

Interactions UTC

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Electric power generation and local “smart” grids

Grid operators, faced with a profusion of local renewable energy electric power producers, are now developing so-called “smart” grids to ensure stability in the overall power supplied to the end-users. With a view to helping the operators in their task to balance the grid, while promoting the development of renewable energy sources produced locally, the UTC-Avenues Lab. is proposing the development of local micro-grids to generate, store and control power exchanges with the national grid system.

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Enabling anyone to become a renewable energy producer with the possibility to inject surplus production into the national grid is indeed an attractive concept but it brings with it a set of technical issues and problems. "Today's national grid in France is not designed to accept a bi-directional power flow", underlines Manuela Sechilariu and Fabrice Locment, both of whom are research scientists at the UTC-Avenues Lab.

When there is excess demand, power generation stations must be started and brought on line to meet the demand, while excess power generation, in reverse, leads to voltage and frequency variations of the power delivered to the grid and the users. Today the network operators want to be able to adapt their grids not only to accept decentralised power production but also the intermittent random inputs as produced by photovoltaic (PV) arrays and wind turbine generators.

Grid stability is a problem One solution, when faced with the problem of 'diffuse' production means, and the essential need to balance production with demand, is to develop so-called "smart

grids". In practical terms, this consists of implementing a communications/information network that is superimposed on the national grid and allows you to regulate the latter as a function of the information collected and exchanged. A smart grid of this nature will have the capacity to exchange information as needed to balance the whole power system. "It is nonetheless a difficult task and necessarily calls for participation of a large number of producers to help the balancing overarching objective", details Manuela Sechilariu.

Local micro-networks communicating with a 'smart' national grid
The solution advocated by the research scientists and their team depends on the development of local micro-grids. The latter use local renewable energy sources, while optimizing production, consumption and storage so as to contribute actively to balancing the national grid performance. A micro-grid system, developed at the UTC-Avenues Lab. includes production facilities (PV arrays or wind turbine generators), storage and grid regulation systems. The main device is a system controller which acts as an interface with the national distribution grid and ensures a constantly- regulated power flow.

"We have developed algorithms that help predict power demand levels, power production to be brought on-line and thereby ensure stability for the national grid as a whole", underlines Manuela Sechilariu. The research engineers are also satisfied that they can "ensure optimal power production, both in terms of operational cost and the appropriate use made of renewable energy sources".

UTC's Avenues Laboratory already has an experimental rig with photovoltaic (PV) panels up and running on the campus, with associated power storage units and algorithmic control systems. The next step will be to build and equip a scale one charging station for all-electric vehicles, the power coming from PV shelters, which connects into the French national grid. "The demand for fast charging electric vehicles could rise rapidly and leads to a sharp

upturn of power demands on the grid", explains Fabrice Locment. One solution consists of developing micro-grids to recharge the vehicles and thereby decrease the national demand while enhancing and encouraging use of renewable energy sources.