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Hitachi Energy

Microgrid

Pathway to energy independence and clean energy for islands and remote communities

Power Conversion Solutions
Regional Sales & Market Manager
PU Jianjiang
3 Jun 2025, Manila, Philippines

Strong Track Record: Combined 7’000+ MW ESS Solutions Installed

Often co-located with PV, we're a leader in PV-BESS hybrids (AC- and DC-coupled)

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Customer Challenges

- PV integration through hybrid BESS
- Grid-forming and seamless switch capabilities in large- and mid-sized BESS applications to support weak- and off-grid applications
- Local content

Customer Outcomes

- Improved reliability and resiliency
- Reducing energy cost and CO2 emissions
- Unlocking new revenue streams
- Maximizing renewable integration

Global Installations (key projects)

Global Footprint

350+
Projects delivered worldwide, +15 PV-BESS DC-coupled

7’000+ MW
ESS capacity delivered worldwide, often PV co-located

30+
Years of experience

90+
Countries supported with Service and Sales organizations

Key Highlights

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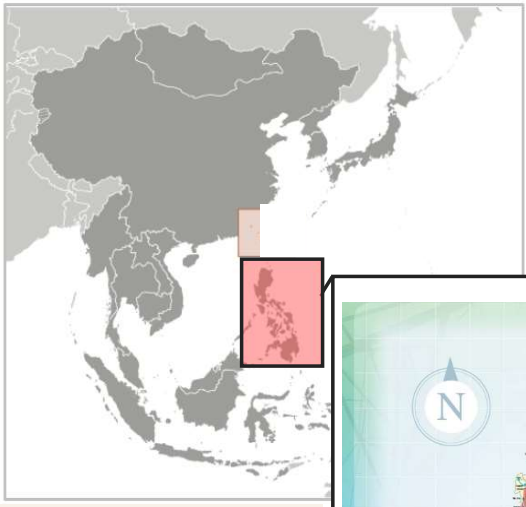
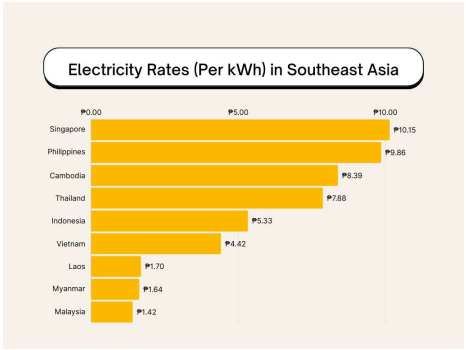
Microgrid opportunity overview	
Current status	▪ 7,000 islands ▪ 2.3m people has no reliable access to Electricity *source DoE Department of Statistics ▪ Energy security and reliability is a major concern ▪ High electricity prices (no subsidies and high CAPEX of T&Ds) ▪ Heavy reliance on fossil fuels and imported energy (96% relies importation)
Challenges	▪ Expensive to extended primary grid to reach out rural/islands ▪ Regulatory challenges (Permits/approval process) ▪ Technology
Recent development	▪ Philippine Energy Plan aims to increase renewable energy in its power generation mix by 35% in 2030 and 50% by 2040 ▪ Solar-storage microgrids are emerging as a leading option (lead time, scalability, reliability and falling cost) ▪ Microgrid Systems Act bill passed to streamlines the process for competitive selection of microgrid service providers
Value proposition of Micro-grid system	▪ Optimal alternative to serve remote communicate ▪ Support and promote renewable integration ▪ Improve reliability and resilience of network





Data source:
Philippine Center for Investigative Journalism

Challenges for Renewables in Island/remote communities without BESS and Smart Control

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Scale:

‘Small’ amounts of renewable generation can cause instability and power quality issues

Power Quality:

Renewables can exacerbate voltage and frequency issues in weaker grids

Instability:

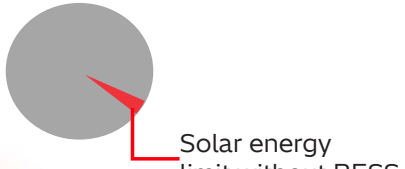
Fluctuating renewables and dynamic loads may cause grid instability

Penetration limits:

Without smart controls and storage, renewable penetrations must be limited to prevent grid problems

BESS with SMART CONTROLS CAN OVERCOME LIMITS

Enables an island to get more energy from solar



Mitigate problems with quality and reliability

Business case study

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Scenarios

- Island load of 11.2MW average with 15MW Peak
- 9x2MW diesel generator in manual operation
- The grid suffers from occasional voltage and frequency issues

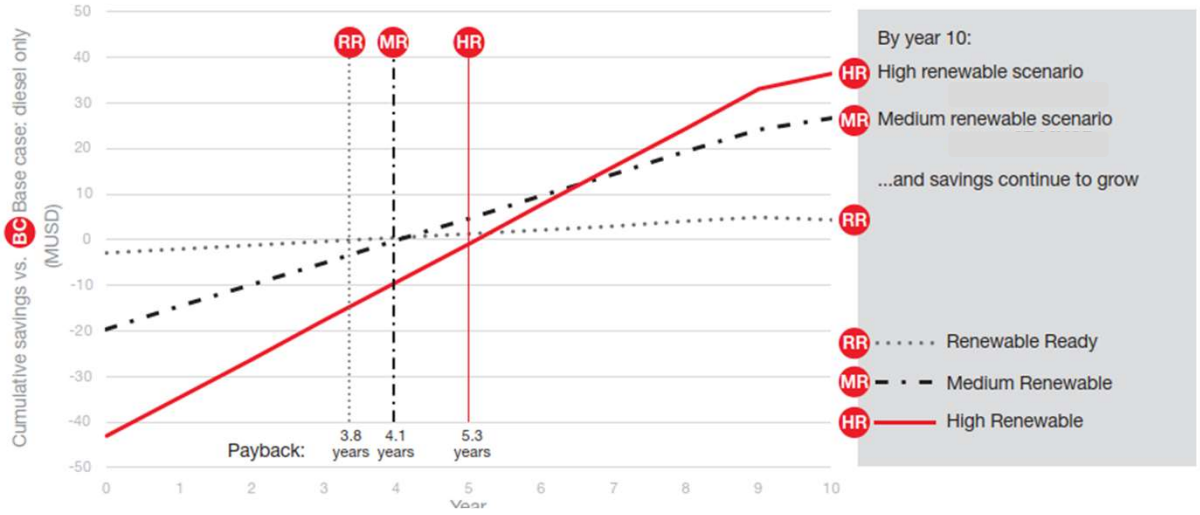
Base case

- Solar installed cost: USD 1.5 / Wp
- Battery cost: USD 300USD/kWh
- Delivered diesel cost: USD 0.75/L
- 9% discount rate and 2% annual cost inflation
- 20 years of project life cycle

Assumptions

- BC **Base case**: Diesel only
- RR **Renewable ready**: Battery Energy Storage System and Diesel
- MR **Medium Renewable**: Moderate solar with BESS and diesel
- HR **High Renewables:** Significant amount of RENs

Comparison of ROI vs Base Case



Renewable contribution	[Peak] renewable penetration
Calculated based on energy [kWh]	Calculated based on power [kW]
Percentage of energy from renewables over a year	Percentage of power from renewables at a particular time
A cumulative (sum) value over time	Presented as peak (largest) value over time
Valuable metric for policy targets, in particular climate change mitigation	Valuable metric for technical operation High values create technically challenges

This business case achieves 100% renewable penetration--when there is adequate sun the utility runs completely on renewables.
From this technical milestone, the island utility can expand the number of hours at 100% penetration, increasing from 35% renewable energy contribution towards 100% renewable energy contribution as utility investments allow.

An integrated hybrid approach

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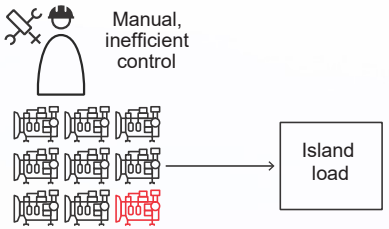
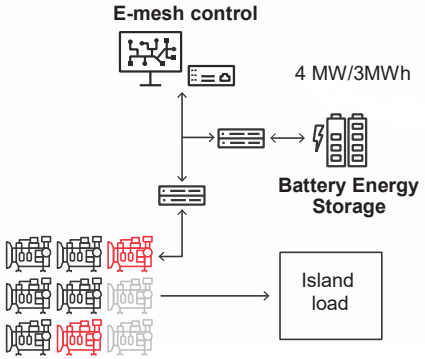
Genset status: On | On (for reserve) | Off

BC Base case: Diesel only



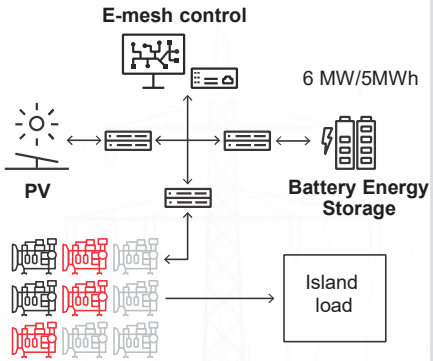
- Nine-generator system is manually switched on and off
- One generator equivalent required as operating reserve at all times Generators share load
- Grid unable to accept significant contributions of renewables

RR Renewable Ready



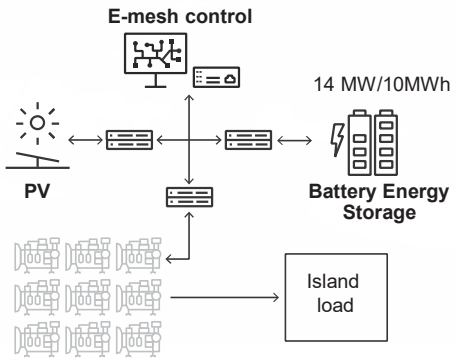
- BESS supplies reserve so two generators can turn off
- Controls remove need to start up a generator during short-term peaks
- BESS improves power quality and reliability
- Grid is ready for renewables

MR Accelerate



- Larger BESS provides more reserve to turn off more generators
- BESS allows PV capacity to exceed transient and generator step loading limitations
- Controls maximize fuel savings and reduce generator hours

HR Sustainable growth



- Even larger BESS provides required reserve to turn all of the generators off
- Increased PV capacity to get more energy contributions from renewable sources
- During sunny daylight hours, all generators can be shut down

Smart controls enable an incremental pathway to affordable, stable and resilient accessible to renewable

Summary of the base case and island investment scenario result

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		Investment			Operations			Economics			Environment	
		PV (MWp)	BESS (MWh)	Capital cost (MUSD)	Operating cost (MUSD)	Fuel use (bbl/day)	Generator hours (op. hours)	LCOE (USD/MWh)	IRR (%)	Payback (years)	Renewable contribution[11] (%)	Peak renewable penetration[12] (%)
BC	Base case: diesel only	0.0	0.0	0	23.0	446	62,555	233	–	–	0%	0%
RR	Renewable ready	0.0	3.0	3.0	22.2 (-3.4%)	441 (-1.1%)	51,184 (-18.2%)	227 (-2.2%)	27%	3.8	0%	0%
MR	Medium renewable	10.0	5.0	19.6	18.2 (-20.6%)	357 (-19.8%)	44,169 (-29.4%)	203 (-12.7%)	24%	4.1	20%	88%
HR	High renewable	22.0	10.0	43.1	14.8 (-35.7%)	287 (-35.7%)	34,123 (-45.5%)	190 (-18.2%)	19%	5.3	35%	100%

HR

High Renewable Scenario

The high renewable scenario yields both the greatest savings and the greatest contribution of renewable energy

RR

Renewable Ready Scenario

The renewable ready BESS investment provides value at a strong return

MR

Medium Renewable Scenario

The medium renewable scenario bridges the gap for islands that still want to use renewable energy but limit the capital outlay

Summary

The All three investment scenarios represent a step toward island goals of using more renewables, decreasing costs and reducing the reliance on volatile energy sources renewable scenario yields both the greatest savings and the greatest contribution of renewable energy

Improve network stability and resilience

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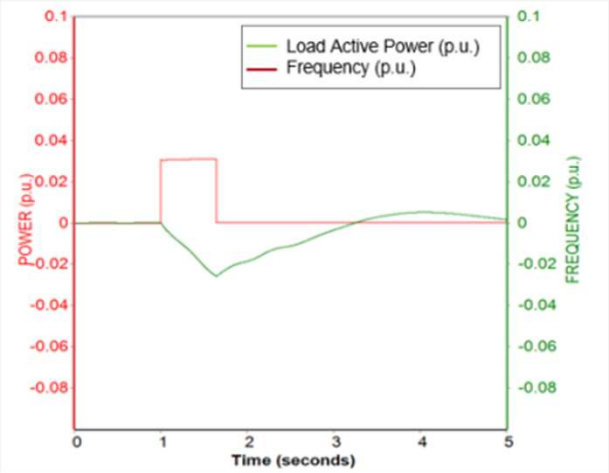
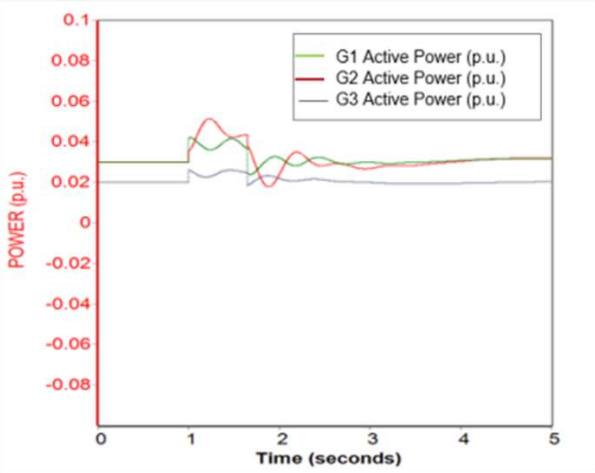
Without BESS

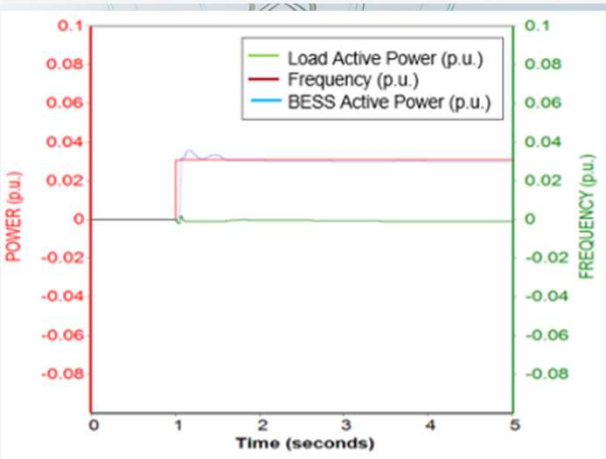
- 0.026 P.U. Max Frequency Deviation
- Load Shedding

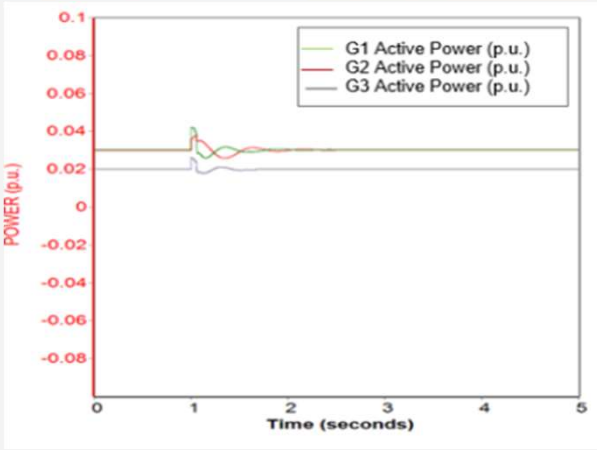




With BESS & Smart Control

- 0.002 P.U. Max Frequency Deviation
- No Load Shedding
- BESS response within 0.06s





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Success Story
Nusa Penida Microgrid System Project

BESS Success Stories - Nusa Penida

- Deployed on an area of 4.5 hectares, the project development was carried out by PT Indonesia Power, subsidiary for Power Generation of PLN, to increase the reliability and sustainability of electricity supply in Nusa Penida. Working together with PT Surya Energi Indotama, Grid Automation's solutions portfolio includes 3 MW/1,84 MWh Battery Energy Storage System (BESS) and advanced e-mesh control, expected to produce 6779 MWh annually, and reduce carbon emissions by 3,200 tons of CO2 per year
- **In the media**

About the project

- **Project name:** Nusa Penida BESS
- **Location:** Indonesia
- **Customer:** PT Surya Energi Indotama
- **End-customer:** PLN
- **Completion date:** 2022

– Customer benefits

- Delivers stable, coordinated operation of the BESS and solar PV with an existing diesel power plant.
- e-mesh control layer constantly monitors power operations for anomalies, and quickly dispatches the energy from the BESS to protect the island network
- Reduce carbon emissions by 3,200 tons of CO2 per year

– Solution

- Solar (40MWp)
- Distributed rooftop solar (3+ MWp)

- PowerStore Battery (3 MW / 3MWh MWh)
- e-mesh Control System

Photo: Dok PT PLN (*Persero*)

Video

Thank you

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