

Vasakronan – Local DC grid for better solar power integration

Participants: Vasakronan, Ferroamp

IEA categories: Renewable power integration

Time plan: The project runs 2017-2021, but the installations are planned to remain and be expanded on

Web: -

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Location: Uppsala Science park

Possible to visit: Yes

Background

By building local, small-scale power grids, electricity produced by solar generation can be utilized in a more efficient manner. The local grid makes it possible to use produced energy locally even when the consumption pattern varies. In the conventional grid setting, a situation can arise where a producer of solar energy will have to sell their surplus production to the grid while the neighbouring building buys electricity from the grid at the same time. With a local grid, a net producer can feed surplus electricity to a net consumer, lowering the strain on the external power grid.

A local grid can also be beneficial in the sense that it lowers the number of conversions needed to use the produced energy. As the electricity produced in solar cells is direct current, which also is used by many appliances, a local DC grid can eliminate the need to convert DC to AC before being fed into the power grid and then converted back to DC when used. This has however had quite limited significance in this project, even if it could be of larger importance later on.

One legal hurdle for local grids is that power grids need to be granted concession to be built. In this project, an exception to that law has been used, that allows for grids to be constructed without concession within research facilities.

Implementation of the project

In Uppsala Science Park there were three buildings that already had solar panels on their roofs, and a fourth building was to be fitted with photovoltaics as well. One of the driving forces behind the project was that the new roof would have a large production capacity in comparison to the building's own consumption, which would mean that a lot of the electricity produced would have been delivered to the grid. In order to make more efficient use of the total solar power production in the science park, the decision was made to connect the four buildings through a local DC grid. This way electricity generated at one roof could be used in a neighbouring building, lowering the need for import and export to and from the power grid.

The three earlier installations were already fitted with power inverters to transform DC to AC. These were now connected to the local DC grid through rectifiers from Ferroamp, transforming the AC back to DC again. The new solar installation is connected straight to the DC network. From the DC network, power is consumed by inverting DC to AC and feeding it to for example the cooling machines in the buildings.

Benefits

The main benefit for Vasakronan is that they can make better use of their locally produced solar power. Before the DC grid was constructed, roughly 90 percent of the electricity produced was used in the buildings. This has been possible to increase to 98 percent. The power grid benefits in the way that less strain is put on it, when a larger part of the power flow can be handled internally in the local DC grid. Instead of exporting energy from one building and importing from another, the external grid only sees a smaller import or export. The benefits can be even more apparent if a common energy storage is connected to the DC power grid, but this has yet to be tested in the installation in Uppsala.

Scalability

The local DC grid in Uppsala is prepared to be scaled up and to allow for additional buildings. Local DC grids can also be built in even larger scale than the one in Uppsala.

Interoperability

In its present configuration, the Uppsala DC grid needs additional AC/DC and DC/AC conversions, that could add slightly to the overall losses. In principle a similar configuration could be run with DC producers as well as consumers to minimize losses even more. From the point of view of the external power grid, the local power grid is not any different from other producers and customers, as the internal grid only alters the size of production or consumption.

Investment horizon

Vasakronan has calculated that the local DC grid will have a pay-off time of less than 20 years.

International potential

This way of utilizing a local DC grid is applicable in most grids, even if the usefulness can vary due to local conditions.