Wind Power Forecasting

BY:

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Context

In 2012, the Italian Regulatory Authority for Electricity and Gas (AEEG) approved the ***delibera* 281/2012/R/erf**, aimed at improving forecasts of power production. Currently, imbalance charges are spread over consumers. With the *delibera*, utilities unable to forecast their future production with sufficient precision will pay those costs.

SecurecoPro, through data provided by Italian energy services operator GSE, **estimates** that, given current average absolute error in forecast of around 25%, **utilities would pay about €8,000 for each GWh** produced. Still, a reduction of this error to 15%, achievable with today's technology, would reduce the cost by 33%. In other words, a **10 MW plant would gain about €35,000 annually** from proper power forecasting. This only taking into account costs arising from the *delibera*: there would of course be increased profits in trading as a result of power forecasting..

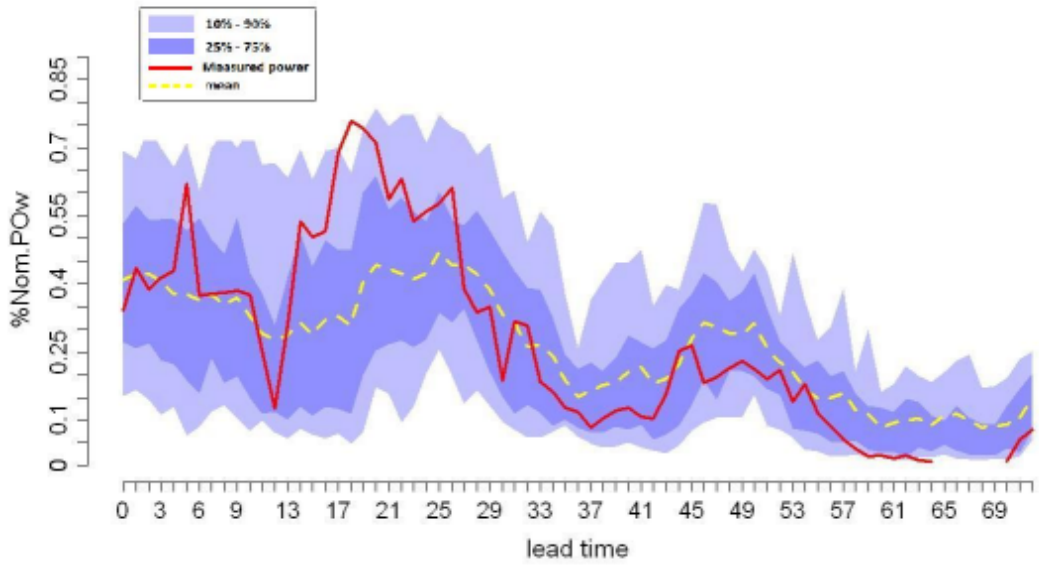
SecurecoPro Wind Forecasts, developed using **real data** provided by **Italian utilities**, have been thoroughly checked. Both by private utilities themselves and the academic world, through **peer-reviewed publications**. Results have been presented at international conferences and

published in high-impact journals.

In the following, we will explain how we can provide one of the best technologies available today.

Description of the Service

SecurecoPro provides **72 hour power production forecasts.** Data are provided both graphically, as shown below, and in a raw format.



Raw data

Raw data are made available on dedicated servers through **secure ftp** and sent via **email**. If needed, **RESTFul APIs** can also be made available (see below).

Web Dashboard

Upon request, SecurecoPro will provide a web interface for all data access:

- URL with all data visualised on a **Web Dashboard**;
- Secure login (username/password on SSL) with authorised access for all users;
- Admin users able to create other users with read-only access.

RESTFul APIs

In the case that the customer needs the data for internal web applications, SecurecoPro RESTful web

APIs provide a standard way to communicate with SecurecoPro servers based on Representational State Transfer (REST) principle. Clients issue requests to the resources on the server identified by structured uniform resource locators (URLs). The server responds with text based information.

SecurecoPro's Forecasting Models

SecurecoPro developed models using:

- **Boundary Conditions** from ECMWF (Deterministic global forecast model) or NCEP global forecast model;
- **Regional Atmospheric Models** (RAMS) for hourly meteorological forecasts until Day+3 from the analysis;
- Post processing method of the meteorological data based on different techniques (**Neural Network** or **Pattern Recognition**).

A post processing method based on Pattern recognition, recently proposed by NCAR (National Centre for Atmospheric Research, USA) with the name of Analog Ensemble, allows the production of a deterministic power forecast together with a probabilistic one.

Biggest advantages

- **Probabilistic forecasts**. This means a probability is associated to different values of power production, where deterministic forecasts only provide the most probable value;
- The algorithm can be trained within a limited period. Typically, 6 months are enough to reach a **12% Absolute Mean Error**.

The **RAMS with Analog Ensemble** is, today, one of the most advanced methods for wind power forecasts. It is important to stress that to **maximize the income** in the day ahead energy market, a **probabilistic forecast is the most suitable approach**. In fact, the hourly spot value offered for trading can be adjusted considering the probability of producing a certain amount of energy together with the energy prices and unbalancing cost.

Testing our Services

SecurecoPro is happy to prove the superiority of its products through testing. Should the customer

take into consideration our services, we are happy to run the forecasts on a pre-existing dataset provided by the company.

Availability and Support

SecurecoPro recognises that 24/7 operation of the service is critical, and is committed to providing the necessary support to ensure the system remains operational at all times.
SecurecoPro will make the services available an average of at least 99% of the time during each month. We will clearly use any possible efforts to schedule planned outages during non-peak hours. Email messages received during regular business hours will generally be answered the same day. Messages received after hours will be answered the following business day.

Pricing

Pricing depends on the size and number of plants to be analyzed. **Indicatively**:

- setup fee: €5,000
- any additional wind farm: €3,000

Setup fees are inclusive of client's **data processing,** plus dedicated redundant **computing and data storage infrastructure**.

About SecurecoPro

SecurecoPro is a branch of Italian Secureco Ltd, which has been active for 30 years. It is specialized in physical and mathematical modelling, data analysis, and Monte Carlo simulations. We are used to heavy computational requirements, and have more than 70 articles published in international academic journals and conference proceedings.
We have 15+ years experience in development of atmospheric models, and a deep knowledge of the Italian power market, with more than 100 analyses published for ICIS Energy (London, UK).

Selected Publications by SecurecoPro on Wind Power Forecast

The publications below are available upon request.

S. Alessandrini et al. A Wind Power Forecast System in Complex Topographic Conditions, Proc. of European Wind Energy Confernec and Exhibition EWEC
S. Alessandrini et al. An application of ensemble/multi model approach for wind power production forecasting, Advances in Science & Research, 10th EMS Annual Meeting and 8th European Conference on Applied Climatology (ECAC) 2010
S. Alessandrini et al. Applicazioni a casi reali del sistema di previsione di energia per parchi eolici, CESI Ricerca 2009

S. Alessandrini et al. The use of different ensemble forecasting systems for wind power prediction on a real case in the South of Italy, EWEA 2012, Copenhagen, Denmark
S. Alessandrini et al. Assessment of an off-shore site wind power energy using meteorological models and measured data, EWEA 2011, Brussel, Belgium