# How to Manage Intermittency on Islands?  
## EDF Case studies

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Promotion of Demand side Management
Stepping up Fossil-fired capacity to guarantee the energy balance of its networks and modernize the plants

Developing Renewable Energy Sources to limit the dependence on fossil fuel and protect its local fragile environment

EDF IES – Presentation in a nutshell

Guadeloupe
490 MW installed capacity
1730 GWh supplied in 2011
12% from RES
Level of intermittency: 30%

Martinique
473 MW installed capacity
1 576 GWh supplied in 2011
2% from RES
Level of intermittency: 22%

French Guiana
284 MW installed capacity
653 GWh supplied in 2011
60% from RES
Level of intermittency: 26%

St Pierre et Miquelon
27 MW installed capacity
45 GWh supplied in 2011
2% from RES

Corsica
703 MW installed capacity
2 130 GWh supplied in 2011
17% from RES
Level of intermittency: 30%

La Réunion
757 MW installed capacity
2 750 GWh supplied in 2011
30% from RES
Level of intermittency: 30%

EDF – More than 1 million customers
1,878 MW generation capacity
¼ Renewable sources

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EDF IES – Detailed vision of production mix

French Islands operated by EDF

- Oil: 19.5%
- Coal: 12.6%
- Hydro: 7.6%
- Import: 8.3%
- Biomass: 52.0%
- Solar: 3.6%
- Wind: 2.9%
- Geothermal: 0.9%
- Waste: 0.6%
- Biogas: 0.2%

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RES development: the main steps

- **1980s-90s:** RES = hydro
  - 50% of RES in islands with hydro (Corsica, la Réunion), share decreasing because of increasing load
  - 0% of RES elsewhere

- **1990s-2000s:** wind, biomass, geothermal
  - Rapid development of wind, issues in some islands (Crete – Greece)
  - Focus on the local disturbances due to wind (flicker, etc...)
  - Priority to RES for baseload generation (bagasse, geothermal, hydro)

- **2000s-2010:** PV
  - Boom in PV capacity, international trend exacerbated by local incentives

- **Goal for French islands in 2020:** 50% RES
  - An energy mix with both baseload RES and intermittent ones

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The Impacts

- **If an increasing share of generation comes from wind and/or PV**
  - Positive impact on climate change (less energy from fossil fuels)
  - Negative consequences on the power system: more frequency and voltage variations while less thermal plants for regulation

- **Wind and PV development needs more regulation**
  - 23 April 2008 decree: 30% power supply limit on intermittent energy on islands
  - Authorizing disconnection when reaching above limit (Last In, First Out)
  - EDF has to propose solutions to go over 30%

- **Increased operational risk of failure**
  - Load shedding, blackout
  - Impact of voltage and frequency variations on the appliances lifetime
  - Island system dispatcher becomes a fascinating job!
Solution for intermittence:

II.1 - monitoring

Illustration:
System PUSH is a dedicated tool to control all generation sources from 36kVA:

- a GPRS modem beside each meter sends every 5 minutes the active power to a central control room;

- a software calculates the share of intermittent energies and proposes disconnection, if necessary, to secure the electrical system.

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Solution for intermittence:

II.2 - forecasting

It works for wind in large Territories.

Difficult for small islands with mountains.

PV forecasting has still to be created for islands:
- Persistence, neighbourhood, neural network, meteorological models?
- With satellites, sky camera?

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Illustration: Pegase project

- Real time meteo sensors surrounding the island
- Battery energy storage
- High resolution meteo modeling
- PV production forecast tools
- Mathematical based optimization tools
- Forecasting, scheduling and firming the power.

Solution for intermittence: II.3 - demand side management

- Heat remote control
  - Water & building heating
- Coldness remote control
  - Air conditioning, industrial and domestic freeze
- Distributed back-up
- A smart energy storage

- Control by incentive tariffs
- Control by dispatching center
PV panels and electricity storage configuration

An electricity storage system:
- Allows to shape the electricity produced by the PV panels
- Contributes in maintaining the balance of the network (frequency, power at period of peak demand...)
- Enables the client to consume its own electricity and have access to energy during a cut-off and grid black out

500 installations to be rolled out in 3 islands

Energy gateway configuration

An energy gateway monitors the client’s equipment (electric heaters, air conditioning units, water heaters…) to:
- Reduce its energy demand
- Help to maintain the balance of the network (frequency, power at period of peak demand...)

1000 installations to be rolled out in 3 islands

Solution for intermittence:

Power storage, the ultimate solution to:
- ‘absorb’ intermittence,
- system backup,
- contribute to frequency and voltage control
- postpone additional investment in peak generation or T&D

But technology and costs bring us back to reality:
- Size limited for electrochemical storage
- available sites limited for hydro storage
- Need to pay for power and energy capacity

Still looking for the right economic model
- Who can own and operate the storage facility?
- Centralized or distributed storage? Which technology? For what use(s)?

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Illustration : Sepmeri project

- Sea water pumping storage: more than 10 years of operating in Okinawa – Japan (JPower)
- Potential sites in Guadeloupe, Martinique and La Réunion
- About 50MW, 20GWh for peak load and PV & wind smoothing

Conclusion

- High renewable energy targets in French islands
- Impacts to deal with on grid and system on a Cost Benefit Analysis approach
- Needs for an evolution of the regulatory framework taking into the new paradigm of intermittency (incentives, tariffs, storage...)