A tailored solar power forecasting system for optimized grid management in Tahiti, French Polynesia

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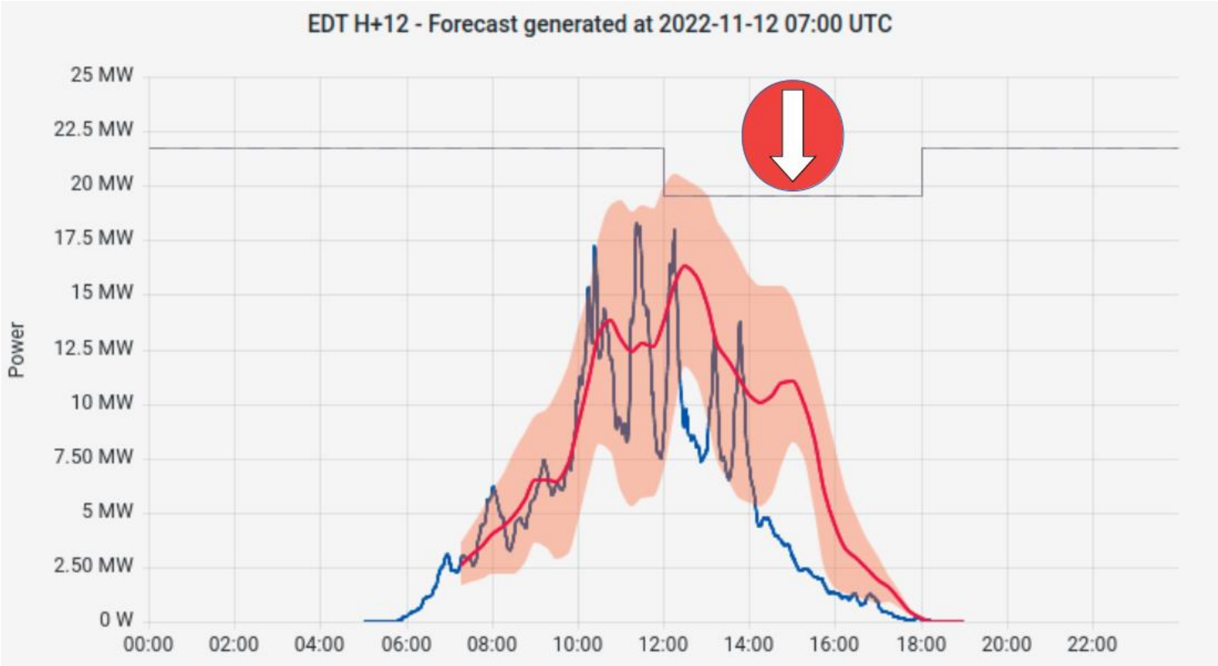
Insular electrical systems are a particularly demanding type of power grids. The remoteness of most islands makes it impossible to take advantage of power production from inter-connections. The increasing share of Variable Renewable Energy (VRE) in the production mix increases the risk of grid instability or blackout. Consequently, insular systems require highly accurate weather forecasts to efficiently anticipate the variability of the power production.

The power grid of Tahiti in French Polynesia belongs to that type of system. The local grid operator Electricité De Tahiti (EDT ENGIE) relies on a production mix made of thermal generators (66%), hydropower with small storage capacity (27%) and solar photovoltaic (PV) with >2800 rooftop installations (7%). The share of Renewables should keep increasing and is planned to reach 75% by 2030. Solar plants are distributed all around the island, maily on coastal areas. The tropical climate combined with the complex topography of the island make the meteorological conditions highly variable in time and space and the weather forecasts particularly difficult.

To tackle this issue, Steadysun developed a tailored intraday solar power forecasting system based on a combination of several global and regional numerical weather prediction models, satellite imagery, custom confidence indicators and post-processing techniques. A dedicated 1km-WRF model has been configured and optimized to get the best performances for cloud cover and solar radiation variables within the framework of the MoNuTeR project. The PV production forecasts are generated for 1) a set of 35 monitored PV plants and 2) a set of virtual power plants gathering by location small and unmonitored plants. Then, the confidence in the forecast is quantified in two ways with: 1) a P20-P80 uncertainty interval based on the inter-models dispersion and 2) a binary confidence indicator specifying if there is a risk of a much higher/lower PV production in the morning or the afternoon. This indicator has been designed to catch the uncertainty related to the location/timing of convective systems by comparing the local prediction with the predicted meteorological conditions over the surroundings of the island.Finally live correction based on PV measurements is applied to correct the remaining error. It uses the past hour data to quantify the best deterministic scenario and the high frequency variations around it. The correction is applied up to 4 hours ahead with a smooth return to initial forecast.

This forecasting chain has been operational in Tahiti for several years and is used by EDT ENGIE for energy dispatch scheduling. It has proven its ability to forecast PV production 12 hours in advance and to provide useful information on the uncertainty related to tricky weather conditions. Independent producers will soon be operating hybrid PV-storage power plants that will require the use of these forecasts to comply with the applicable grid code.

1.https://www.steady-sun.com/monuter-project-better-forecasting-solar-production-to-reduce-costs-of-variability/


EDT H+12 - Forecast generated at 2022-11-12 07:00 UTC
25 MW
22.5 MW
20 MW
17.5 MW
15 MW
12.5 MW
10 MW
7.50 MW
5 MW
2.50 MW
0 W
Power
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00