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Saturn2e Diagnostic of Primary Frequency Control

Competitive electric markets were designed to improve price and quality of the grid.

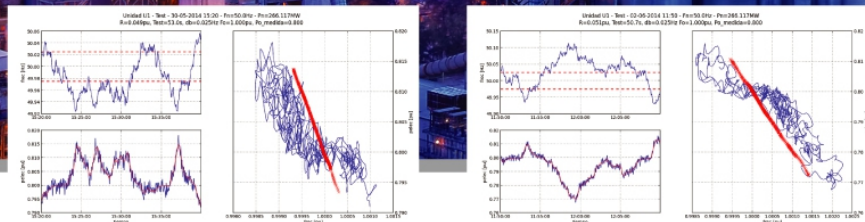
In these markets, voltage and frequency are the "indicators" from which it can be measured the performance of the power system and, consequently, the quality of the grid management.

Loads, distribution, transmission, generation and grid management are the actors and all of them are responsible for the performance of the whole system. However, regarding to the frequency, generators have the main role.

Independent System Operators (ISO) invest time and money performing simulation studies to predict the behavior of the grid and design actions to control it.

These studies are done with electromechanical transient programs which have a dynamic database of the whole system including generators and their associated controls (governors, avr, etc).

It is important to highlight that the result of the simulation depends only on the models and parameters used.



Examples

What would occur if some plants are simulated contributing to the frequency regulation and in fact they are not doing it?

The answer is:

"The predicted dynamics as well as the corrective actions determined by simulation studies will not be effective"

Still more, it is highly possible that, in case of a contingency in the system, the frequency cannot be kept within the band determined during simulation studies and load shedding will occur, with enormous economic consequences for all players, even for generators.

ESTUDIOS ELÉCTRICOS has dealt with this issue for more than a decade. Our outstanding consulting team was involved in system studies as well as power plant modeling, testing and auditing in many countries.

After many years of hard work feeding with field data and colleagues background, our **R&D** staff has found the solution and create **Saturn2e**, a new monitoring system of frequency regulation.

Saturn2e is an independent governor monitoring equipment designed to alert the Power Plant and the system operator when the generator unit is not responding according to ISO's primary frequency regulation criteria.

The internal mathematical model allows Saturn2e to fit all types of units, whether hydraulic or thermal, and all types of operating conditions. The soundness of the implemented mathematical algorithms along with the computing power of the internal microprocessor system provide excellent robustness and reliability.

The calculation core and all involved processes are executed by an industrial computer to ensure high levels of performance.



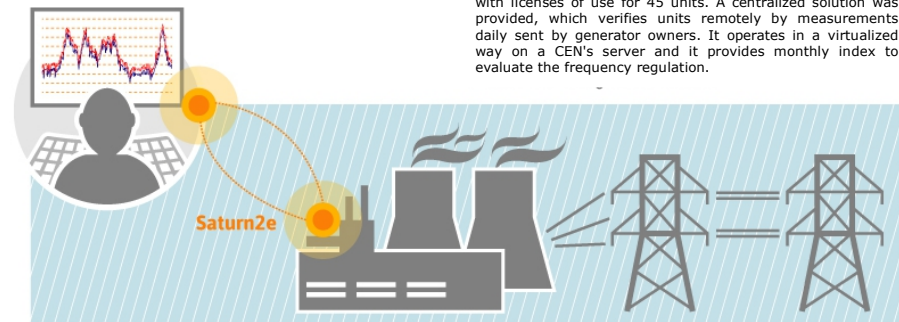
How does it work?

To ensure that primary frequency regulation is operating properly, it is necessary to keep track on-line frequency variations and consequent contributions of active power of the monitored unit.

Saturn2e receives continuous data of electrical power and frequency and uses a rule-based expert system to determine, with a high level of certainty, the quality of frequency control.

From a detailed parameter estimation process, the parameters of performance are determined:

- Droop
- Dead band or backlash
- Settling time



Based on the obtained results, the sample is marked if it satisfies the requirements of the frequency regulation.

Due to its high storage capacity, **Saturn2e** can be used as an event recorder. In consequence, it is easy to perform equivalence analysis between reality and power system simulator output.

Saturn2e implements a web server, which allows the user to access all the information recorded by the monitor system simply by using a web browser.

Case of Success

Saturn2e has been operating in Chilean's ISO (CEN: Coordinador Eléctrico Nacional) for two years approximately with licenses of use for 45 units. A centralized solution was provided, which verifies units remotely by measurements daily sent by generator owners. It operates in a virtualized way on a CEN's server and it provides monthly index to evaluate the frequency regulation.