i-Sare: The future Grid

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Abstract

A real implementation of a hierarchical control scheme for a smart grid equipped with voltage source converters, attached to renewable and conventional energy generators and storage systems based on ultracapacitors, a flywheel and batteries as well as controllable local loads. The intelligent grid can operate autonomously when islanded or can interact with the main power network, in a controlled, coordinated way using a distributed communication architecture based on EPICS to manage the generated information.

Elements distribution in i-Sare
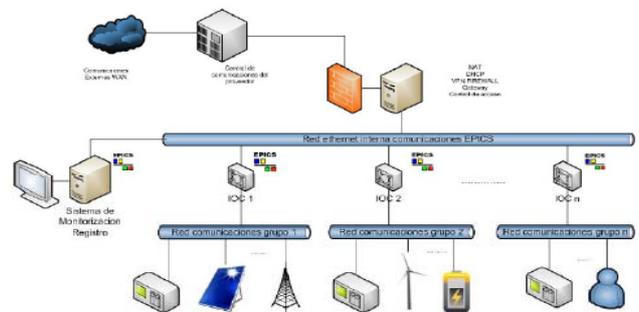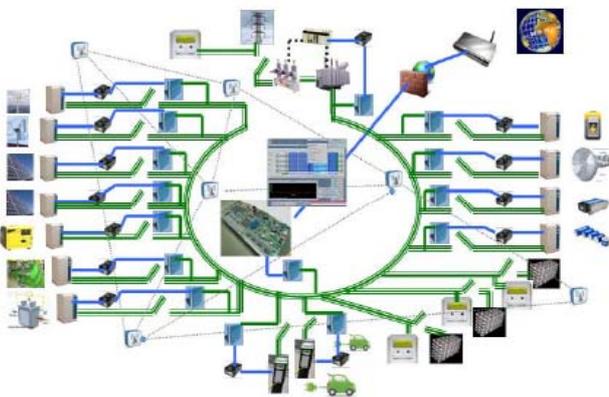
i-Sare micro grid:

Real bidirectional micro grid in order to serve as a test plant to develop and validate different technologies in products and services in relation to generation, storage and control strategies, as well as to help the integration of electric vehicles .

Hierarchical Control:

On the one hand, Primary in a local control; on the other hand, Secondary, Tertiary and Fourth control in a central control so as to consistenly mantein the optimal power flow in each generation and storage element.

Communications infrastructure:

Distributed system based on EPICS routines in client/server architecture and database on Input / Output Controllers with Ethernet, Modbus TCP and Power Line Communications.

CCS Screen Monitoring Data
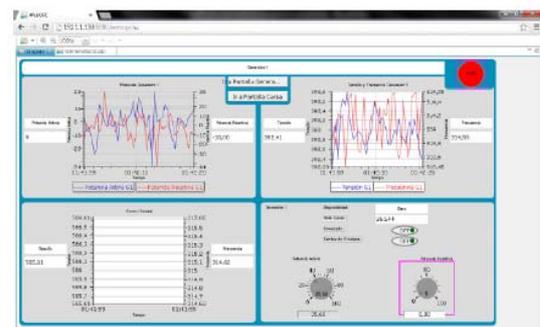
Experimental results:

Control & communications tested in a micro grid formed by two solar inverters working in a VSI mode, controllable loads and a central control. Every data and grid status is shown and managed from a CSS screen based on EPICS.