$/kWh		
4h 1 MW	0.149	0.133	0.133
2h 1 MW	0.165	0.146	0.136
1h 1 MW	0.175	0.156	0.136
	PhP/kWh @PhP55/US$		
4h 1 MW	8.20	7.31	7.31
2h 1 MW	9.08	8.02	7.49
1h 1 MW	9.62	8.56	7.49

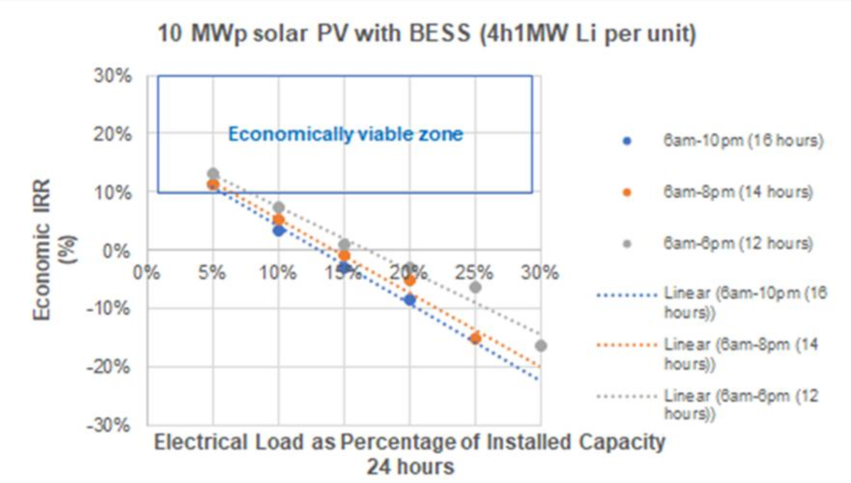
Higher curtailment levels and smaller capacity BESS units have higher levelised cost of electricity.

5. Discussion Paper commissioned by ETP-UNOPS
Dispatchable Capacity









7. Highlights

1. Policy Evolution

- The DOE has **transitioned** from general ESS recognition in 2019 to a **formal, functional classification** system in 2023, **enabling structured integration into the grid and markets**.

2. Curtailment Trends

- VRE are **increasingly curtailed** due to **grid congestion, limited interconnection, and market dispatch rules**—especially in high-VRE regions.

3. BESS as Enabler

- Battery energy storage is essential **for reducing curtailment**, **firming renewable output**, and **supporting grid stability** through ancillary services.

4. Cost Effective Design

- Under **high curtailment conditions**, **optimal inverter ratios** and **storage durations** are crucial to **keeping levelized costs manageable.**

5. GEA Round 4

- GEA - 4 is a **landmark step**, mandating the **integration of storage (IRESS)** with solar, **with clear targets** for the period 2026-2029.
- Mandates **minimum 4-hour duration** and **RE-only charging**, ensuring **dispatchability and alignment** with **national RE goals**.