Reuniwatt

Excellence in forecasting

Fuel saving assessment from a simulated hybrid photovoltaic-diesel system using forecasts-integrated control from a sky imager

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Sky imaging team engineer

June 19

A leader in cloud observation and forecasting

- Founded 2010
- Head Office in Reunion Island (France), Business offices in Paris and Toulouse
- Staff: >20 employees, 5 PhD
- Offering services for 3 markets:
  - Renewable energy
  - Atmospheric science
  - Defence & Space
- Particular emphasis on solar energy forecasting
- Coordinator of IEA task16 action on evaluation of forecasting techniques
- Strong investments in R&D: >50 scientific publications, 4 patents

A complete solar data and forecasting portfolio

Solutions for all solar stakeholders

Our expertise addresses all the solar photovoltaic value chain.

Project development

Asset management

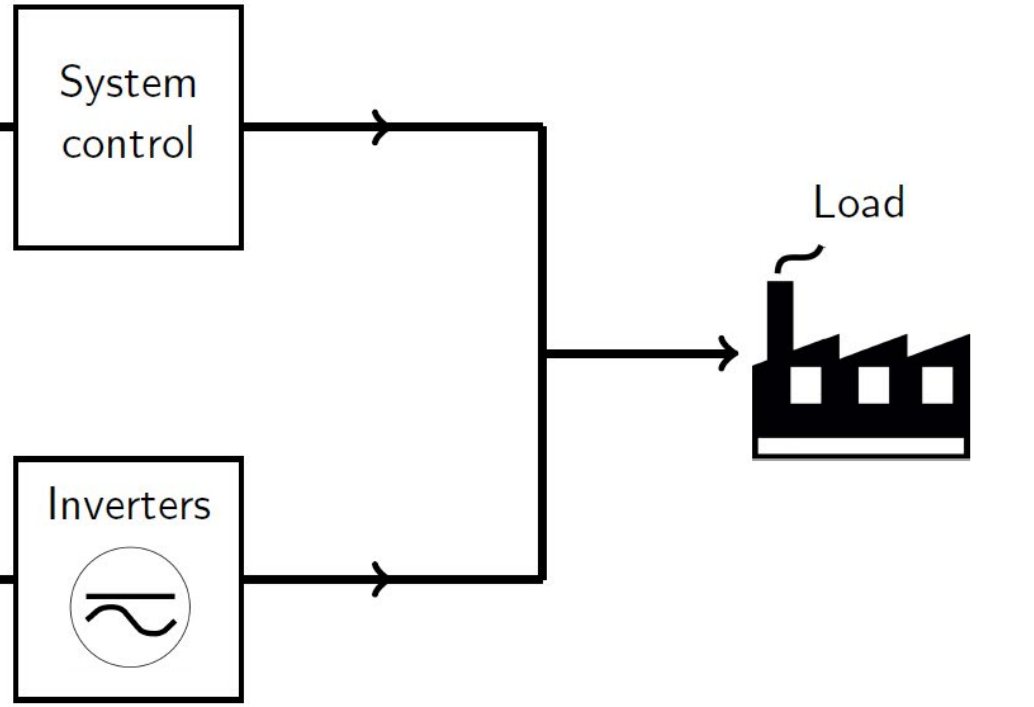
Energy trading, aggregation

Grid management

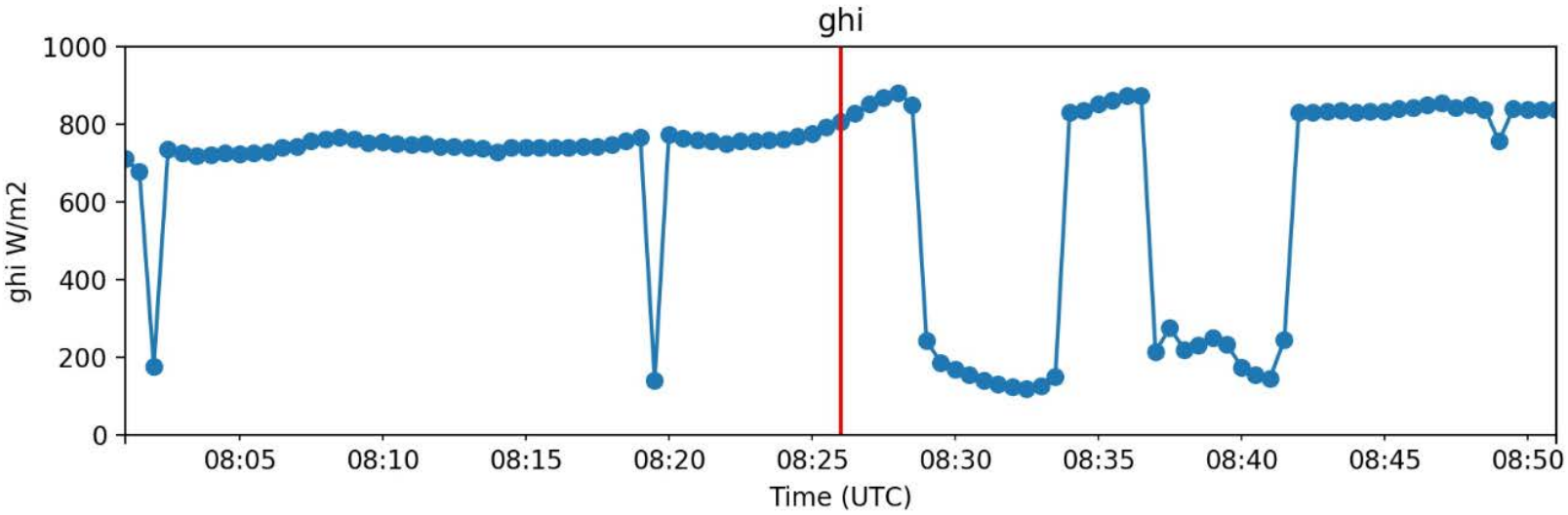
Microgrids & off-grid solutions

Smart grids & Smart cities

PV-Diesel hybrid systems

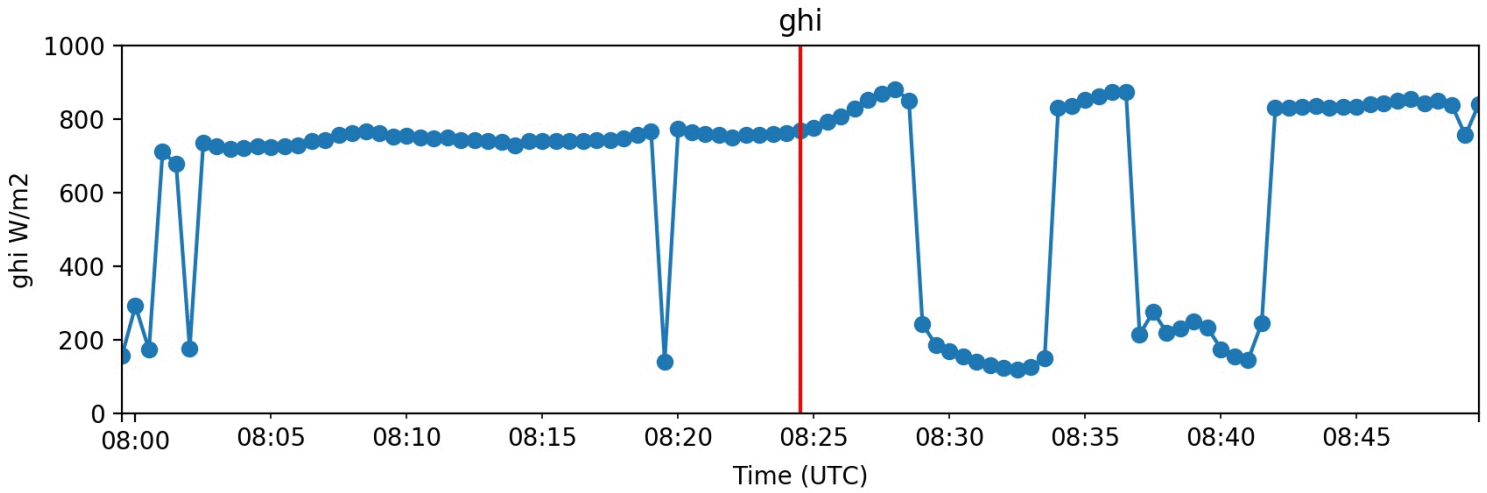


Chase the clouds



- Extra spinning reserve 
  - Genset runs at partial load
  - Increase fuel consumption
- Battery storage 
  - Increase CAPEX
  - Hard to know how long the battery will last (depends on the control scheme)

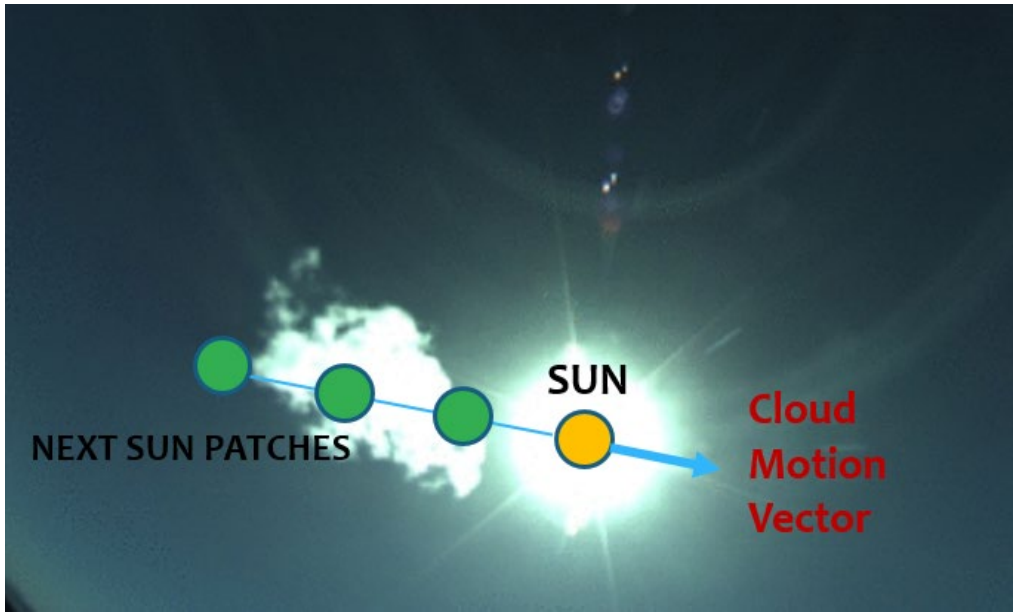
Chase the clouds



Sky Cam Vision™: the visible-range sky imager

- 360° high-resolution images of the cloud ceiling thanks to a fisheye lens
- Solid, reliable hardware
- Reduced maintenance
- Sftp/Modbus communication
- Proven compatibility with several hybrid controllers

Forecasting methodology



- Cloud motion is assessed with optical flow algorithm
- Pixels coming towards the sun are used as model inputs
- A trained Machine Learning then uses this data to perform a forecast

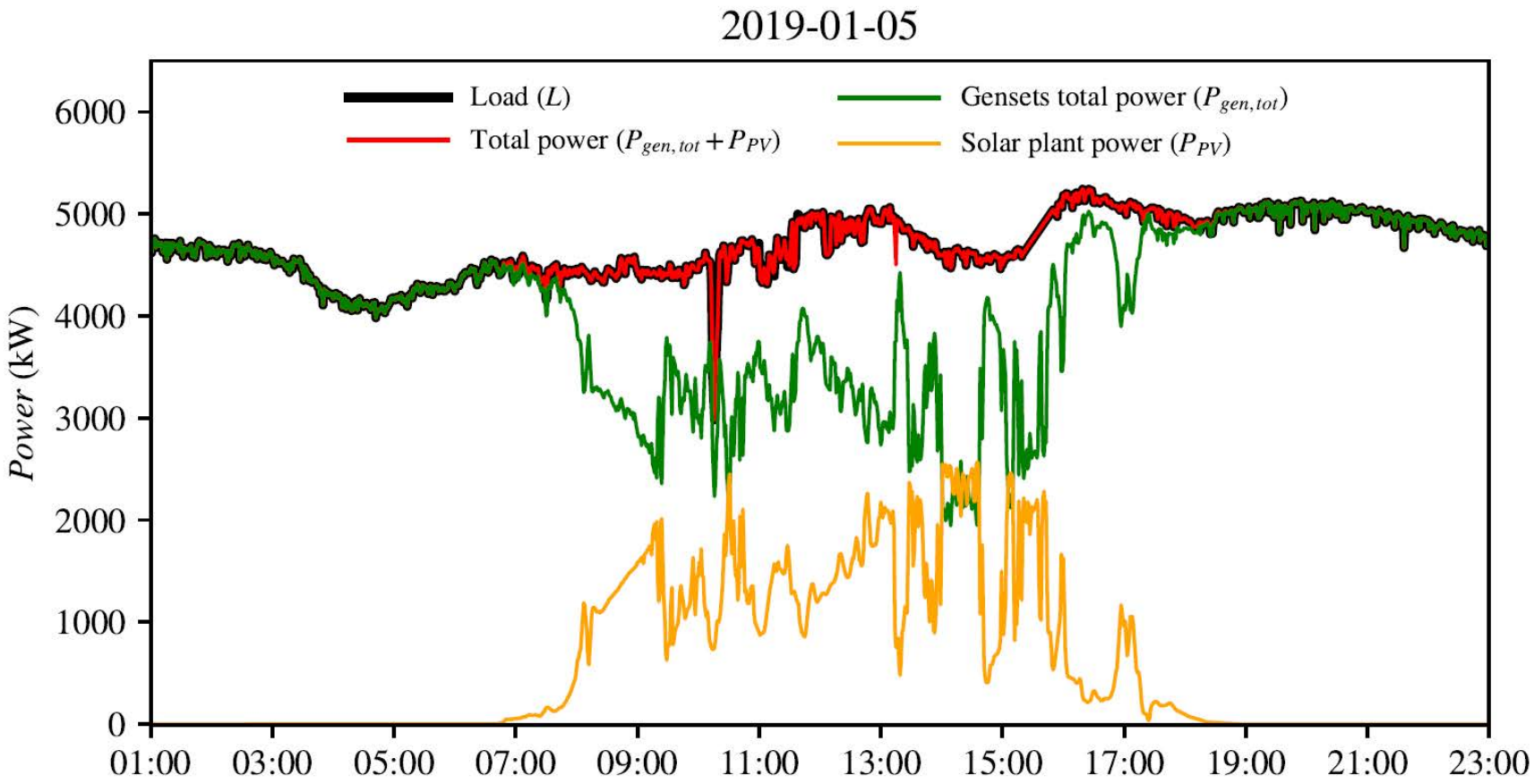
Short-term forecasts for a PV/diesel microgrid in Oïapoque, Brazil

- Plant located in Oïapoque, Brazil
- 24,000 inhabitants community in the Amazon rainforest
- Isolated from the national grid
- 4 MWp PV + 12 MW gensets
- Operated by Voltalia
- DEIF controllers

voltalia

DEIF

Short-term forecasts for a PV/diesel microgrid in Oïapoque, Brazil



Credits : Voltalia

Short-term forecasts for a PV/diesel microgrid in Oïapoque, Brazil

- We used power and load measured at Oïapoque to feed a home-made PV-Diesel generator plant simulator (*Hybrid Cast*)
- Simulation parameters
  - A gensets requires 2 minutes to warm up
  - Genset minimum runtime is 30 minutes
  - A genset can only be run as low as 30% of its nominal output power
  - 2 minutes ahead forecast are use to start genset when needed
- Economical parameters
  - Fuel price of 0.9 €/l i.e **21 c€/kWh**
  - PV price of **7,5 c€/kWh**

Short-term forecasts for a PV/diesel microgrid in Oïapoque, Brazil

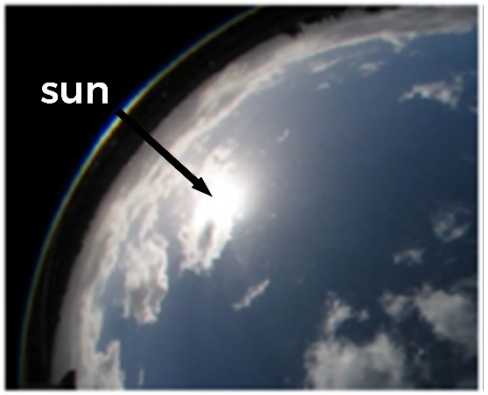
With the current PV/Diesel ratio

- Current sky cam forecast enables to save **~5 000 €/year**
- A perfect forecast would enables to save **~20 000 €/year**
- *cf* paper submission #42 for details
- We can improve the performance by optimizing the ignition/extinction rules. No complex optimization was performed
- We can improve the performance with forecasting algorithm fine-tuning

With an increased PV/Diesel ratio

- More PV injection would improve the energy cost
- But then, forecasting becomes one of the key player of the system
- And forecast ROI would increase
- Improved forecasting & benefits can be reached with Reuniwatt infrared camera Sky Insight™

Sky InSight™: the thermal infrared sky imager



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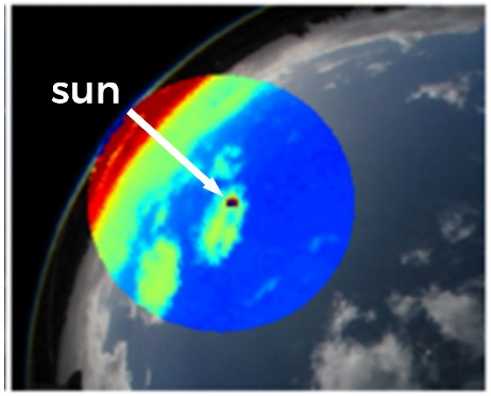
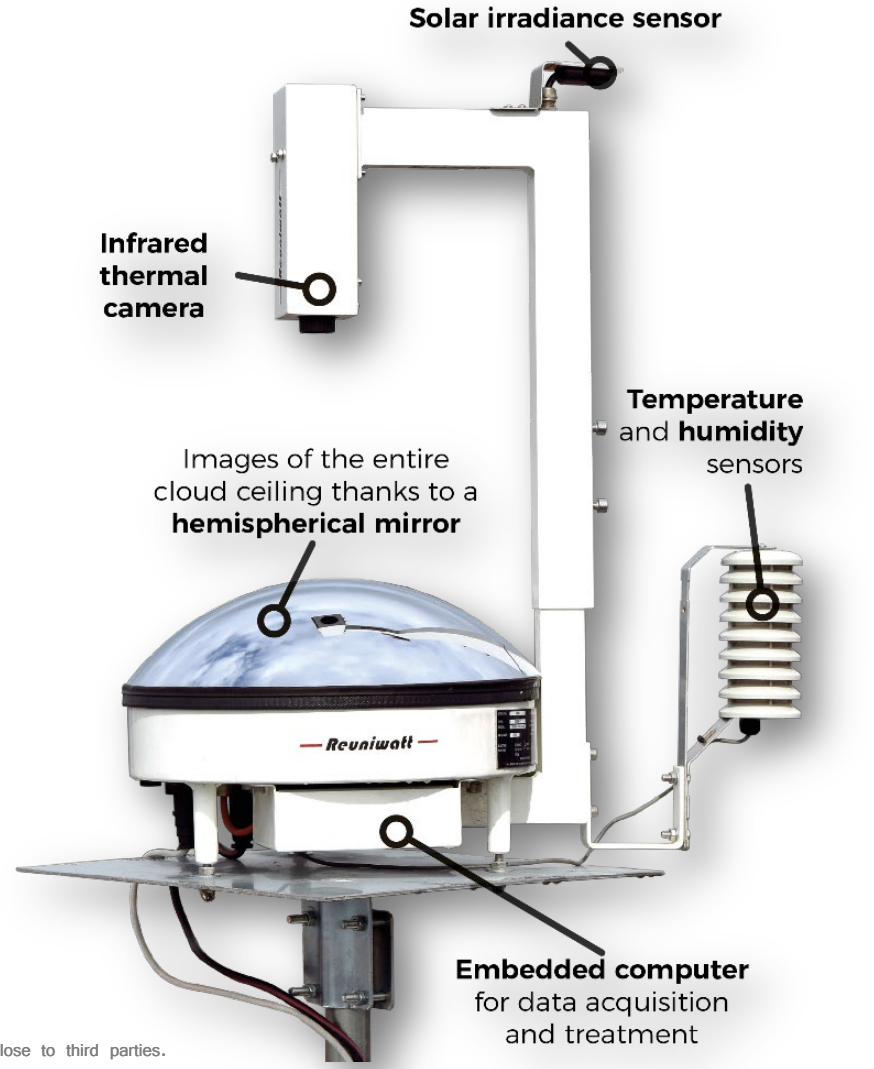


INFRARED



Perspectives

- **Reuniwatt R&D**
  - Continously improve our sky imager forecasting skills
  - Improve our simulator capacity to optimize the sizing, forecasts and control scheme all together to reach the maximum benefits
- **Voltalia - Oïapoque plant**
  - reduction of fuel consumption have been observed since the camera is operating (november 2018). We should be able to deliver consolidated fuel consumption statistics at the end of the year
  - Work on the control scheme improvement with the support of DEIF
- **Other projects** currentlty running in Australia & Africa.
- Sky cameras are a valuable tool for genset control
- the more we experiment, the more we increase the ROI : **give it a try !**

Contact

Would you like more information?
Do not hesitate to contact us.

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