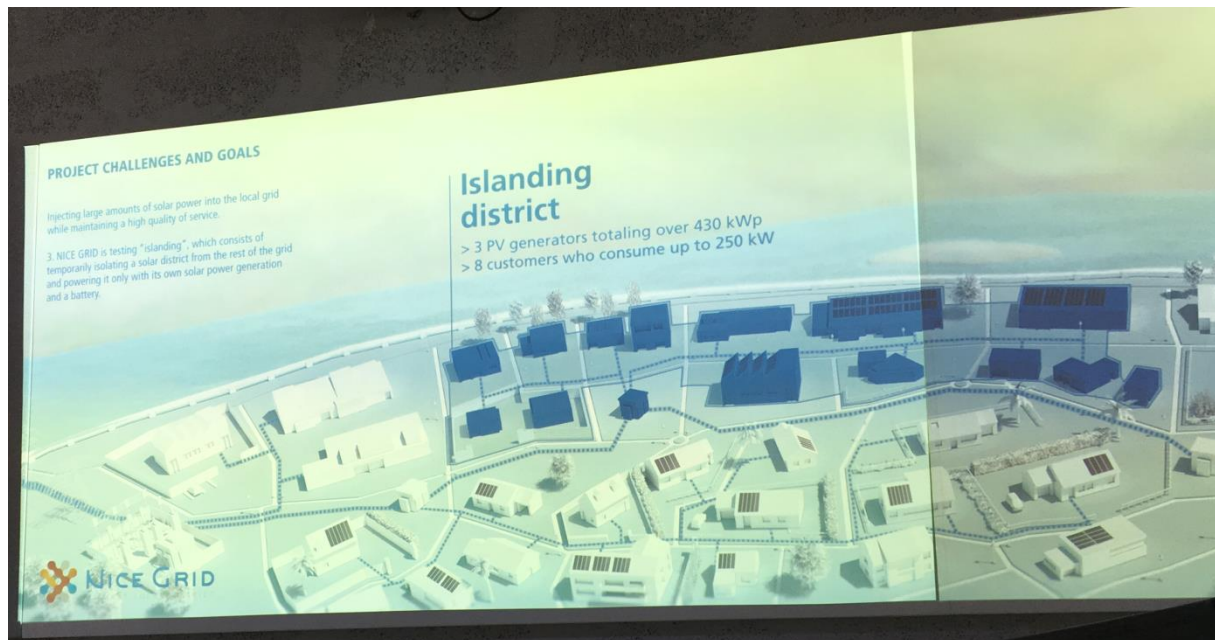


Test of batteries and island operations in area with distributed generation of solar cells



Along with Norway Nett, The Norwegian Smartgrid Centre has been on an exciting and informative day visits with the demonstration project Nice Grid on June 20 this year. It was especially interesting to hear about the experiences with the use of batteries in combination with PV, and what happened when connecting an office area from the grid and run it in island operation mode (both planned and unplanned).

With GE Grid Solutions and the French distribution company ERDF hosting the visit in field and showed the 200 square meter showroom, we got to see and hear about the tests that have been performed.

The objectives of the demonstration project Nice Grid are as follows:

- Optimizing operation of a distribution network with a lot of local, variable production of solar panels and several types of storage bases for Li-Ion batteries.
- Test of islanding operation for areas with involvement of local production and battery / storage.
- Involve end-customers and give them an active role in contributing to the optimum balancing of local consumption, local production and storage.
- Test different business models for flexibility during both winter and summer time.

To be in line with the EU climate objectives for 2020, France should produce at least 23% of final consumption of energy from the sun and other forms of renewable energy. The demo area Nice Grid is located in the residential and industrial area Carros, about 30 minute's drive north-west of Nice. Carros has 11,500 inhabitants of whom 5500 are located within the demo area. 124 household customers with PV on the roof were actively involved in the experiment and 450 customers were eligible to participate.

Specifically, it was interesting to hear about the experiences of running an area with many offices in islanding mode.

5 hours in island operation without any problems

The tests of islanding mode are taking place at a MV / LV substation in an industrial area where 8 offices and warehouse buildings located on the same side of the substation were affected. Three of the offices have PV on roofs with a total output of 430 kWp, while 5 of the buildings do not have local production. Maximum power requirement for the 8 offices is 250 kW. Energy storage system - a Dock Trachel islanding Battery - consisted of a battery of maximum 250 kW / 620 kWh with 4 inverters. The equipment was located in a container and placed on the other side of the street above the transformers.

Prior to the actual test, the project had developed an optimization procedure for automated balancing of consumption and production to match load curves, expected solar radiation and efficiency of PV equipment in the area. The battery and inverters were used to keep the stability of the grid and supply electricity during underproduction relative to consumption and vice versa. In addition, there were installed light sensors on the ceiling of the battery container whose role was to record clouds (changes in brightness) in front of the sun, accompanied by the need for response from the battery and the four inverters. The test was conducted in October 2015 which is a time of the year with cloudy weather.



250 kW / 620 kWh Li-ion battery from Saft place in a container with power conversion system (PCS) from Socomec. GE Grid Solution was responsible for the overall system with software and optimization procedures worked under test

The area operated five hours in islanding mode without the customers noticed anything on supply capacity or supply quality. When the test began, the battery had 73% of maximum capacity. After four hours the islanding battery was stored below 55% of maximum capacity. According to the engineers of ERDF it could theoretically maintain the islanding operation for 5 hours, thus totaling 9 hours. Such a time window will enable the performance of some maintenance work during the day without the need to rig assemblies or shut off the power supply.

The field test demonstrated that:

1. The manual disconnection of the substation with a subsequent automated synchronization phase between battery, inverters, solar modules and cargo, was carried out without noticeable interference in power supply or voltage quality for the end- customers.

2. The battery modules in combination with the four inverters handled a seamless exchange between saving overproduction and supply the grid with the production of PV systems, while system reacted quickly enough to adjust operations when clouds shadowed the sun impacting both solar cell production and customer load curves.

Flexibility of batteries as a separate service

The French DSO, ERDF, said that the Nice Grid project has shown that there are different players who can benefit from increased flexibility due to the introduction of batteries at different levels in the network. Households or commercial buildings can increase their flexibility in the way that they can change the time of day they use power from the grid and when they use the local batteries, and customers can also reduce the maximum power they need in just a short span of time during a year. Whoever operates the grid can provide signals about local bottlenecks where good relationships with flexible consumption and local production can remedy the situation or reduce the need for expensive grid reinforcements. One can also use batteries to islanding operation as the example in this article shows.

It is desirable that the flexibility and support batteries can provide power to the grid, enabled through price signals. The French grid company envisages the development of business models for batteries, where, for example aggregators or other operators offering flexibility through batteries as a service.

Lithium-ion storage systems

Lithium-ion storage systems with different capacities and sizes have been installed at various levels of the power grid in the demo area outside Nice. The aim has been to increase the flexibility of private households, with industrial / office buildings, and for distribution in an area with a lot of local energy production from solar cells.



Inspection of one of the households with PV on roofs, inverter wall and battery pack placed one meter from the house wall

The battery types that have been at work in the demo project Nice Grid:

- At high voltage, "Energy Storage System Intensium" maximum 1 MW / 560 kWh
- Battery Distribution Network at a MV / LV transformer in an industrial area, a maximum of 250 kW / 620 kWh
- Battery at LV substations, up to 30 kW / 1000 kWh

- Shared battery for several households with PV plants: maximum 33 kW battery with inverter and operating at maximum 3 hours
- Battery Pack with two modules for residential houses with solar cells on the roof: 48 volt, 4 kW (24 such batteries together in demo area)
- Modules Showroom: 11 modules connected to a battery pack

ISGAN Technical Report on interoperability certification procedure for battery energy storage systems (BESS)

The Smart Grid International Research Facility Network (SIRFN) created a draft interoperability certification procedure for battery energy storage systems (BESS). The testing protocol harmonizes multiple national and international grid codes and standards two provided a single validation test procedure for multiple BESS grid support functions, including servers Request Active Power from Storage, Request Reactive Power from Storage, Commanded Power Factor, Frequency-Watt and Volt -Our. The report can be found on The Following Link: <http://www.iea-isgan.org/index.php?r=home&c=5/378>

Facts about Nice Grid

- Project leader: ERDF, the French DSO
- Duration: 4 years, starting in 2012 and ending in January 2016 (the partners are working on opportunities to upscale or proceed with some parts of the project)
- Website: <http://www.nicegrid.fr/>
- Budget: EUR 30 million, of which EUR 4 million from local government, EUR 7 million from the EU's 7th Framework Programme for RD & D and the rest from industry partners.
- Part of the project umbrella for various demo projects in Europe: Grid4EU

Partners and sponsors:



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