Solar energy assessment and forecasting in insular regions: the Tahiti case study

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Context

Grid management
How to maximize the use of RE while ensuring power network stability?

Demand/supply balancing and scheduling
➔ 12 hours ahead total PV production probabilistic forecasts, every 1 hour
Spinning reserves management (fuel saving, maintenance costs)
➔ 10-30 minutes ahead total PV production probabilistic forecasts, every 1 min

Grid stability

- Ensured by thermal generators only
- Spinning reserves regulation + 85% PV production / highest genset power
- More flexible thermal generators
- Storage systems (virtual synchronous generator)

Energy transition plan

- 37% RE in 2020
- 75% RE by 2030 (2015 policy)
- 55% RE by 2030 (current pathway)
- Energy sufficiency: 2% consumption
- ~5 MW hydropower (~75 GWh)
- ~70 MWp solar PV (~10 GWh)

100% electric mobility

Hybrid plant development & operation
How to enhance projects profitability at the different stages?

Project development (CAPEX optimization)
➔ Solar resource and PV+ESS energy yield assessment
Plant operation (OPEX reduction)
➔ 12 hours ahead PV+ESS production forecasts, every 15 minutes

Project development

- Use of historical and live data
  - Network of 10 pyranometers
  - 40 supervised PV plants + estimated irradiance (inversion modeling)
  - Satellite derived irradiance data
  - Impulse and PV forecast data
- Simulation platform (SPIDER)
  - Modeling of PV-ESS
  - Optimal planning and control strategies
  - Simulations using historical data (measurements, estimates, forecasts)
  - Techno-economic indicators

Solution: Cloud-Edge Physics-AI forecasting system and services
Results: H+12 and M+30 forecasts examples and performances

Perspectives

- Additional weather/cloud observation and PV monitoring systems
- Data assimilation into HR NWP models
- More AI (e.g. ML based cloud nowcasting using satellite imagery)

More info:

Results: solar resource and PV-ESS yield assessment; ESS optimal sizing