Article

Leonardo ENERGY

The first micro grid in The Netherlands: Bronsbergen

Tom Loix, KULeuven

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Distributed Generation

Focus

The first micro grid in the Netherlands is located in the Bronsbergen holiday park, near Zutphen (about 100km to the west of Amsterdam). This park consists of 208 holiday homes, of which 108 have been fitted with a solar PV installation on the roof. Peak generation capacity is 315 kW compared with a peak load of 150 kW. Furthermore, two battery banks have been installed as energy storage. It is, after all, not out of the question that when the power demand is high, the PV installations will not be able to produce the necessary power. To allow for this, the energy from the batteries can be recovered, and these can then be recharged later on (when the PV installations are producing more than the demand).

Configuration

The topology of the micro grid in Bronsbergen is shown in Figure 1. It consists of four parallel low voltage branches that the houses are connected to.

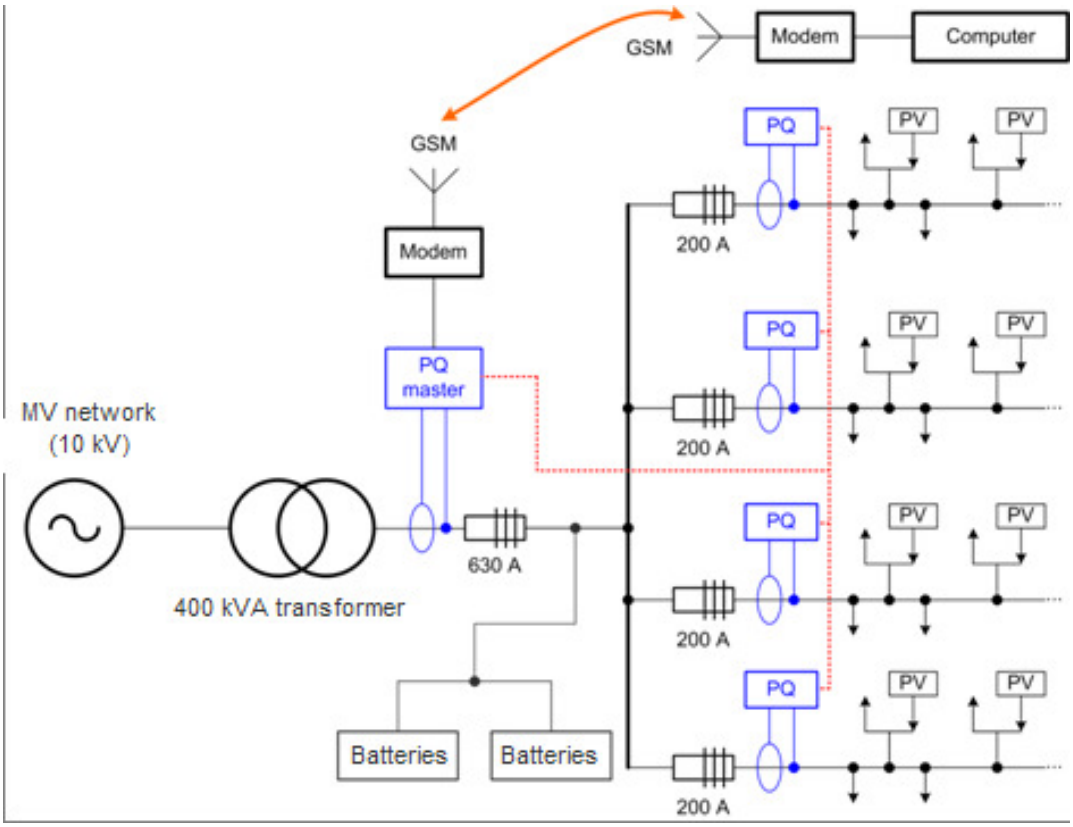

Figure 1: Topology of the micro grid in Bronsbergen

Each branch is protected with a safety fuse rated at 200 A and equipped with measuring equipment which determines the active and reactive power over the line. These measuring appliances are linked to the master, which measures the total amount of active and reactive power exchanged between the micro grid and the mid-voltage grid. The micro grid is linked to the mid-voltage grid by a 400 kVA transformer (400 V – 10 kV). The master can exchange data via GSM communication with a computer (e.g. in a dispatch centre). The battery banks are connected to the grid connection on the load side of the 630 A fuse.

Objectives

The principal objectives of this micro grid are to guarantee the electrical energy's quality and assure the supply. Moreover, it is used in research for the integration of micro grids, amongst other things to look at the practical problems that can be expected with such grid structures.

At the moment, several problems have been concretely identified with regard to harmonisation (among which there is sometimes an important third harmonic in the neutral conductor – see Figure 2), voltage imbalance resulting from an unequal division of the load over the three phases and maintenance of the voltage amplitude within the standard.

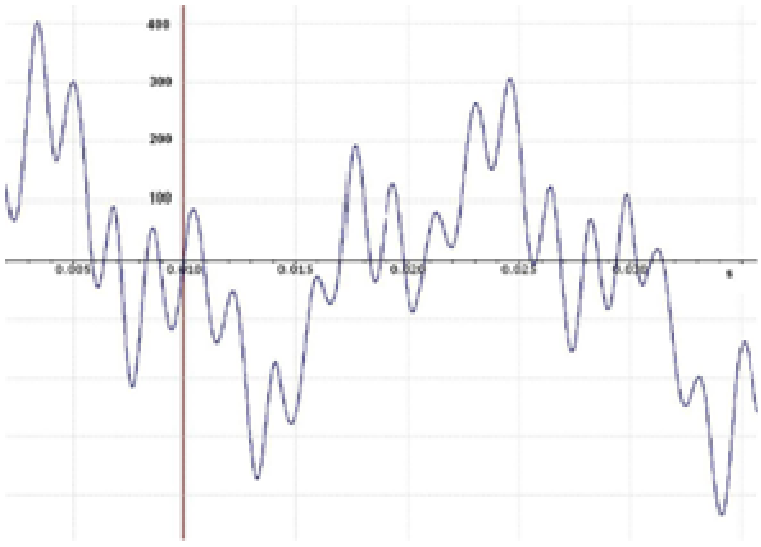

Figure 2: Neutral conductor

Research

Regarding research objectives, tests have already been completed successfully where the grid has been allowed to function as an autonomous island (disconnected from the mid-voltage grid) for a period of 24 hours. The opening and closing of the coupling circuit breaker with the 10 kV grid can also occur automatically. In the coming months, subsequent issues will be investigated further:

- Maintain the correct operation of the micro grid due faults on the medium-voltage grid or in one of the branches of the micro grid itself.
- Reduction of the harmonic pollution and buffer any potential resonance phenomena.
- The development of an optimal energy management system to maximise the battery banks' life-span.

Although in this micro grid only PV installations and batteries are used, Continuon – the grid manager involved in the operation of the micro grid – also works on comparable projects concerning cogeneration units, another important small-scale energy source for the future.

Figure 3: Installation of the Battery Banks

Source: S. Cobben, "Bronsbergen: The First Micro Grid in the Netherlands", Kythnos 2008 Symposium on Micro Grids, Greece, June 2nd, 2008.