

# SHORT TERM FORECAST IN THE MICROGRID CONTEXT: IMPROVED TECHNIQUES AND ISSUES

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Energy Forecast, both from the end user and the generation side, has gained more interest in the scientific community. In particular research has been focused in the last decades on the forecast of Renewable Energy Sources (RES) for their spread and because they are inherently unpredictable.

Several methodologies have been set up and applied bringing effective results in terms of high accuracy [1][2]. A growing interest and useful applications of these techniques have brought to remarkable results [3], and nowadays this topic urges to be further addressed in the microgrid context, which is an emerging field of application for these topics both for technical and scientific reasons.

A micro-grid can be defined as a local distribution system, on a small scale, which is formed by distributed generators and loads [4]. It has two types of functioning: autonomous (isolated) if it is able to operate independently from the main power line or not autonomous, that is, connected to main electric grid. A central controller is in charge of detecting conditions that require to switch from parallel to islanding mode providing the main features of a “smart-grid” of guaranteeing an efficient operation of the electrical system, with low losses, high level of safety, continuity and quality of supply. The optimal management of a micro-grid includes: the interaction of several not-programmable energy sources, many typologies of storage, electrical loads and vehicles.

Together with the need of forecasting the power produced by the RES, the increasing penetration of distributed generators requires the capability of these latter to support the public distribution network providing/absorbing active and reactive power. As the required levels of active and reactive power are a function of the actual frequency and voltage of the grid, the ability to forecast frequencies and voltages is becoming a key activity in the optimization of the State Of Charge (SOC) of battery electrical storage systems that are usually included in a microgrid layout. On-line and off-line voltage and frequency forecasters with different time horizons can also be used in a number of applications such as, for example, the optimization of the voltage-reactive power and frequency-active power profiles at the Distribution System Operator (DSO) level, and to overcome time delays due to communication latencies in real-time applications [5].

In this operational framework it is extremely important to have the most accurate forecast of the output power deliverable by the RES in the microgrid which should be headed to:

- Ultra-short term (15'), in order to promptly respond when sudden variations occur;
- Short and Mid-term, for planning and load gain/drop;
- Short and mid-term forecast of the grid frequency and voltage for the SOC optimization
- Very short (less than 1 second) forecast of the frequency and voltage for real-time applications

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