



TECHNICAL REPORT

Integration of Hybrid Distributed Generation Units in a Smart Grid

Smart Grid

The Smart Grid concept assumes a cluster of loads and micro sources operating as a single controllable system that provides both electrical power and heat to its local area. This concept allows a higher degree of penetration of distributed generation in the electrical power distribution systems.

HDGU

The Hybrid Distributed Generation Units (HDGUs) are small power plants, (<100kW), equipped with power electronic interfaces.

They typically consist of renewable sources (small wind turbines, PV panels), energy storage devices and fuel fed rotating generators, placed at customers sites.

The HDGUs can balance local power demand and generation, leveling the active power generated by the intermittent and not programmable renewable sources with the support of the energy storage systems and the continuous operation of the rotating generators.

Distributed Generation and Smart Grids

In a Smart Grid the Distribution Network Operator (DNO) is capable to interact with the generators and loads, to balance power demand and generation, to improve voltage regulation and system protection, which makes possible a wide deployment of DG





HDGU Controller

Power flow management

The power flow management in the HDGU is governed by a Master Controller, which responds in milliseconds and uses local information to control the units during all events. It can provide a Basic Control of Active and Reactive Power and it allows both the Grid Connected Operation and the Island Mode of the HDGU.

Communication between the HDGU and the DNO

The communication system between the HDGU and the Distribution Network Operator (DNO) can be based on different technologies as : PLC (Power Line Carrier), Internet, Wireless (Wi-Fi and Wi-Max). The basic objective is to exchange control and status signals to enhance the operation of the HDGU and to allow control of generated active and reactive power, monitor the DG performance, improve the safety and reliability of the entire distribution system.

Integration of HDGUs in the Smart Grid

Most electric distribution systems are designed, operated and protected with the assumption that only a single voltage source is connected to each distribution feeder.

This fundamental assumption is violated by Distributed Generation, and the grid integration of HDGUs poses several issues on protections, voltage control, power quality.

An enhancement of operation can be obtained if an effective data communication is established between the HDGU and the DNO.

The HDGU is ideal to be integrated in a Smart Grid thanks to its capability to store energy, to the flexibility of its power electronic interface, to the presence of a Master Controller, equipped with data communication devices which allow information exchange with the DNO.



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