

PV Integration and storage optimization for a solar farm on a mall rooftop in Reunion Island

Authors : Sébastien N, Buessler E, Chaintreau E, Cros S

Presented by: **Évariste Chaintreau** evariste.chaintreau@reuniwatt.com

On session 3C : "PV and Storage", Tuesday 24th October 2017

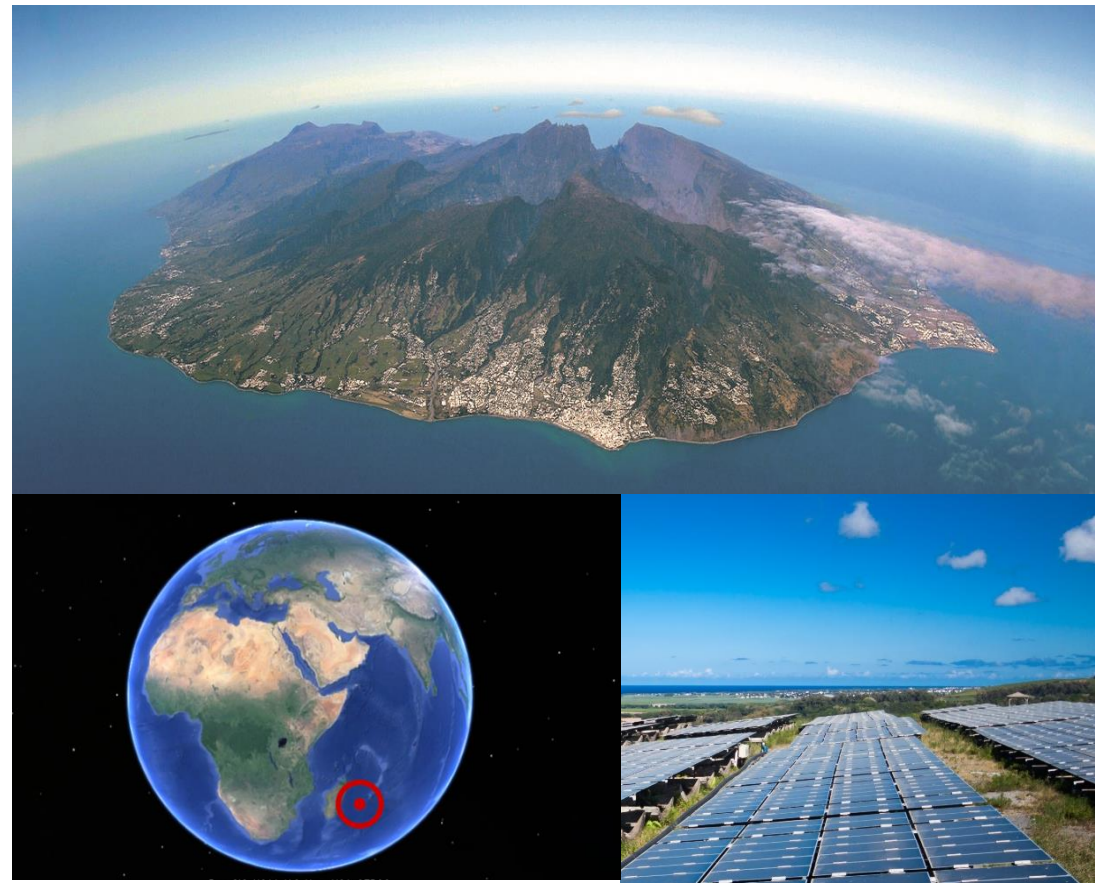
at 7th Solar Integration Workshop, Berlin, Germany



Reunion Island energy context

Reunion island's profile

- 850,000 inhabitants
- 841 MW overall production capacity
 - Diesel: 291 MW
 - Coal/bagasse (cane residue): 210 MW
 - Hydro: 134 MW
 - **Solar: 187 MW**
 - Wind: 15 MW
 - Biogas : 3 MW
 - Grid storage : 1 MW

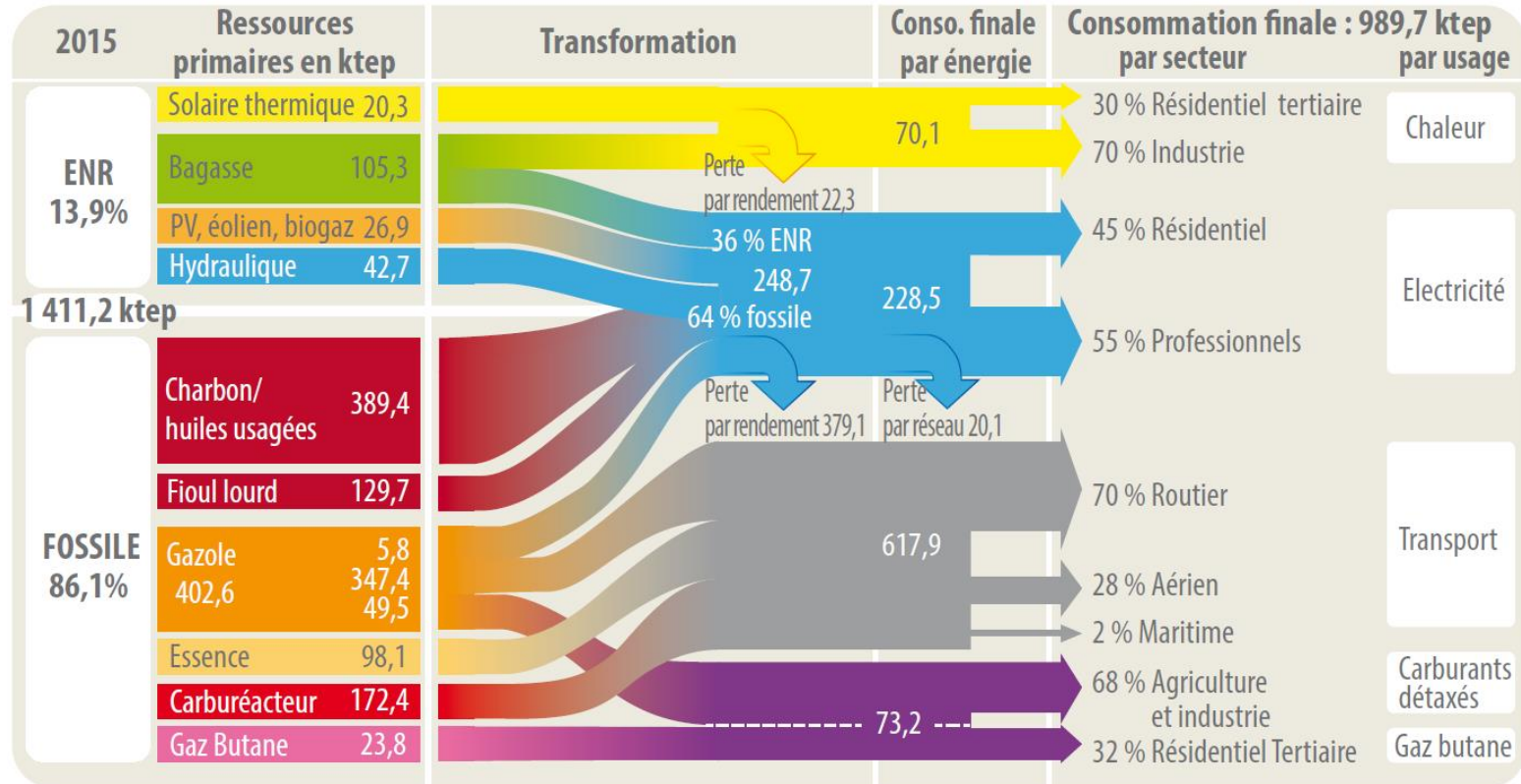


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Important energy challenges

- Fossil fuel dependancy :

Reunion Island: 86,1% **Mainland France : 47,5%**

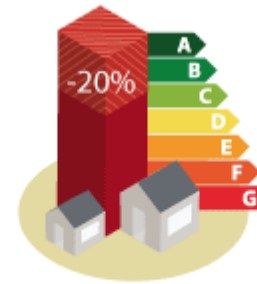


Ambitious energy targets and solar potential

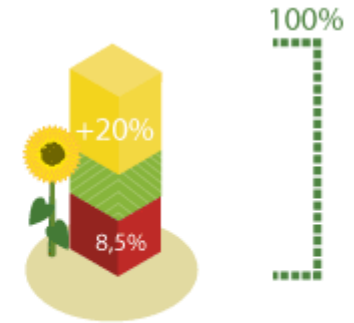
- European plan on climate change :
 - 20-20-20 targets



Green House Gases



Energy consumption



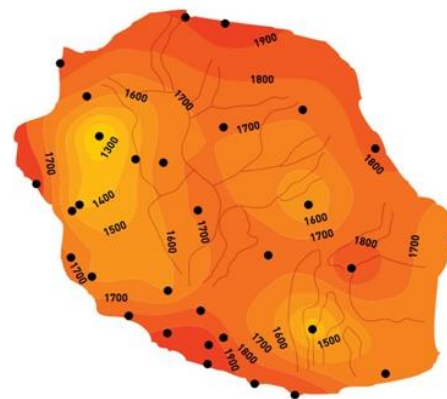
Renewable energy in the energy mix

Credit: Askja Energy

- French Overseas Departments and Territories targets :

- 100% autonomous energy for 2030
- 50% renewable for 2020

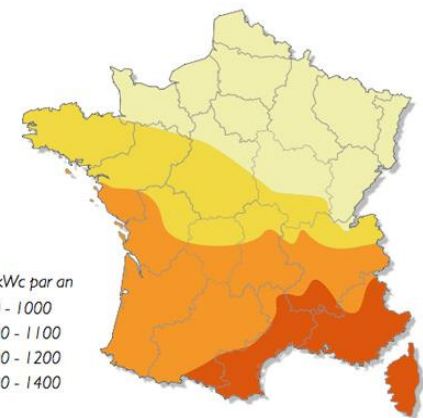
- High solar potential



Credit: MétéoFrance

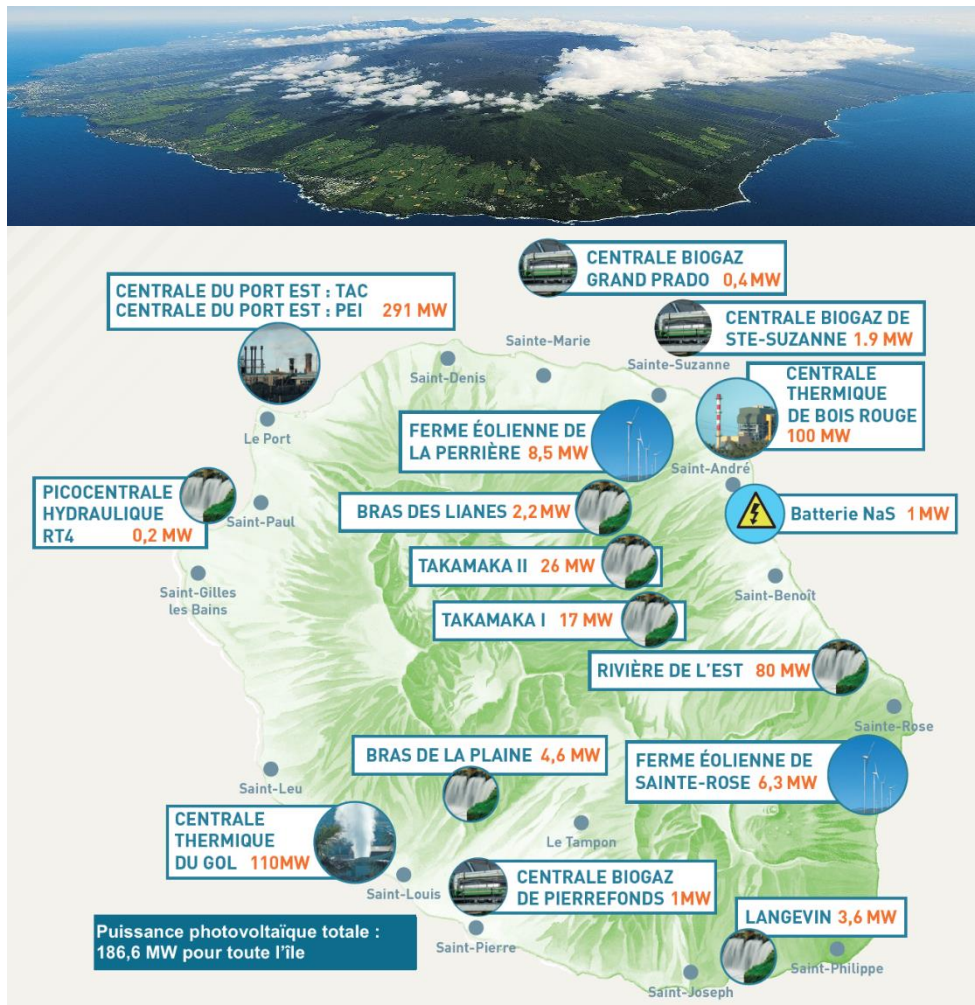


En kWh/kWc par an
800 - 1000
1000 - 1100
1100 - 1200
1200 - 1400



Crédit: ADEME

Reunion electric grid issues



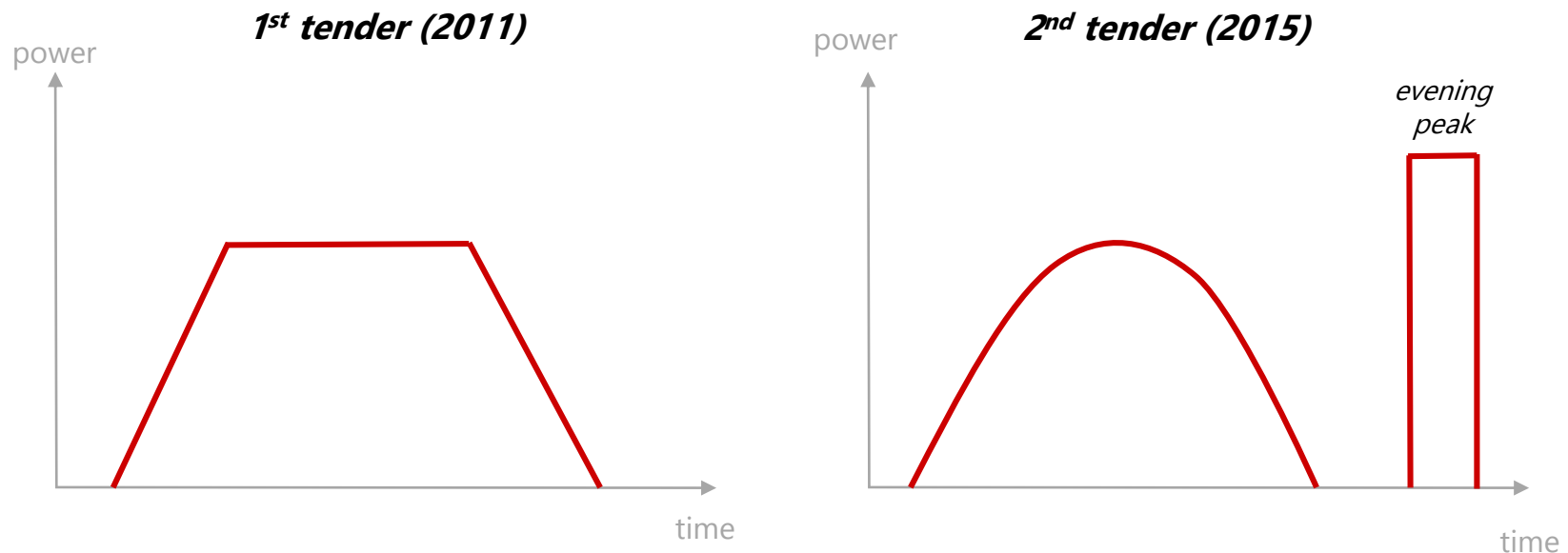
- No interconnection
- Operating reserve :
 - 211 MW Diesel Generator
 - 80 MW combustion turbine
 - ~50 MW Hydraulic Power
 - 1 MW Grid Storage
- Maximum renewable injection on the grid set to 30% by the local DSO.



French Energy Regulation Commission (CRE) initiatives for solar development

Solar Initiative for grid stability

- Tenders released by the French Energy Regulatory Commission (CRE), specific conditions for French insular areas
- Experimentation of rules regarding the feed-in profile tarif



Profile to be announced the day before, adjustment in intraday (for the 2nd tender)

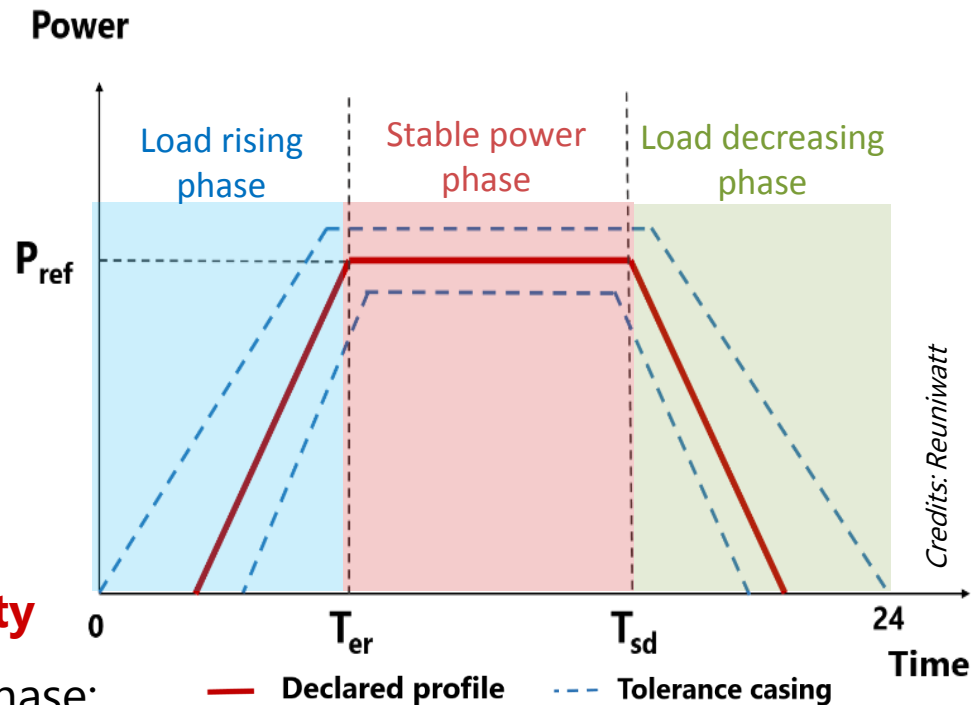
Feed in profile detail

■ Elements needed from the producer :

- P_{ref} : power reference for the stable phase
- T_{er} : ending time of the load rising phase
- T_{st} : starting time of the load decreasing

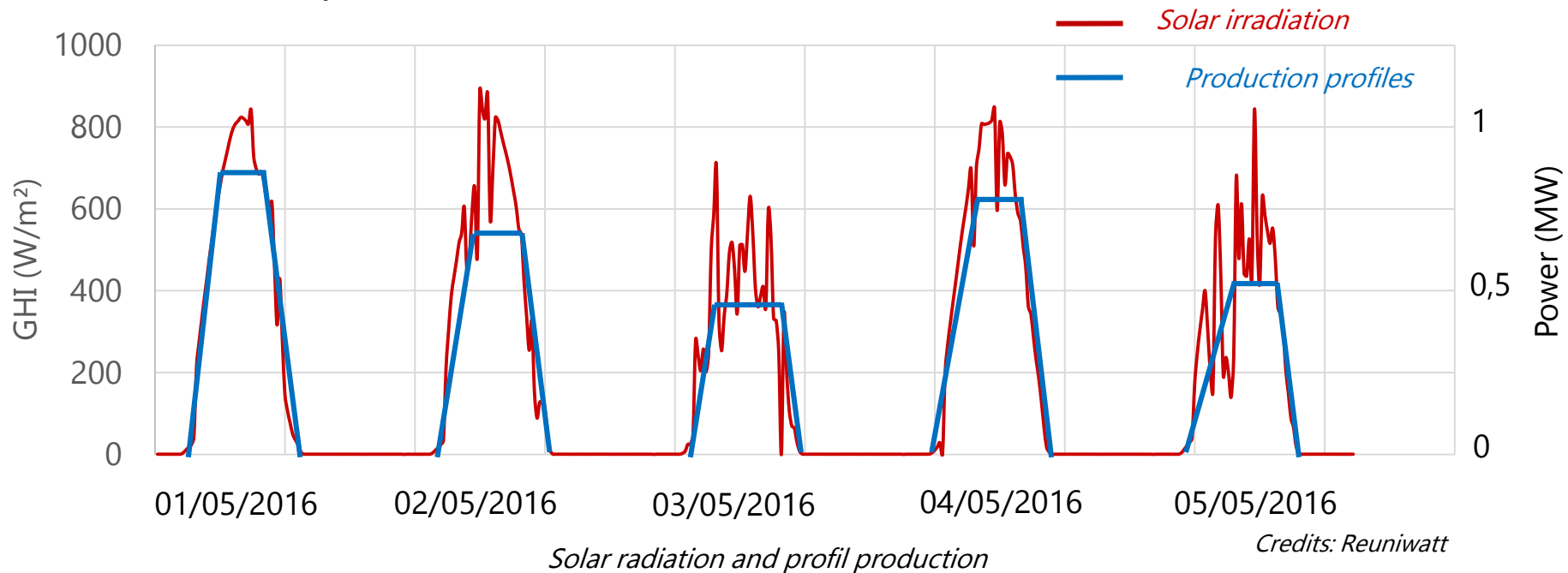
■ Producer must respect:

- $P_{ref} < 40\%$ of installed capacity
- During rising and decreasing phase:
 - The power slope must **remain between 0 and 0,6%** of the total installed capacity
- During Stable power phase:
 - The power injected must stay around P_{ref} with a **2,5% tolerance**

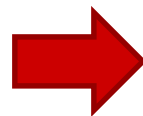


Expectation on the solar generation

■ Profiles expected:



Solar producers



Actor/manager of their
Intra-day and Short-term stability

Solar producer needs with this new regulation

- Storage capacity:
 - Due to peak shaving (P_{ref})
 - High response time
 - Appropriate capacity sizing
- Forecasts at diverse time horizons required :
 - **Day-ahead** forecast for profile declaration commitment
 - **Intra-Day** forecast for storage optimisation
 - **Short-term** forecast for operational plant management



Credits: Albioma

Credits: Reuniwatt



“Le Portail” solar power plant

Le Portail, mall rooftop solar power plant

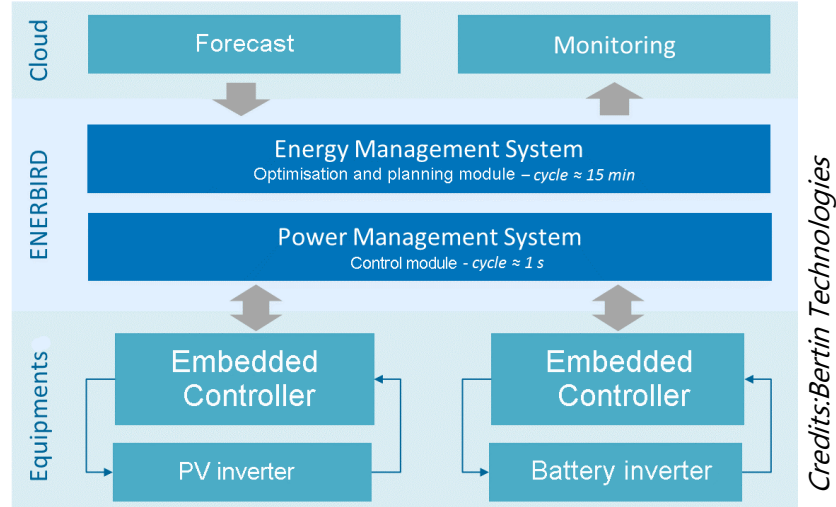
- located in Saint-Leu, Reunion
- In operation since September 2014
- 946 kWp rooftop solar panels
- 1200 kWh lithium storage capacity



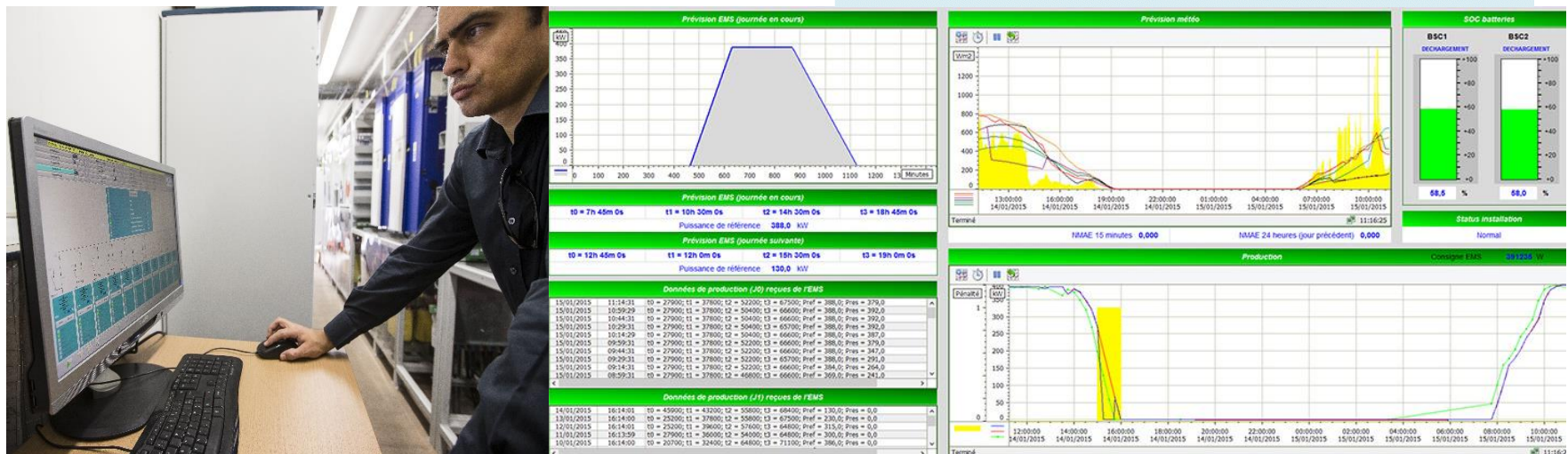
Credits: Albioma

Energy Management System (EMS) deployed

- Automatic forecast data acquisition from Reuniwatt
- Optimum Storage and injection recalibration every 15 minutes
- Automatically send next day power profile at 4PM every day



Credits: Bertin Technologies



Credits: Albioma



Focus on Reuniwatt solar forecast technologies

The Portail solar power plant forecast details

- Reuniwatt provide forecast on
 - **Global Horizontal Irradiance (GHI)** with its components :
 - *Direct Normal Irradiance*
 - *Diffuse Horizontal Irradiance*
 - **Temperature**
 - And their related **confidence interval**

Each
15 minutes

32 hours
ahead

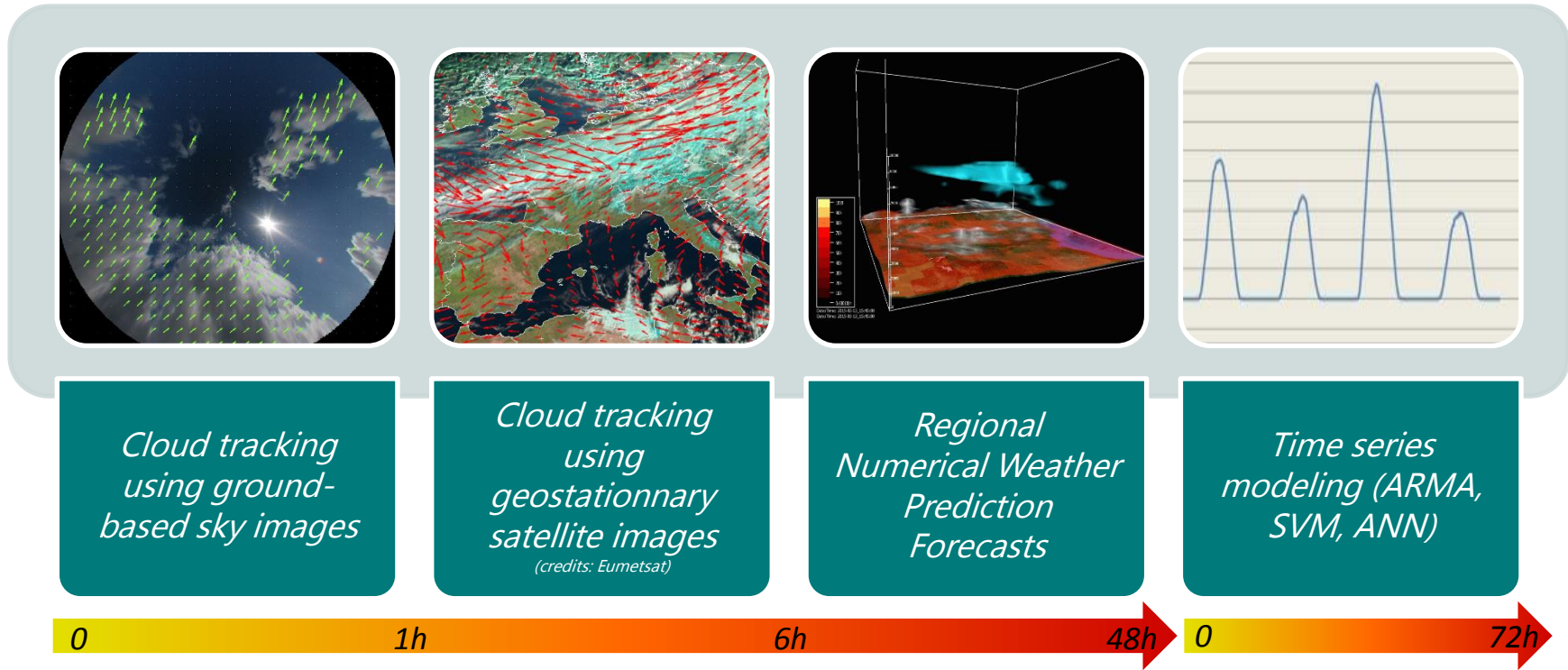
Granularity
15 minutes



Credits: Reuniwatt

Reuniwatt solar forecasting tool : Soleka

- A multiple technology approach to ensure the best performance forecast for every time horizons and spatial scale :



Credits: Reuniwatt

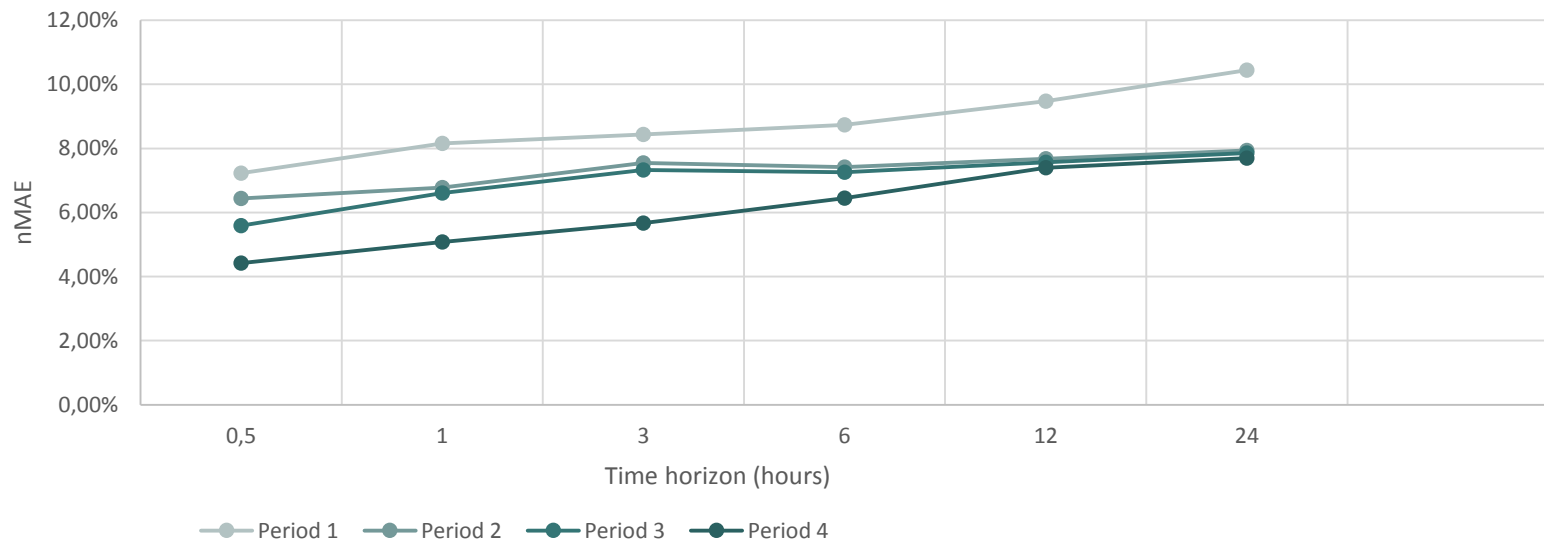


Results

Impact of the forecasts on the Portail PV storage system

- Project allow us to improve our forecast accuracy :

Measured performance of the production forecasts



Credits: Reuniwatt

- But also to improve solar production injection of the power plant:

87 to 95% production injection



In Conclusion

Conclusion

- On this use-case application of solar forecast solutions deployed on PV + storage systems we have seen:
 - Forecast solutions are suitable solutions to reduce solar variability on the grid
 - The global system allows us to inject more photovoltaic electricity on the grid and maximise income of solar power plants
 - Those systems are particularly interesting for feed-in-profile systems as currently in experimentation on Reunion Island
- Possible research perspectives for the forecast solution
 - Adjust the current deployed system to integrate the 2015 tender regulation with:
 - intra-day adjustment
 - evening price calls on peak-hour demand mechanism
 - Estimate, with the deployment of similar systems, the possibility to increase the renewable energy injection limit, currently set to 30% of the total mix.

— Reuniwatt —



Thank you!

Evariste Chaintreau, Forecast integration solutions researcher
evariste.chaintreau@reuniwatt.com
www.reuniwatt.com