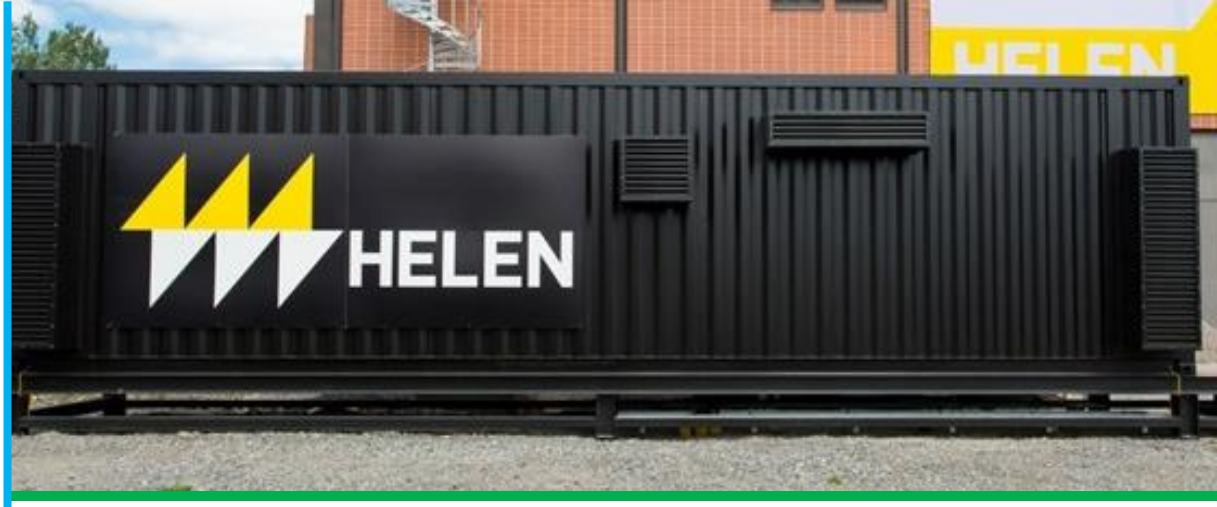


EU-SysFlex

Finnish Demo:

Market based integration of distributed resources in transmission system operation

The objective of the Finnish demonstrator was to increase the use of market-based concepts and virtual power plants to support the operation of transmission and distribution networks. The innovative aspect was to integrate small, so far untapped, flexible assets on the medium and low voltage grid to aggregation processes, and offer the flexibility of these assets to TSO ancillary (frequency) services and DSO needs. Active, as well as reactive, power management were applied as flexibility services.

Assets in the active power demos:

- Industrial-scale BESS 1.2 MW/0.6 MWh
- Medium-scale BESS 0.1 MW/0.13 MWh
- Residential-scale BESS 40 kW
- EV-charge points 22 kW AC / 50 KW DC
- Simulated residential heating loads 20 MW

Assets in the reactive power demo:

- PV-plant 0.8 Mvar
- Industrial-scale BESS 0.9 Mvar

Key Features

- Aggregation of small, distributed assets to TSO ancillary services and for DSO reactive power compensation needs
- Developing and piloting suitable interfaces to connect the small, distributed assets to the aggregation platform
- Developing tools to forecast the available capacity from different resource and developing control logic to optimise use of the resources

Implementation approach

The core of the virtual power plant is an aggregation platform. Four commercial aggregation platforms were tested. The main objectives for an aggregation platform were the ability to add new assets to the platform and to control the attached assets according to the use cases. In addition to the tested and implemented platforms, interfaces, and communications presented in Figure A2.1 for the TSO ancillary services, corresponding controls were demonstrated for the DSO reactive power market demonstration.

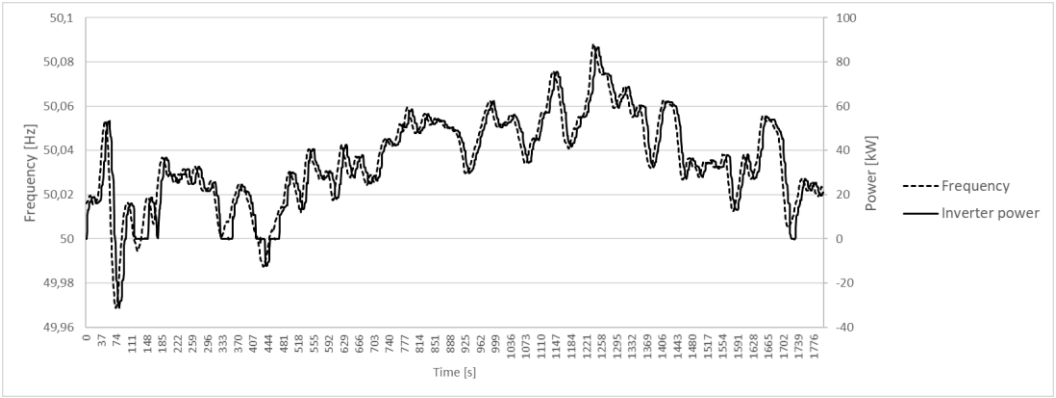
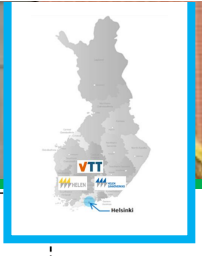


Figure 1. The medium-scale BESS in FCR-N operation

Disclaimer: This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 773505.



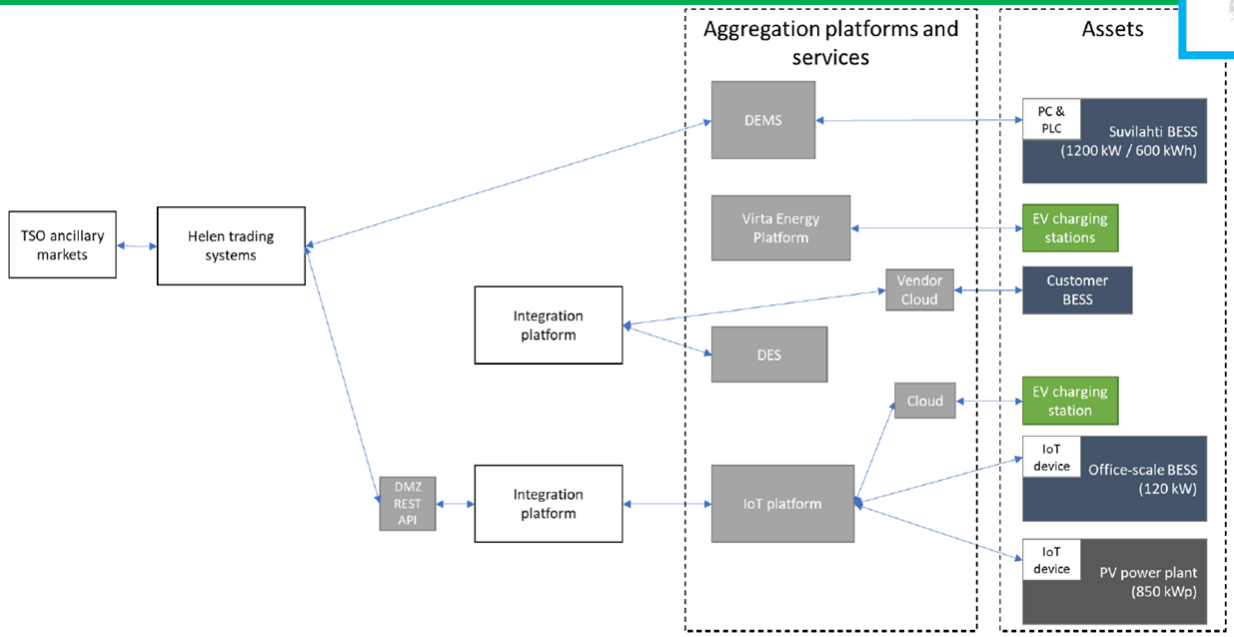


Figure 2. Overview of the developments in systems and interfaces in the Finnish demonstration

Key Achievements

- Development of a set of forecasting/optimisation tools to estimate the available flexibility of LV/MV assets for TSO ancillary services.
- Accomplishing technical proof of concept of distributed flexibility resources BESS (residential, medium and industrial scale), PV and EV charging points, and controlling these assets according to market actions.
- Operating BESSs in an actual TSO market.
- Technical proof of concept for a new market mechanism to manage reactive power at the TSO/DSO connection point.

Findings

The share of RES is increasing in the Nordic and Finnish power system. The Finnish demo demonstrated how small, distributed, so far untapped, MV / LV assets can be aggregated to be utilised in TSO ancillary service markets and for DSO needs. At the same time, this will contribute to a higher amount of flexibilities, representing various sets of new types of assets. Sophisticated forecasting and optimisation methods contribute to more reliable market operation, which promotes favourable development of the operational environment for the TSO, aggregator, DSO, and customers. As a practical business achievement, the industrial-scale and office-scale batteries were operated in the actual TSO FCR-N market. Figure 4.3, in Chapter 4, depicted successful operation of the medium-scale BESS in providing FCR-N service. The Finnish demonstration has shown a strong case for scalability and replicability for industrial-scale BESS, with new developed IoT platform and optimisation tools. Multi-use of both industrial and office scale BESS when possible is strongly advised.

Recommendations and Lessons

For efficient use of small, distributed assets in a power system, the following are recommended:

- Characteristics of aggregation platforms (easy connection of assets, standardised interfaces and communication) play a key role in promoting replicability and scalability. A reliable and agile platform is essential in integrating different services.
- Forecasting and optimisation of the availability of distributed energy resources should be further developed to ensure successful market operation.
- All technologies should be treated in a neutral way, with future power systems consisting of a more diverse set of flexible assets.
- Acceptance by end-use customers owning flexible assets is to be identified and supported.
- Ancillary market rules should be developed to allow smaller units and various, possibly new, types of assets.

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