# Implementing Li-ion Energy Storage on Island Grids

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saft

# Purpose and Benefits of Battery Storage on Island Grids

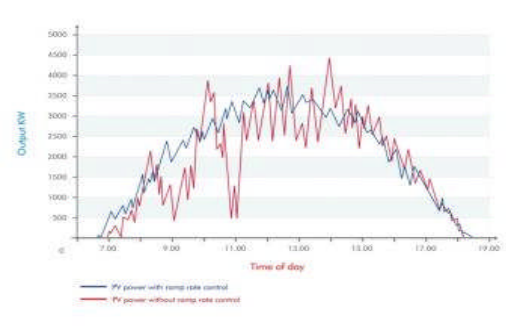
- Overcome technical limits in integrating intermittent renewables:
  - Smoothing of highly variable generation, control of ramp rates
  - Stick to the forecast:
    PV & wind power become firm and predictable components of energy mix
- Provide ancillary services
  - Cheaper than fossil based generation
- Avoid loss of revenue due to curtailment
- Avoid investments in balancing reserves

# Major Functions of Storage

## Wind & Solar generation

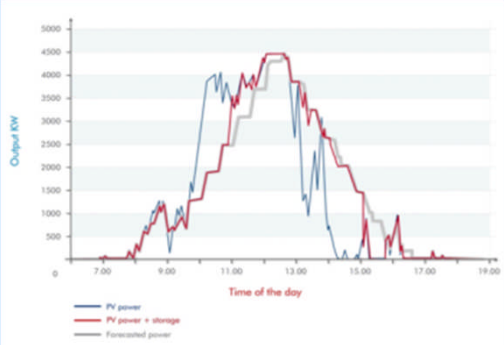
### Ramp control

Limit up & down ramp rates




### Smoothing

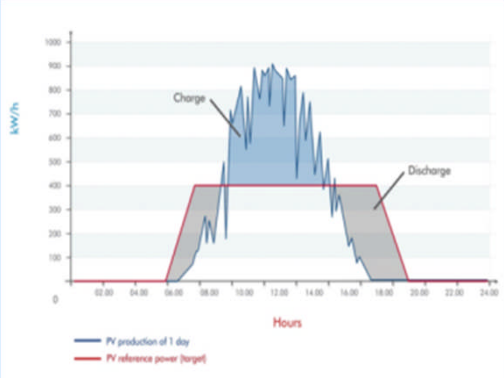
Keep production in forecast window




### Shaping

Stable power output

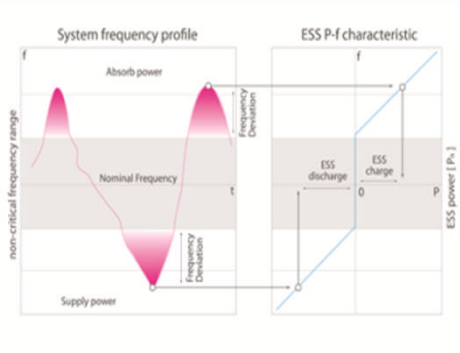
Controlled ramp up/down




## Grid

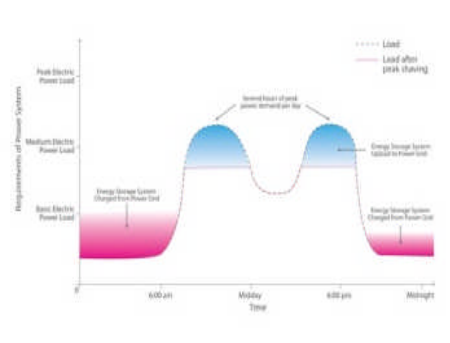
### Frequency Regulation

Injection/Absorption of active power




### Peak Shaving

- of consumption peaks
- of generation peaks

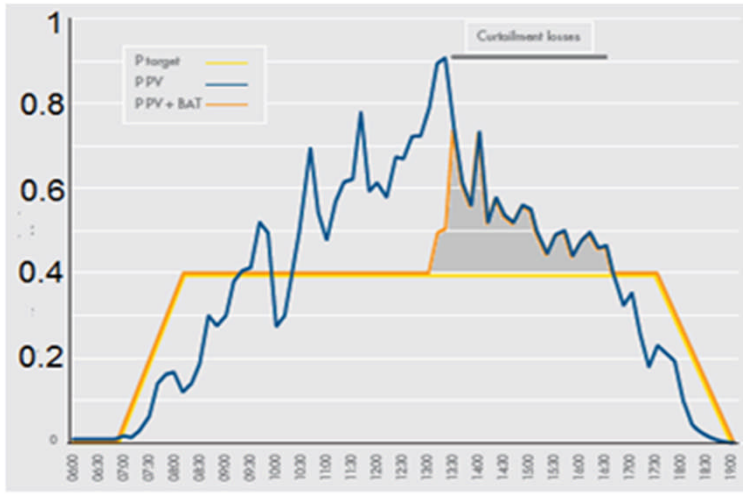


# La Réunion – CRE Tender

- 9 MW PV  PV plant
  - First project out of 16 contracts CRE (50MWp)
- 9 MWh Li-ion Energy Storage System
  - Consortium Saft, Ingeteam, Corex
  - 9 containers Intensium Max 20+E
  - 5,6 MVA converters in 4 containers
- EDF SEI specification
  - Constant power injection @ 40% Pmax
  - Primary reserve : 10% Pmax / 15 minutes
  - Voltage support by PCS reactive power
- Battery Optimization

| Energy capacity | Losses | Average DOD | Lifetime |
|---|---|---|---|
| 9 MWh | 11.3% | 69.8% | >12 years |
| 14 MWh | 3.5% | 56.3% | >17 years |
| 21 MWh | 0.7% | 44.9% | >20 years |

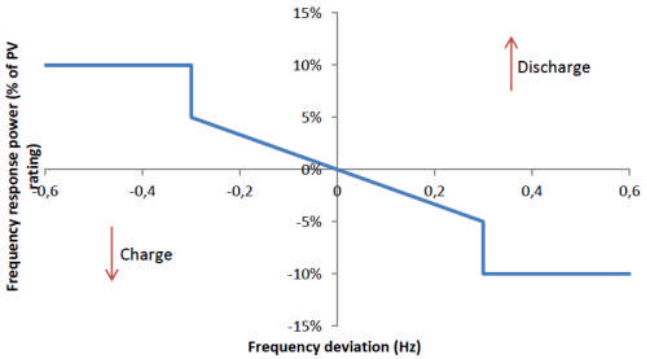
Installation
Octobre 2014



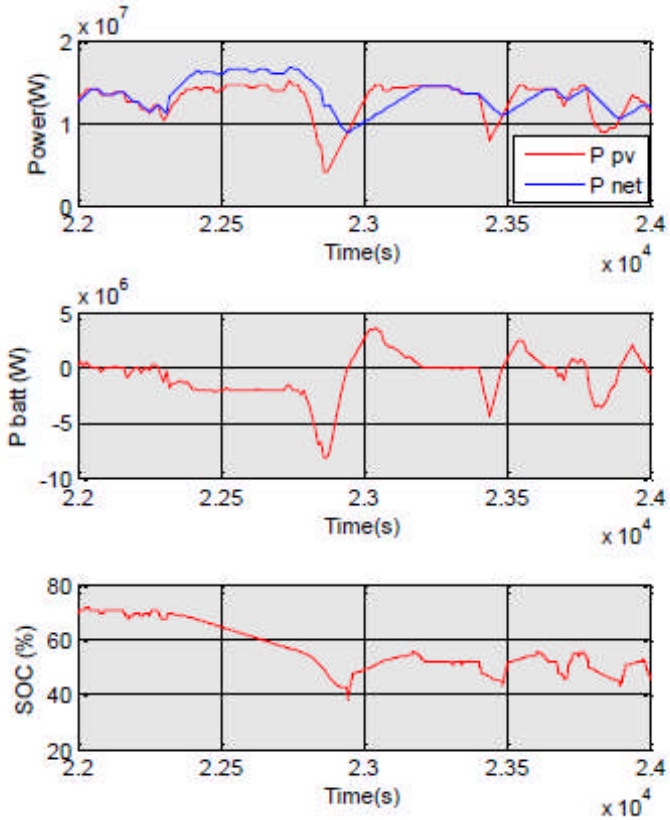
# Salinas 10MWp PV Power plant (Puerto Rico)

## PREPA Minimum Requirements

- **PV ramp rate control**: 10% per minute
- **Frequency response**
  - With 5% droop
  - Up to 9 minutes in case of large under-frequency
  - Required compliance > 98,5% in a week period

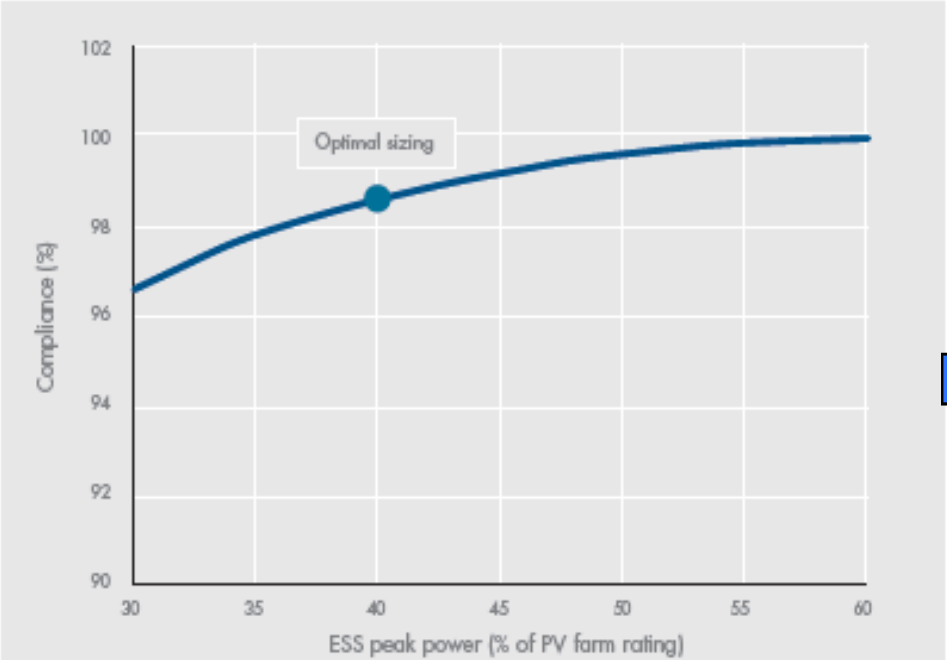



## Ramp Rate Control + Frequency response



# Salinas 10MWp PV Power plant (Puerto Rico)

## Optimal sizing




- Compromise between ESS peak power and compliance of MTR
- PREPA requires 98.5% compliance of MTR during a week period.

## The chosen solution

| PV Farm | Building blocks |
|---|---|
| 10MW | 3x (IM20P+PCS) |


**1,3 MWh**
**5 MW**

Operational
Oct 2014

# Takeaways

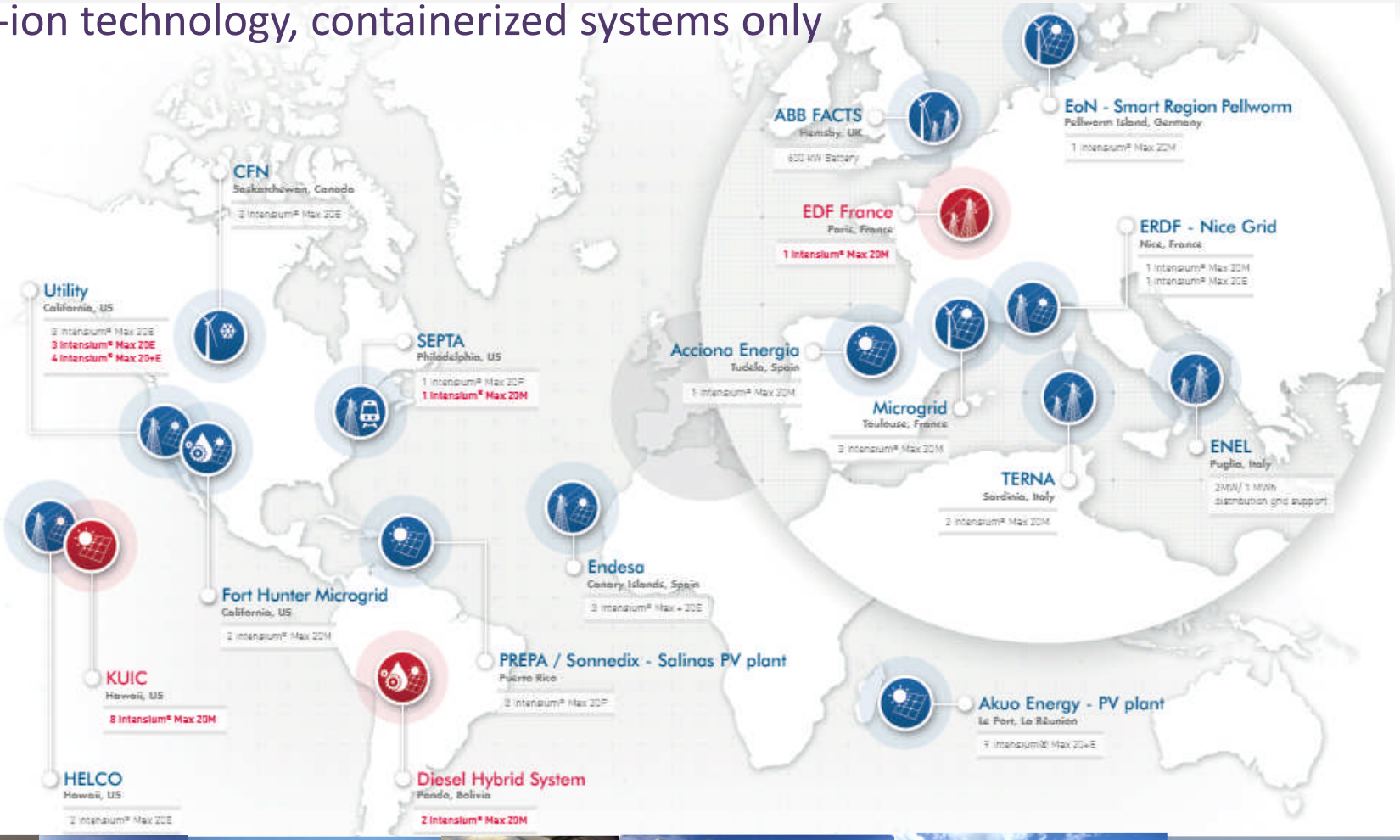
- One single device
  to provide multiple functions and to address multiple value streams

- Each system is unique:
  optimium Power & Energy versus requirements and cost

- Integration is key
  Battery – Conversion – Controls

# Energy Storage installations 2012/14

- Lithium-ion technology, containerized systems only




# Thank You

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