

NEWSLETTER 3_2017



EMPOWER is an H2020 project on the topic “Modernising the European electricity grid: LCE 7 – 2014: Distribution grid and retail market” of the call “Competitive Low-Carbon Energy” of the HORIZON 2020 work programme 2014-2015.

The project started in January 2015 and will be finishing at the end of 2017. It focuses on local energy markets development, proposing innovative business models to exploit the flexibility of generation, load and storage units at distribution level. An ICT platform is being designed to manage this flexibility based on the business models. The ICT platform enables exchanging the signals between the SESP (Smart Energy Service Provider), brain of the system, and the field elements in order to ensure minimum cost of operation. The energy scenario being envisaged is encouraging micro-generation and the active participation of prosumers in the electrical power flows. The ICT platform designed will be tested in different pilot sites.

The present Newsletter shows the advances in the ICT platform development and pilot sites implementation.

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The SESP ICT platform

EMPOWER project is divided in 9 work packages being developed simultaneously to allow the conceptualisation and construction of the ICT trading platform that will enable the operation of grids with flexibility, introduced by renewable power generation and prosumers participation.

The market and trade concept developed are organized around prosumers and regular small-scale suppliers operating micro-generators and storage systems.

The local market is managed by a Smart Energy Service Provider (SESP), through the ICT trading platform. The SESP governs the operation of the whole system based on business models to provide flexibility services.



SmartFlex app. Example of figures and data displayed

Types of contracts

The EMPOWER platform is designed to offer energy contracts, flexibility contracts and service contracts to prosumers through the SESP. In this sense, the trading concept between prosumers and the SESP is peer-to-platform.

- **Energy contracts** regulate conditions related to sales and purchase of electricity between the prosumer and the SESP
- **Flexibility contracts** regulate conditions related to sales of flexibility from a prosumer to the SESP and from the SESP to a DSO
- **Service contracts** regulate conditions related to sales of different services from the SESP to a prosumer

The SESP can handle these contracts, including all information about the resources, sites and prosumers. This also includes handling meter values and predictions at different aggregation levels and with different time resolutions. Furthermore, economic settlement information is calculated for the various contract types.

Metered values, predicted values and calculations are stored in the cloud and are presented in dashboards that the prosumer can check through the application SmartFlex or a web interface and the SESP through the so called iEMS system.

Exploiting flexibility

In particular, flexibility contracts allow to exploit local flexibility to create local benefits. This is included in the control plan handling, where the distribution system operator (DSO) submits a request for up or down regulation in a zone in cases with congestions or other operational problems. The SESP generates a control plan, consisting of a list of flexibility contracts that are activated such that the DSO's control request is met to lowest possible cost and without violating any of the technical and commercial constraints with the prosumers.



FAT participants. From left Project Leader Virginia Hyde/eSmart Systems, G.Berger/eSmart Systems, S.E.Tønnesen/eSmart Systems, Vidar Kristoffersen/Norgesnett, Joseph Negreira/ Smart Innovation Norway, M.Andersen/eSmart Systems, H.Steinert/NewEn, P.Gjergløyw/Schneider and S.Ø.Ottesen/eSmart Systems

SESP ICT Platform Press Release – EMPOWER project reaches important milestone

[On-line access to the press release](#)

Friday, June 23rd 2017, partners from Norway, Germany met at the eSmart Systems headquarters in Halden to observe a Factory Acceptance Test (FAT-test) related to the project EMPOWER.

eSmart systems has developed a system which helps prosumers (users who also produce power) to gain better overview of their own power consumption, and to save money by producing and storing power in a more effective and smart way. The system also permits sale of new services

for power- and service providers. An important part of the delivery is flexibility management as needed for power utilities, something which can contribute to a reduced need of grid expansion. During the FAT-testing, the system delivery from eSmart Systems was put to trial, with testing of functionality for prosumer management, contract management and flexibility management.

- The testing went as expected. We conducted a detailed test of functionality, with data collected from – among other – from the pilot area at Hvaler. Now, we are working toward making the solution more robust before the pilot activities this fall, says Project Manager Virginia Hyde at eSmart Systems.
- We were presented a comprehensive system solution which connects customers, markets and power utilities together in a whole new way. The systems is developed with good functionalities and has a user friendly and attractive interface. This is a product which will have a short way to a larger, European market, and which will be a great tool for realizing a functional flexibility market. In Norway, this platform will perfectly fit provident power providers developing their business concepts to also include the revenues of flexibility. Norgesnett sees great opportunities, both in terms of efficient operations and good investments, in purchasing flexibility in such a market and such a system, says Vidar Kristoffersen from Norgesnett.
- For eSmart Systems, there lies great business potential in utilizing these system solutions in various new solutions. The EMPOWER functionalities are already being requested among companies and partners in the energy industry taking digitalization seriously. We are looking forward to working on implementing the EMPOWER-solutions to our customers, says Business Manager Joakim Sveli in eSmart Systems.

After the FAT-testing, further work consists of strengthening the solution (bug fix and further development) towards the next phase of the project – testing of the system solution in the pilot areas of Malta, Germany and Norway (Hvaler). This will be done during fall 2017.



Project Members and development team

From ideas to real testing

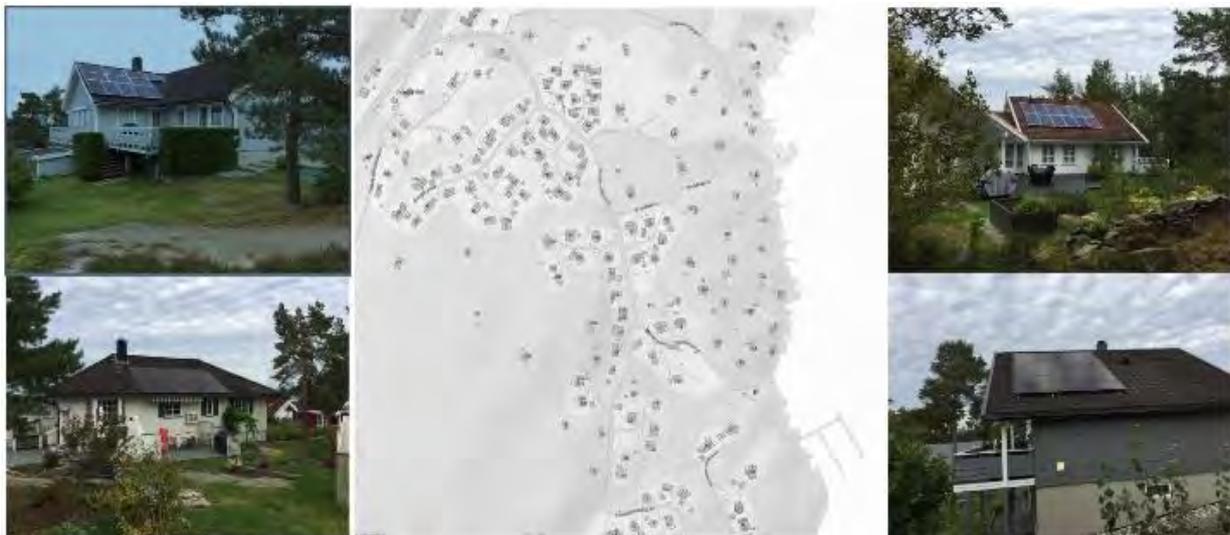
The ICT platform developed will be tested in different pilot sites, located in Norderhaugveien and Sandbakken (Norway), Wolpertshausen (Germany) and in Gozo (Malta). The pilots' specificities have been taken into consideration before applying the business models, ensuring an appropriate adaptation. To do so, the pilot characteristics in terms of elements installed, technologies used, functionalities and regulatory market constraints have been identified and the use cases to be tested have been selected. The pilots are described in next sections.

Pilot site 1: Norway

The Norwegian pilot consists of two sites, they are both located on islands of Hvaler, in the south east of Norway.

Norderhaug

The Norderhaug site contains primarily households. There are approximately 20 customers participating in Empower. 5 of these customers have solar PV panels installed. Norgesnett, the DSO, has also installed a community storage unit at this site.



Norderhaug

Sandbakken

The Sandbakken site is a recycling facility owned and operated by the Municipality of Hvaler. The recycling facility is constructed with the intent of periodically operating disconnected from the grid. EMPOWER has developed a microgrid containing a full-fledged microgrid power router which makes it possible to operate part of the local grid in island mode in situations with power outages and switch the microgrid back to connected mode when the local grid is back in normal operation. Sandbakken is equipped with approximately 190 kW of production capability.

The generation is mainly solar production, in addition 4 wind turbines are planned, the first one being installed for test and evaluation before additional wind turbines will be chosen and installed. A battery pack of 250 kWh with an inverter which allow island operation.



There is also a charging station for EVs at the facility. *Sandbakken*

Smart Energy Service Provider (SESP)

During the pilot, the customers will enjoy several of the benefits the SESP role can offer. The services offered will include consumption and generation monitoring. Which will be available through a GUI provided under the SESP umbrella, flexibility and battery management. There will also be services for EV charging management and Island operation. All these services will be explored through pilot use-cases defined in the empower project.

- PUC-1: Consumption and generation monitoring
- PUC-2: Production management
- PUC-3: Flexibility management
- PUC-4: EV Charging station management
- PUC-5: Battery management
- PUC-6: DSO interaction management
- PUC-7: Island operation management.

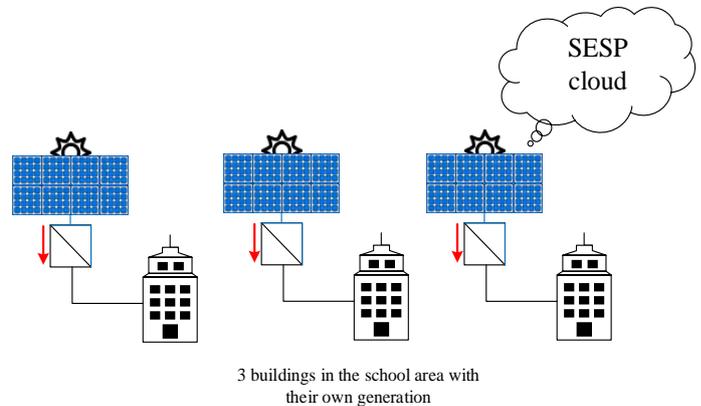
The tests will be conducted in close collaboration with the participants in the project, and provide valuable feedback to the project about the feasibility of the SESP.

Pilot site 2: Germany

The German pilot site is located in Wolpertshausen. This pilot site consists of two parts: the public and the private households.

School area (public households)

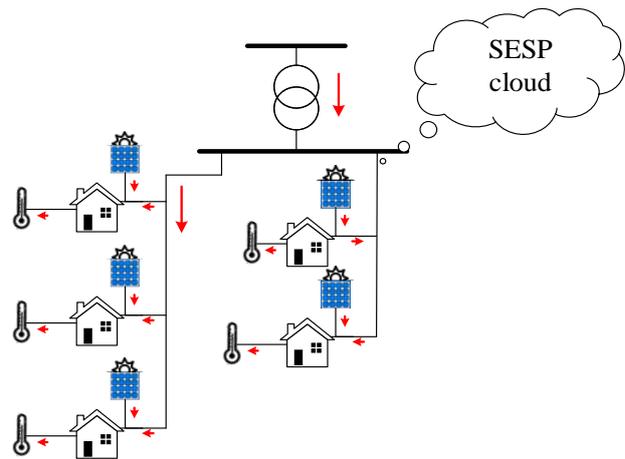
3 of the 9 public buildings in Wolpertshausen (town hall, building yard and energy centre) will be included in the EMPOWER project. The buildings are in a radius of about 500 meters. Unfortunately, the PV used on the roof of the buildings cannot be used for EMPOWER purposes, since the facilities are rented to third parties. Instead there is an EV charger and a heat pump available.



School area scheme in Germany

Residential area (Private households)

Within the municipality of Wolpertshausen there are 5 prosumers located widespread. They all have PV panels and the majority of them has flexible loads available. In addition to these private households, there is also an enterprise (including the private house of the director) participating in the EMPOWER project, having an EV charging point and several PV plants available.



5 Prosumers with PV panels and Flexible loads

Residential area in Germany

Smart Energy Service Provider (SESP)

Due to local weather forecasts it is a main task for EMPOWER to control the private household's flexible loads (e.g. heating elements). The SESP on the German pilot site will therefore identify flexibility potentials by metering the prosumer's consumption and production data. Furthermore, the flexible loads available will be used according to the participant's consent to fill the gaps between local consumption and production. Although this cannot be represented monetarily (high feed in tariffs for private households, insurance problems to interfere into existing PV plants and strict balancing market regulations), it can be foreseen to identify considerable flexibility potentials for scientific reasons.

In order to examine the functionality of the SESP architecture, the test performed are classified in:

1. Standalone tests
2. Communication tests
3. System integration tests

The devices installed on the pilot site were already installed in the beginning of 2017 within the public buildings and will be installed in the private households soon and include

- Smart Meters (installed by the DSO in the public buildings for another research programme)
- Sub meters (as smart meter replacement in private households)
- Optical Readers (for both smart meters and sub meters)
- Smart Plugs (for smaller flexible loads)
- Smart Relays (for bigger flexible loads)
- Local controller (to send and receive measured data and control signals)
- GSM-modem (for buildings without a suitable internet connection)

Find above an example of the first installation (in the town hall of the municipality)



Installation in the Town Hall

- 1 EMI (External Meter Interface). Takes the LED-signal
- 2 Local Controller (Gateway). Sender and receiver for data
- 3 GSM-Modem (replacement for lacking internet connection)
- 4 Adapter for power supply of the devices

Pilot site 3: Malta

The Maltese pilot consists of both residential and public buildings, all located on the island of Gozo. The pilot sites have been selected following an expression of interest which was issued by MIEMA in order to invite interested pilot participants. Participation in the Empower pilot project is voluntary. The pilot consists of ten selected sites, six typical households and four public buildings. MIEMA is collaborating closely with the Ministry for Gozo and Victoria Local Council on the implementation of the pilot in Gozo. Pilot sites consist of both consumers and prosumers (consumers that have photovoltaic installations).



Ministry of Gozo

MIEMA aims to develop a plan on how consumers and prosumers may exploit the flexibility elements identified in the Empower project to maximise their benefits within the local energy scenario. The project will enable participants to save energy and reduce their energy costs, as well as their CO₂ emissions. The potential for savings and the opportunity to learn more about their own energy consumption patterns was the main motivation for households to participate in the pilot voluntarily.

Real time data related to consumption and generation from PV systems is being obtained from the pilot sites via equipment that has been installed as part of the Empower project. The equipment is used transmit the data on a web platform or mobile app and allows for remote monitoring and control of selected loads through the use of “smart plugs”.



Equipment used at the pilot sites to obtain real time data and control loads

Spreading the project

Dissemination actions have allowed to spread the objectives and evolution of EMPOWER project. They include the organization of Symposiums, the TAG meetings, the attendance to conferences and workshops, the participation in webinars and the publication of articles, among others. Recent events are detailed next.

REM Forum - St. Gallen 8th St. Gallen Forum for Management of Renewable Energies Organized by Moritz Loock and Merla Kubli, May 12th 2017

During the workshop organized as part of the Renewable Energy Management (REM) forum, the implementation of local energy markets was discussed. The focus of the workshop was on flexibility-based business models with a special emphasis on local flexibility co-creation. [Article of the event](#)

EMPOWER H2020 participates in CIRED 2017

“Design characteristics of a Smart Grid dominated local market” is a Conference paper authored by Bernt Bremdal, Pol Olivella, Jayaprakash Rajasekharan and Iliana Ilieva, presented by Bernt Bremdal at in CIRED 2017, held on June in Glasgow. This paper describes the design and the first tests of the EMPOWER market, a local energy market situated in the distribution grid. The aim of the research reported here is to develop and verify a local market place and innovative business models including operational methods to encourage micro-generation and active participation of prosumers to exploit the flexibility that this creates for the benefit of all connected to the local grid. The paper provides an overview of the research and the first results from ongoing tests. [Access the article](#) and [the presentation](#)

EMPOWER H2020 participates in IEEE Powertech 2017

“EMPOWER: a network market approach for local energy trade” is a Conference paper authored by Bernt Bremdal, Pol Olivella and Jayaprakash Rajasekharan, presented by Bernt Bremdal IEEE Powertech 2017, held on June in Manchester. It describes a local market design and trade to boost, contain and manage locally generated renewable energy. Efforts have been made to design a community market concept that is economical sustainable and based on a active prosumer and consumer interaction. A highly user centric approach has been applied. This has been inspired by energy cooperatives and shopping clubs. The concept derived at applies a set of principles typically found in other network markets that have emerged over the past few years. [Access the article](#)



EMPOWER H2020 participates in the International Symposium on Energy Innovation “The transition to a flexible electricity market”

There is a need to find answers and propose solutions to the increasing integration of Renewable Energy Sources in the existing electricity transmission network. The subsequent technological (r)evolution is affecting the structure of the electricity markets and also the interactions between TSOs and DSOs.

The symposium held in Barcelona on 11th of July, covered all these issues through the vision of three European projects (SmartNet, EMPOWER and INVADE), academic experts and professionals from the electricity sector with long expertise in the subject.

The programme is available [here](#)

The whole Symposium was registered. The videos of each session are accessible:



Pol Olivella, from CITCEA-UPC explaining EMPOWER H2020 results

[Welcome ENDESA \(Directora ENDESA Cataluña\) – Isabel Buesa](#)

[Opening CITCEA-UPC - Andreas Sumper](#)

[Opening OMIE - Rodrigo Escobar](#)

Track on Smart Net

[Overview of SmartNet project. Carlos Medina \(Tecnalia, Spain\)](#)

[Barcelona pilot-SmartNet. DSO. Miguel Pardo \(Endesa, Spain\)](#)

[Barcelona pilot-SmartNet. Aggregator. David Sanchez \(ONE, Spain\)](#)

Track on Flexibility Markets

[Local flexibility markets: From EMPOWER to INVADE. Pol Olivella \(CITCEA-UPC, Spain\)](#)

[Flexibility at the TSO level. Christina Plum \(ENERGINET, Denmark\)](#)

[European Network Codes, a first step towards flexibility. Daniel Daví \(ENDESA, Spain\)](#)

[Peer to peer: Is Blockchain the solution? Andreas Sumper \(CITCEA-UPC, Spain\)](#)

[Hardware for flexibility. Daniel Heredero \(CITCEA-UPC, Spain\)](#)





EMPOWER H2020 architecture model explained in MPS Conference 2017

The Architecture of EMPOWER H2020 project was explained by Andreas Sumper, from CITCEA-UPC, in Cluj- Napoca (Rumania) the 8th of June. The paper "Architecture definition and operation testing of local electricity markets. The EMPOWER project" was accepted for oral presentation in "2017 International Conference on Modern Power Systems (MPS)" .

More Information of MPS conference [here](#)

Andreas Sumper presented the EMPOWER architecture, developed using SGAM (Smart Grid Architecture Model)

EMPOWER H2020 project explained in EURELECTRIC 2017



EURELECTRIC Conference

The conference "The electricity market design of the future" was organized by EURELECTRIC on 7th of June. Pol Olivella, from CITCEA-UPC, presented "Design and Operational Characteristics of Local Energy and Flexibility Markets in the Distribution Grid". The article was co-authored by Pol Olivella-Rosell, Jayaprakash Rajasekharan, Bernt Arild Bremdal, Stig Ødegaard, Andreas Sumper and Roberto Villafafila-Robles. The agenda of the event is available [here](#).

EMPOWER H2020 explained in the Workshop "Connected buildings"

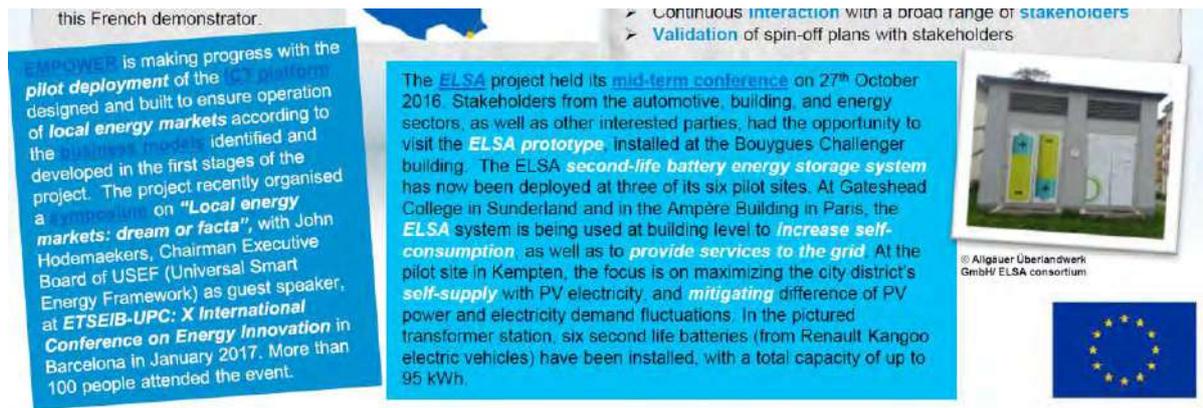


Mònica Aragüés presented CITCEA-UPC expertise in vehicle to grid and battery to grid and projects, like EMPOWER H2020, that are promoting distributed generation

EMPOWER H2020 project was shown in the Workshop "Connected buildings", held on 16th of May in Girona, which covered topics that included self-consumption, photovoltaic generation, energy storage and electric vehicles grid integration. The contents and presentations of the Workshop are available [here](#) (in catalan). There were more than 100 attendees, mainly from the industry.

EMPOWER H2020 announced in 3rd BRIDGE Newsletter

EMPOWER H2020 project main findings up to April 2017 appear reflected in the 3rd BRIDGE Newsletter. Bridge is a cooperation group composed of all LCE 6-10 projects funded under Horizon 2020. The aim of this group is to foster continuous dialogue between the different projects and to enable the exchange of non-confidential reports, experience and key learnings. To facilitate this, four working groups have been established: Regulation, Data Management, Consumer Engagement and Business Models. Download the 3rd BRIDGE Newsletter [here](#).



EMPOWER announcement in 3rd BRIDGE Newsletter

EMPOWER H2020 project in German press

As a result of the visit of a group of German journalists to Smart Innovation Norway and to the EMPOWER pilot site Hvaler, 3 publications have been released.

VDI Nachrichten (German Engineers Association News) has recently published an article about electric vehicles in Norway and about EMPOWER, with special emphasis in the Hvaler pilot site:

[PRESS VDI Nachrichten 27 Januar - Halden in the German Engineering News red](#)

Erneuerbare Energien (Renewable Energies) has also released a publication with focus on electric mobility and EMPOWER project. Hvaler pilot site also appears in it:

[Erneuerbare Energien 01-2017 - Norwegen Smart Meters - EV Vorreiter red](#)

Silicon.de explains the Internet of Things (IoT) in Norway and also mentions its application in Hvaler pilot site:

[Norwegen auf dem Weg zum IoT-Musterland](#)



Norway's first and only full-scale microgrid

[Online access to the article](#)

Hvaler Energy Park, an energy-producing recycling centre, was officially opened by the Norwegian Minister of Petroleum and Energy, Terje Sjøviknes, September 5th, 2017.

Smart Innovation Norway has been an essential contributor to the pilot project Smart Energi Hvaler, which has promoted production and distribution of renewable energy on the islands of Hvaler. Today, the municipality produces both solar and wind energy.

Last week, brand new Hvaler Energy Park was officially opened by the Norwegian Minister of Petroleum and Energy, Mr. Terje Sjøviknes.

He was shown around the facility, which consists of 1200 square metres of solar panels and (currently) one wind turbine and which is a smart energy demonstration site for several research and innovation projects.

Result of EMPOWER

Hvaler Energy Park, with its Microgrid Power Router (MPR) as its heart and brain, is a result of the EU Horizon 2020 project, EMPOWER.

“The EMPOWER project investigates the concept of a local electricity and flexibility market and a platform to manage exchange of electricity, communication and monetary credit assignment”, explains Dieter Hirdes, Head of Research & Innovation at Smart Innovation Norway and EMPOWER project coordinator.

“The main delivery of EMPOWER is a cloud based ICT platform for local energy markets, based on big data analysis technology and intelligent agents who perform the actual trading between neighbours or members of a cooperative”, he notes.

First in Norway

Naturally, Hirdes was present during the opening of the new energy park. He presented the status of the EMPOWER project, as well as Hvaler's role as a pilot site.

“The Microgrid Power Router makes this the only microgrid facility in Norway that can go into ‘island mode’ if the local electricity grid goes down. It can run until the grid is up and running again, then it will automatically switch back to grid connected mode”, says Hirdes. He adds:

“The facility can run without power from the local grid for six months, from spring to fall”.

Happy minister

After the tour and presentations, Minister Sjøviknes expressed clearly that he was satisfied with what he had seen and heard.



“This is very exciting! Smart Energi Hvaler, with its energy park, takes part in international networks to apply new competence and results of research, converting this into commercial products and services for a real market.”

“In the context of the green shift of economy, there has to be focus on commercialization and work places, otherwise we will not succeed. But I am sure that the work being done here, opens a lot of possibilities and will help us succeed”, he said.

Facts

- Since 2010, Hvaler has developed to be Norway’s most important demonstration site for smart energy solutions.
- The work is organized through the project Smart Energi Hvaler (SHE), which is a collaboration between Hvaler municipality, Fredrikstad Energi and Smart Innovation Norway.
- When Hvaler planned to build a new waste management facility, the SEH project group suggested to build a roof on top of the facility with 1200 square meters of solar panels and up to four wind turbines.
- With the support of ENOVA, Hvaler municipality built the facility, which is Norway’s first and only full-scale microgrid.
- ENOVA is owned by the Norwegian Ministry of Petroleum and Energy and contributes to reduced greenhouse gas emissions, development of energy and climate technology and a strengthened security of supply.
- Through the EU Horizon 2020 project, EMPOWER, a Microgrid Power Router (MPR) was built. The MPR makes it possible to run the buildings around the facility in ‘island mode’ whenever the local grid is down.
- When the error on the local electricity grid is repaired, the MPR will automatically switch back to regular grid connected mode.
- The technology has huge market potential in Norway, a country of many islands with vulnerable power supply.
- With self-produced electricity and a battery bank, the microgrid (with the recycling facility and the buildings around) can operate without external power from spring to fall.



Interested in the project?

Join our TAG

The Technical Advisory Group (TAG) and suitable profile of its members

The TAG is an instrument for dissemination, general promotion and preparation for EMPOWER exploitation. It is constituted by members of the industry or academia that are experts on the topics included in the project (microgrids, smart grids, electrical markets, communication systems, operation and control of electrical systems) and which are not directly related to the project (their institution is not inside the consortium). An example of topic that could be treated during a TAG meeting is international communication formats and standardization.

Responsibilities for TAG members

The TAG includes members from the most important types of stakeholders and constitutes a network of interest that shall help to promote the project in a knowledgeable manner, solicit target for exploitation and yield advice on the demo and our R&D effort. This means that TAG members should be aware of the progress of the project. They are invited to the project meetings and to any event organized in the project frame and they should give advice at different stages of the project.

What kind of arrangement (e.g.; financial) that was included when becoming a TAG member?

Unfortunately, any part of the budget of the project can be dedicated to the TAG. This means that its members they cannot be paid and any expenses derived from project meetings or attendance to related events can be covered.

Join our Network of Interest

Joining our Network of interest means keeping you informed of all the news of our project and the possibility of being part of the TAG (Technical Advisory Group) being constituted.

Sign up [here](#) to be a member of Friends of EMPOWER.

