Akuo Energy

Storage presentation

June 2022

akuoenergy
Entrepreneurs by nature

Confidentiel

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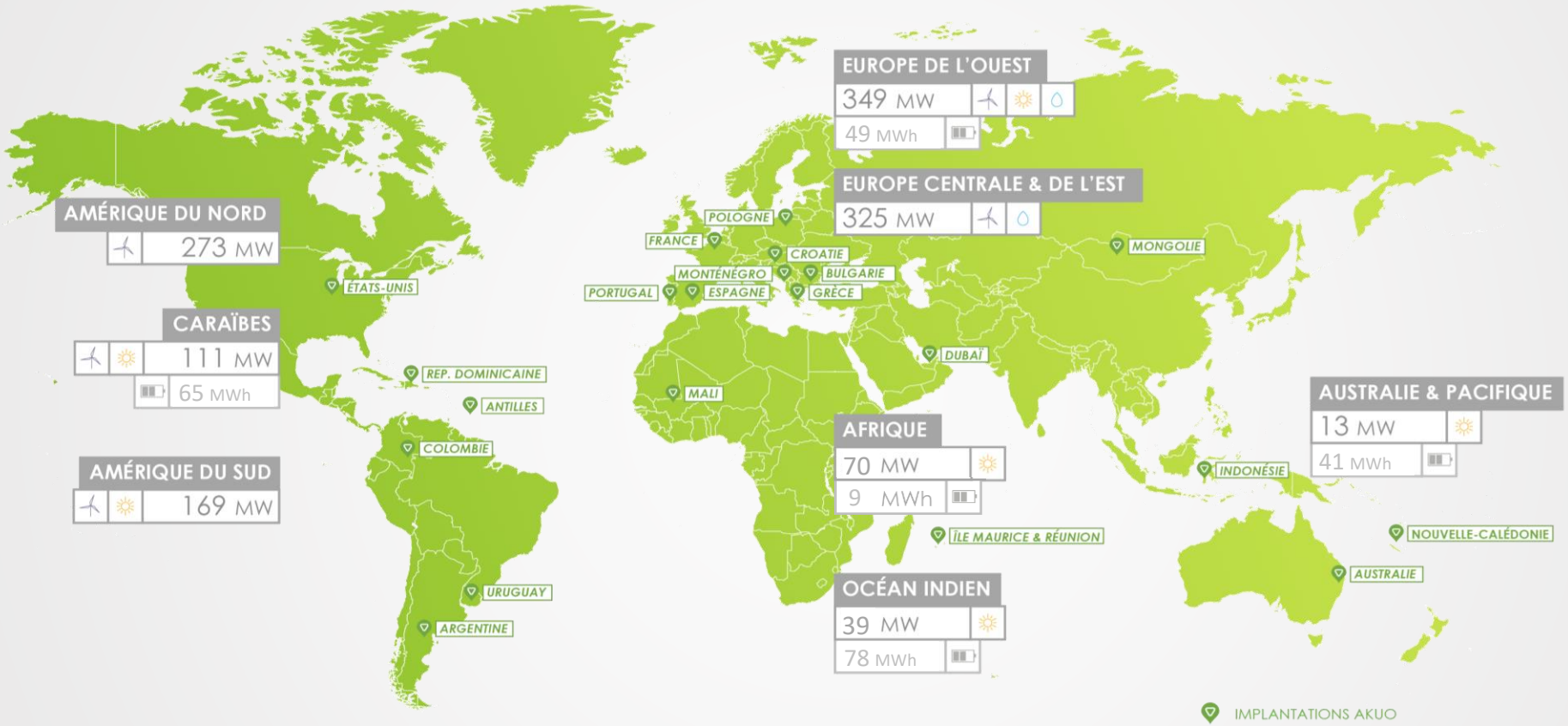
Akuo at a glance

Akuo's global presence



Capacité en exploitation et en construction :

1,4 GW
Électrique

> 70 MWh
Stockage

Technologies :

Solaire · Éolien · Hydro · Stockage

Numerous and diverses projects

- Storage for Akuo is exclusively BATTERY ENERGY STORAGE SYSTEM (BESS)
- Significant number of project in operation or already secured
- Project in various geographic areas. Mainly islands with strong and complex environmental constraints (Seismic, hurricanes..)
- Various projects sizes. BESS from 1MWh to 24MWh for diverse usages and functionnality.

- On grid : Grid services projects
  - 8 sites Akuo in operation
  - 4 sites under construction in 2022
  - 14 projects won or under financing
  - Total : 221 MWh
  - Taille moyenne : 8,5 MWh

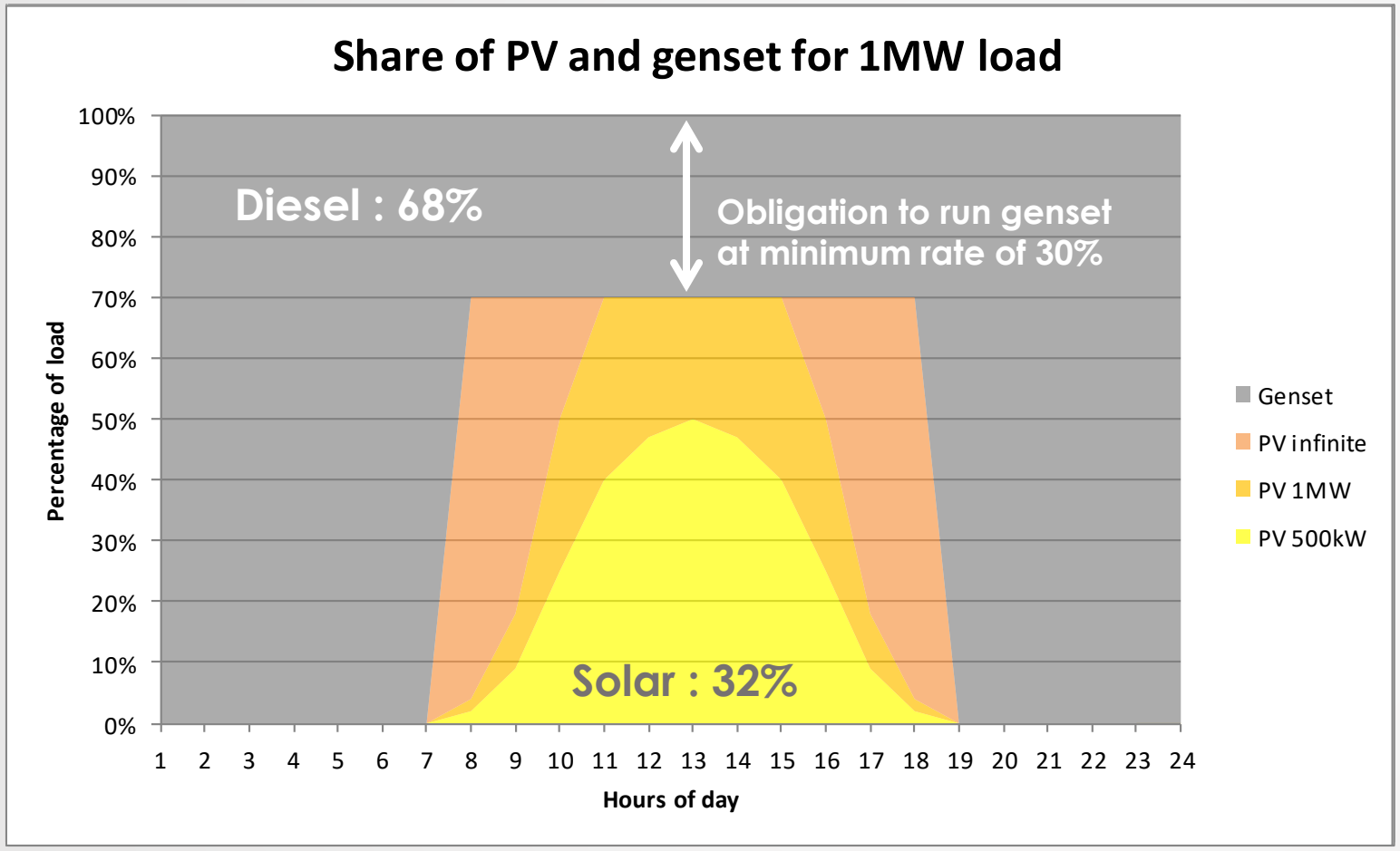
- Off grid : Batteries have the control of grid
  - 4 sites Akuo in operation
  - 10 sites under construction in 2022
  - Total : 6 MWh
  - Taille moyenne : 0,4 MWh

BATTERIES FOR VARIOUS TYPE OF USAGE

- Batteries forming the grid and replacing diesel generators in order to allow a increase renewable share in the energy mix.

Grid Forming – Why adding storage ?

Shut down thermal generators



- Without storage, generators needs to be running to ensure a spinning reserve in case of very fast solar power variation.
- By adding storage, we can switch off the generators as the battery can be the spinning reserve.

Grid Forming – Hybrid system

EMS/SCADA Functionnality

PV
- Coupling managed by the EMS
- Synchronized on the grid created by BESS inverters.
- Solar power curtailement is controled by the EMS
- Main power source during the day.

BESS
- Blackstart
- Coupling managed by the EMS
- Inverters are the regulators of the voltage and the frequency on the grid.
- P,Q regulated to ensure the grid stability.

Genset
- Coupling managed by the EMS
- Synchronized on the grid created by BESS's inverters.
- Respect of power orders from the EMS.
- Turned off during the day
- Grid forming if the BESS is not available.

Grid
- Blackstart managed by the EMS

Grid Forming

Project examples

Indonésie – MCA Indonesia	
Technology	• 2 MWp (Solar GEM®) • 2,1 MWh (Storage GEM®) • diesel gensets shared between 3 sites
Commissioning	Mar-2018
Project type	EPC, off-grid (plants operated by villagers)
Client	MCA

Grid Forming

Project examples

MASDAR project – Union Island	
Technology	• 480 kWc of ground mounted PV • 600kWh (Storage GEM®) • 6 diesel generators
Commissioning	Mar-2019
Project type	EPC, off-grid: power plant managed by the local utility – Akuo system forms the entire Island grid
Client	MASDAR

Grid Forming – Operation data

Project CARI

BATTERIES FOR VARIOUS TYPE OF USAGE

- Batteries forming the grid and replacing diesel generators in order to allow a increase the renewable share in energy mix.

- Batteries for grid operator to optimize his production assets.

Energy Arbitrage

Project Examples

Madinina	
Technology	12MW / 19,2MWh (Storage GEM®)
Commissioning	November-2021
Project type	Arbitrage Frequency regulation
Client	EDF SEI

Tonga 2	
Technology	6MW / 24MWh (Storage GEM®)
Commissioning	January-2022
Project type	Arbitrage
Client	TPL

Storage capacity at the disposal of the operator

Energy arbitrage functionnality

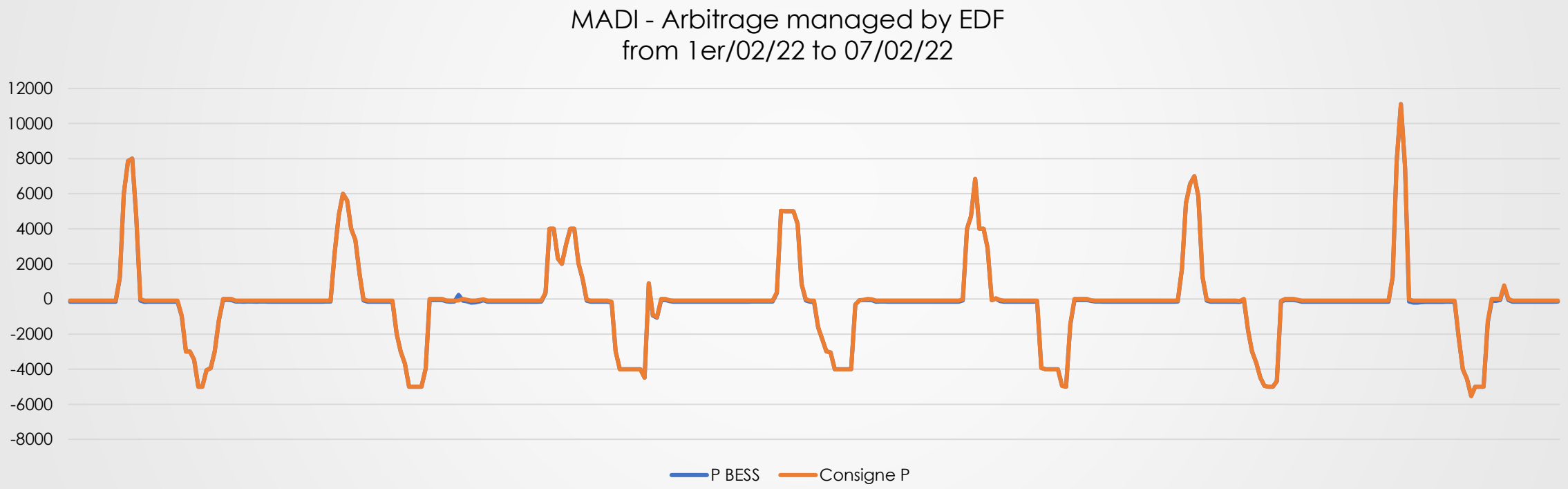
- From his control system the grid operator can manage the battery.
  - The battery can be charged when the electricity production is cheapest, often during the day when there is a lot of solar power.
  - Battery discharge during the evening when there is a electricty consumption peak.

- Automatical frequency and voltage regulation in case of incident on the grid.

Energy Arbitrage – Operation data

Project Madinina

Projet Madinina – week from 1er/02/2022 to 07/02/2022



EDF use Akuo's battery in order to optimize his production assets

BATTERIES FOR VARIOUS TYPE OF USAGE

- Batteries forming the grid and replacing diesel generators in order to allow a increase the renewable share in energy mix.
- Batteries for grid operator to optimize his production assets.
- Batteries associated with PV to ease his grid integration

Renewables integration

Project examples

Bardzour	
Technology	• Ground mounted PV solar of 9 MWp • 4,5MW/9MWh of Li-ion storage
Commissioning	Dec-2014
Project type	IPP, on-grid
Client	EDF SEI

Les Cèdres	
Technology	• Shaded and greehouse PV solar of 9 MWp • 4,5MW/9MWh of Li-ion storage
Commissioning	August -2015
Project type	IPP, on-grid
Client	EDF SEI

Renewables integration

Project examples

Olmo 1	
Technology	• Ground mounted PV solar of 4 MWp • 2MW/4MWh of Li-ion storage
Commissioning	Dec-2014
Project type	IPP, on-grid
Client	EDF SEI

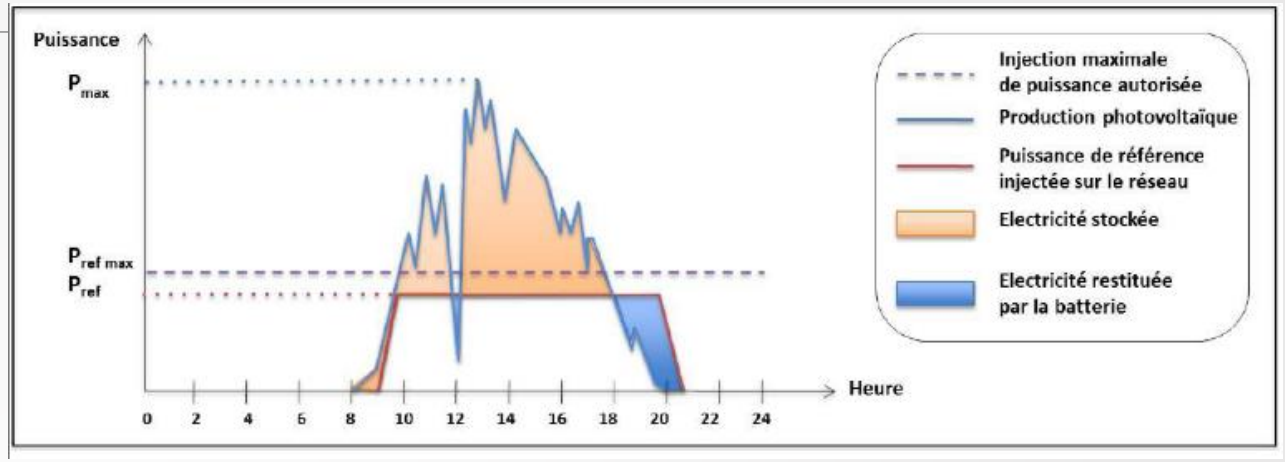
Mortella	
Technology	• Ground mounted PV solar of 7 MWp • 3,5MW/7MWh of Li-ion storage
Commissioning	August-2015
Project type	IPP, on-grid
Client	EDF SEI

Optimization of the PV+BESS power plant by Akuo's EMS

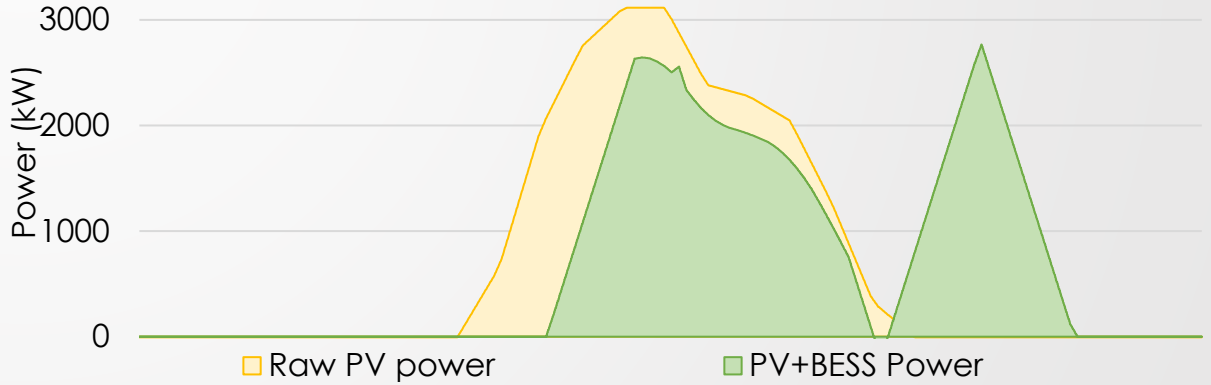
EMS functionality

- Day ahead annoucement of the injection profile. If not respected penalties are applied.
- Limitation of power injection
- PV smoothing : variation max : 2,5%P_{max}/min
- Power supply out of sunny hours (
- Frequency regulation

Akuo's EMS allows to maximise the power production while fitting with the operator rules.
→ Ease the integration of renewable power

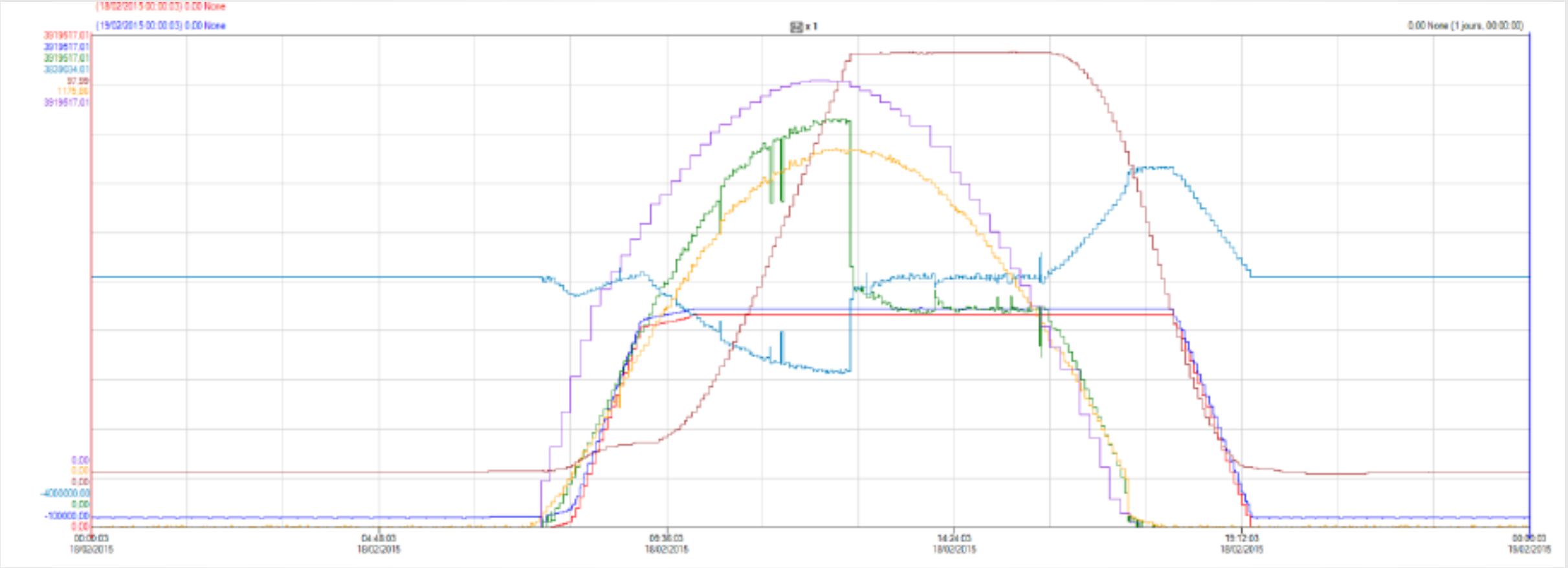


Profil d'injection typique de centrale hybride on-grid Akuo dans les territoires d'outre-mer



Renewable integration – Operation data

Project on Réunion Island



Trapezoidal injection profile defined by the EMS and storage in accordance with tender requirements vs default PV resource

BATTERIES FOR VARIOUS USAGES

- Batteries forming the grid and replacing diesel generators in order to allow a increase the renewable share in energy mix.
- Batteries for grid operator to optimize his production assets.
- Batteries associated with PV to ease his grid integration
- Batteries designed to support automatically the grid

Frequency regulation

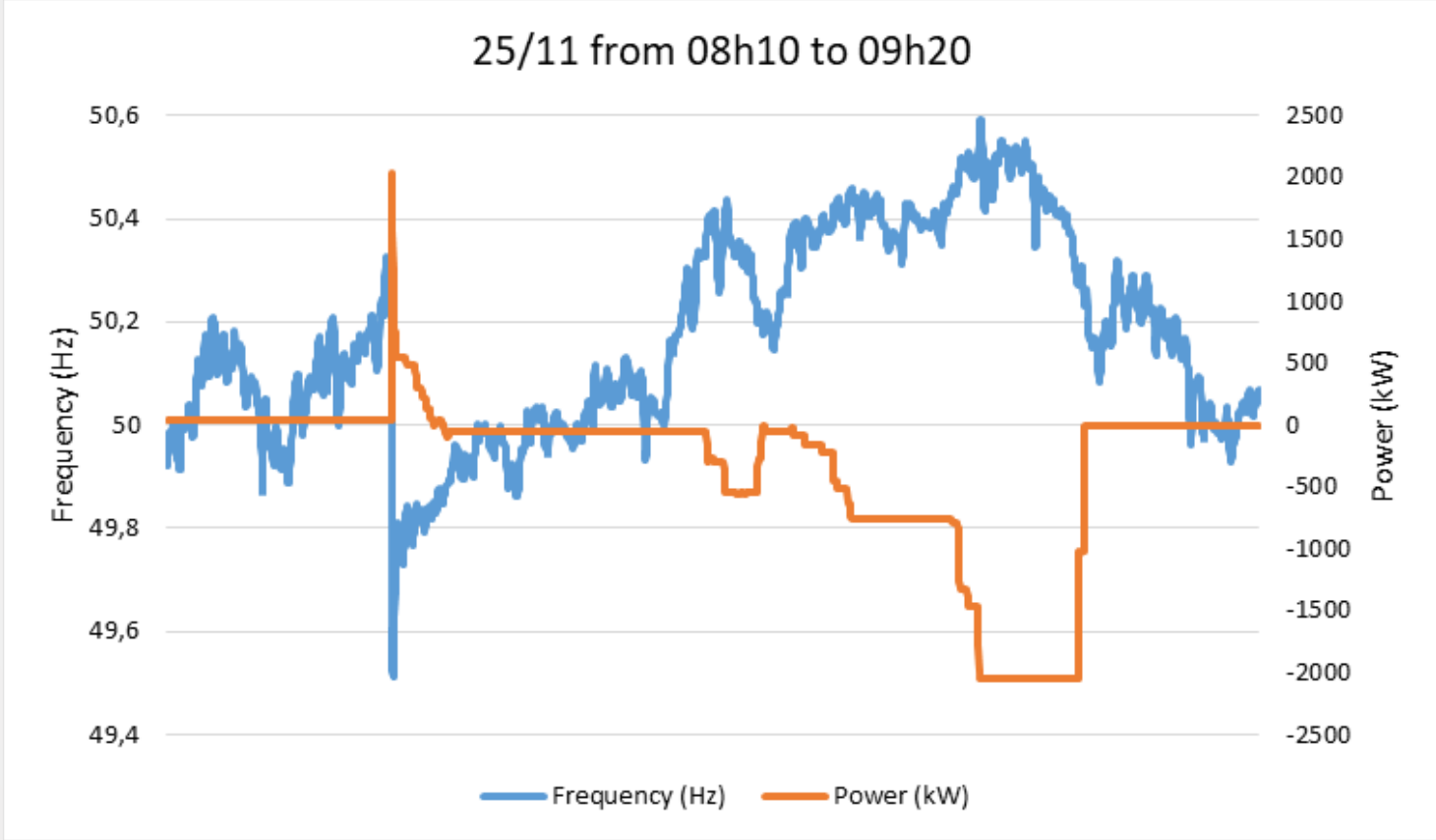
Project examples

Île Maurice : AMHE Amaury & Henrietta	
Technology	4MW / 2MWh (Storage GEM®) shared in two sites
Commissioning	July-2018
Project type	Frequency regulation
Client	CEB

Tonga 1	
Technology	7,2MW / 5MWh (Storage GEM®)
Commissioning	December-2021
Project type	Frequency regulation
Client	TPL

Frequency regulation – Operation data

Project AMHE

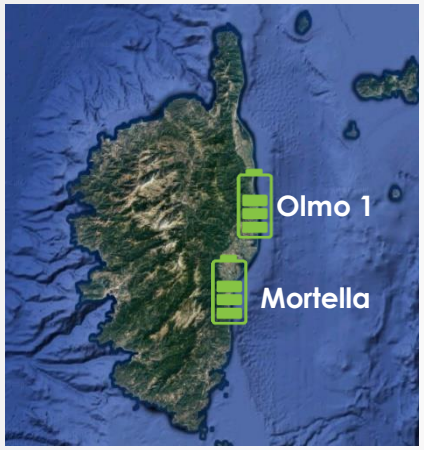


A very fast response in power stop the frequency deviation. Batteries can do it either when frequency goes down or goes up by injecting power of withdrawing it

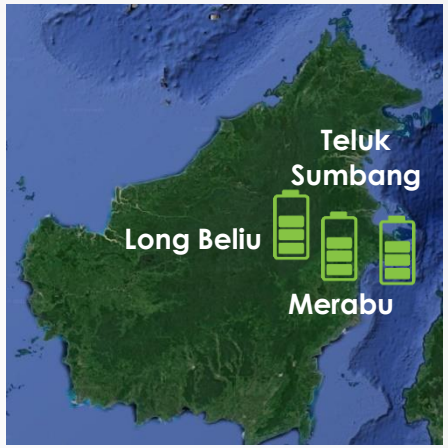
82 MWh of Storage installed in the World

Reunion island
18 MWh

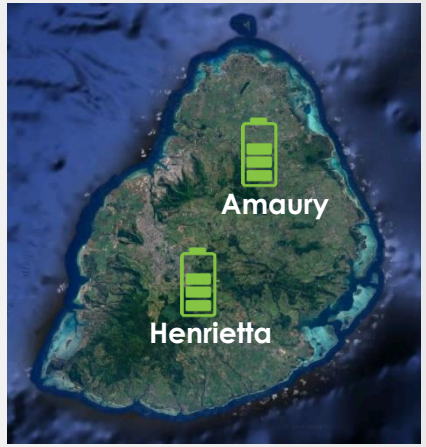
Corsica island
11 MWh



Indonesia
2MWh



Mauritius island
2 MWh



Solar + storage plants - CRE ZNI

- Integration of renewable energy in the grid
- Island context
- Ability to commit the day before on a smoothed and curtailed power profile specified by grid utility

MCA Indonesia

- Rural electrification of 3 villages thanks to GEM® solutions
- Off-grid context
- Construction of all electricity distribution

CEB Mauricius

- Frequency and voltage regulation
- Capacity firming
- Island context

82 MWh of Storage installed in the World

Tonga island
5 MWh

ADB tender

- 7,2 MW/5,3 MWh
- Frequency and voltage regulation
- Commissioning mid-2021

Tonga island
24 MWh

ADB tender

- 6 MW/24,0 MWh
- Arbitrage
- Commissioning mid-2021

Akuo EMS controls the whole island grid

Martinique Island
19 MWh

Madinina

- Standalone storage plant
- Frequency Regulation

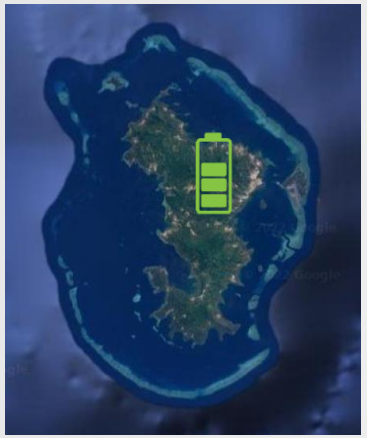
Union island
1 MWh

Vinlec : Union island

- PV + storage plant
- Full hybridization with existing genset
- EMS controls the whole island

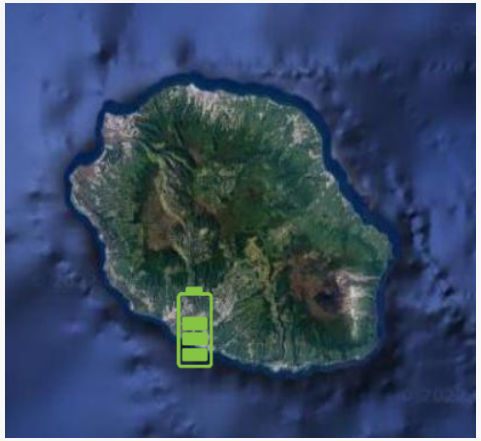
24 MWh under construction in 2022

Hamaha
4 MWh



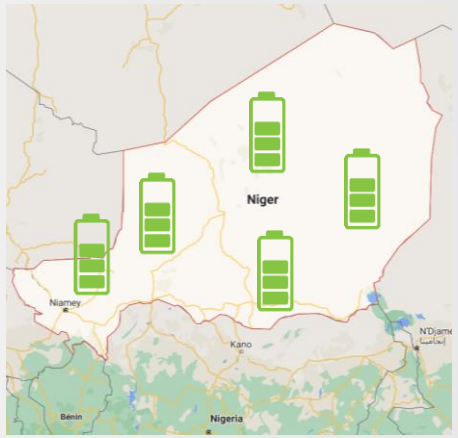
Agrimarguerite
4 MWh

Janar
10 MWh



New Caledonia
3 MWh

Niger
3 MWh



Solar + Storage Plant

- Integration of renewable energy
- Energy shift from peak hours to the evening
- Construction started in 2021

Solar + Storage Plant

- Integration of renewable energy
- Ability to commit the power profile communicated the day before
- About to be commissioned

Thermal Plant Hybridization

- Storage GEM ® to be deployed in 8 villages
- Solar solutions provided by a partner
- Project supported by The World Bank