28/02/2019

Newsletter #8

The latest news from the InterFlex project!

Edito - **Complementarity of energies leads to flexibility**	Introductory words from Dr Gregory BERTRAND, Head of GRDF in the French Riviera
Implementation of a flexibility market through a DSO platform	Enexis developed a local market place to solve congestion problems in the grid
200 customers involved in the Flexibility Market in Nice	A growing flexibility capacity enriches the experiment learnings, in Nice Smart Valley
Flexibilities provided by thermal inertia of buildings in Malmö	In Malmö, thermal inertia and the district heating/cooling networks are used as sources of flexibility
Smart charging concepts are tested in the field in the Czech Republic	Cez Distribuce directly controls on-premises EV charging stations
The German demo migrated onto the national smart meter framework	The German InterFlex demonstrator showcases the integration of grid operations and small scale flexibility via the public smart meter framework (SMFW)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n°731289

DR GREGORY BERTRAND

Complementarity of energies leads to flexibility

The natural gas network contributes to reducing seasonal demand on the electric power grid especially during winter, limiting CO_2 emissions and preventing important investments in the power sector. It can be considered as a "macro-flexibility" for the global energy system. This advantage is reinforced by the exponential development of renewable gases like hydrogen produced from renewable electricity and like biomethane produced from biomass. Renewable gases could represent 30% of the global French gas consumption by 2030 (about 70 TWh) and could reach 100% by 2050, according to studies carried by the French Energy Agency in 2017 and 2018. Considering that the gas storage capacity in France is about 150 TWh, gas self-sufficiency is a realistic French scenario!

Today, the emergence of smart technologies using the gas network, referred to as sector coupling through "Gas/Electrical flexibilities", represents an opportunity for electrical DSOs to also take advantage of the complementarity of gas and electricity for their localized needs. Within Nice Smart Valley, the French gas DSO, GRDF, implements these "Gas/Electrical flexibilities" through high efficiency gas appliances. Installed in residential and non-residential buildings, these devices provide extensive flexibilities to the power grid without any impact on end user comfort. The tested flexibility portfolio includes two product families: hybrid heating solutions coupling heat pumps with condensing boilers and mini Combined Heat and Power systems based on engine, turbine or fuel cell technologies.

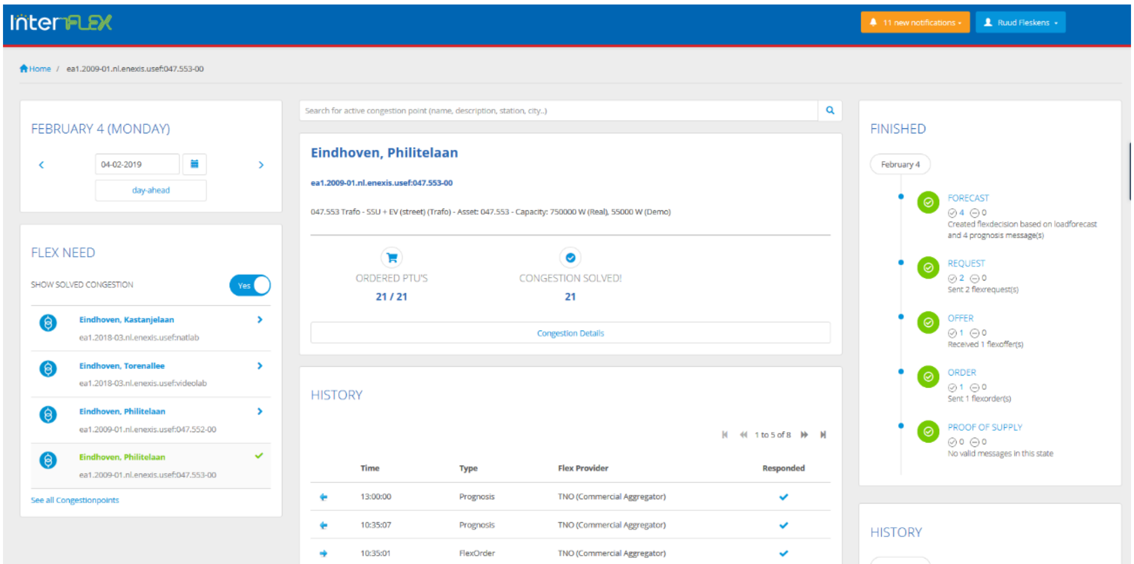
The project partners will be able to measure the competitiveness of hybrid flexibilities in the energy transition, in terms of renewable shares in the final consumption (renewable gases included).

Dr Gregory BERTRAND
Head of GRDF in the French Riviera, Strategic Pilot for GRDF within Nice Smart Valley/InterFlex EU Project
Advisor to the MSc Engineers for Smart Cities, Université Côte d'Azur

ENEXIS IS MOVING TOWARDS A FLEXIBLE AND SMARTER GRID

The first version of Grid Management System (GMS) – a smart grid tool developed by Enexis for the Dutch Interflex (Strijp-S) project - has been released, meeting all requirements that were set for this version.

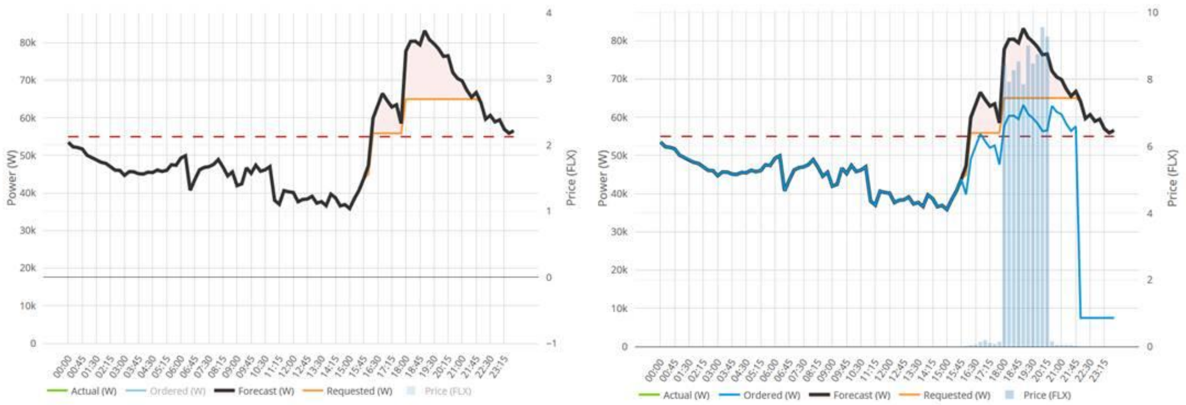
Enexis developed the first version of GMS in order to address the congestion problem in the grid. Congestion refers to capacity problems on a transformer or feeder level. This happens as a result of an unexpected increase in local demand or supply and consequently overloading or overgeneration. A check for congestion is automatically performed each morning for the upcoming day and is based on forecasting of inflexible and flexible loads. The forecasting module takes into account various kinds of factors and data including, weather data, transformer loading / DALi (Distribution Automation Light) data and prognosis data (flexible load forecast) from commercial aggregators which manage Electric Vehicle (EV) charging poles or solar panels.



Screenshot of Enexis GMS Platform

Using this daily load forecast as an input, a flex decision module was built, which checks for grid constraint violations (e.g. capacity limits). In fact, the flex decision module determines how much flexibility is needed in order to mitigate the congestion on a certain congestion point in a specific period of time.

When there is a demand for a flex supply, the GMS starts an auction, similar to a marketplace mechanism. The system sends a flex request to all commercial aggregators that manage private energy sources connected to the congestion point. The flex request contains the requested power to produce or consume for every 15 minutes on that day and the price the grid operator is willing to pay for the period. The aggregators connected to each congestion point have the possibility to respond with a flex offer in case of finding the flex request interesting. The flex offer contains the power values the aggregator is able to produce or consume (again, for each 15 minute period). If the grid operator accepts the flex offer, then the GMS sends a flex order.



The red dotted line shows the capacity of the transformer / feeder
The black line shows the forecast made by Enexis
The yellow line shows the forecast that is requested
The blue line shows the forecast after ordering
The vertical bars show the price that was paid by Enexis for that Ptu (15 minutes) in FLX (Flexcoin).

Management of the grid congestion at the transformer thanks to the activation of local flexibility.

At the moment this process is limited to one run once a day (day-ahead). However, Enexis is developing the next version of GMS, which is also capable of ‘intraday’ functionalities. This will make it possible to repeat the flex decision process multiple times during a day, further increasing compatibility.

In short, the GMS is able to reduce congestion in a sustainable way - for instance by using solar panels with a battery storage in a parking garage equipped with Electric Vehicle charging poles. Enexis is actively investigating cases where this solution can be applied.

Within the Dutch Interflex (Strijp-S) project Enexis is working together with other partners such as TNO, Sympower, Jedlix, ELaad and Croon Wolters & Dros. Enexis has adopted the USEF protocol - a messaging protocol built mainly for the smart grid market – for communication between the grid operator and connected partners. All messages are synchronized to a single research database, enabling further research in the (inter)flex program.

NEARLY 200 CUSTOMERS INVOLVED IN THE FLEXIBILITY MARKET OF NICE SMART VALLEY

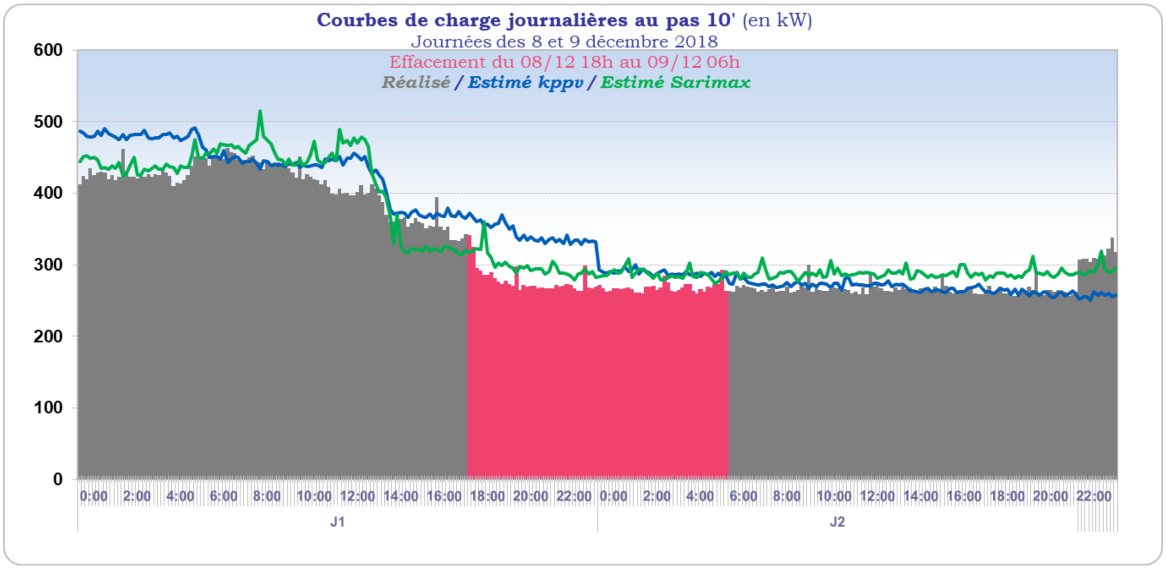
In the frame of the French Demonstrator of InterFlex - Nice Smart Valley - the project partners are experimenting the activation of flexibilities upon DSO's demand. An average of two activation requests per week are sent from the DSO (ENEDIS) to the aggregators (EDF and ENGIE) since last summer.

Thanks to ongoing recruitment efforts – and innovation – of EDF, ENGIE (aggregators) and GRDF (gas DSO), there are now nearly 200 customers involved in the demonstration, spread over 7 cities covered by 4 primary substations.

The growing amount of flexibility capacity enables the consortium to improve the interest of the experiment learnings, namely:

- Motivation and involvement sources depending on the type of customers
- The flexibility effect to alleviate local grid constraints
- Test of activation control methods of the DSO and of the aggregators
- Comparison of the behaviour of a large panel of customers and technologies :
  - B2C/B2B (industrial and services)
  - Steered flexibility as well as behaviour-based flexibility
  - Dual technologies promoted by GRDF (from a few kW hybrid heater to a 70kW CHP)

The recruitment is about to end, but is still to be enlarged especially with administrative buildings, a battery storage system of 33kW shared between ENEDIS and ENGIE, and an electric vehicle with Vehicle to Building capabilities developed by EDF.



Example of the comparison between actual load curve (in kW) of an industrial B2B customer – with a load decrease request between 6pm and 6 am – and DSO estimated reference load curve with two different methods

THERMAL INERTIA OF BUILDINGS TO PROVIDE FLEXIBILITY FOR GRID MANAGEMENT PURPOSES IN MALMÖ

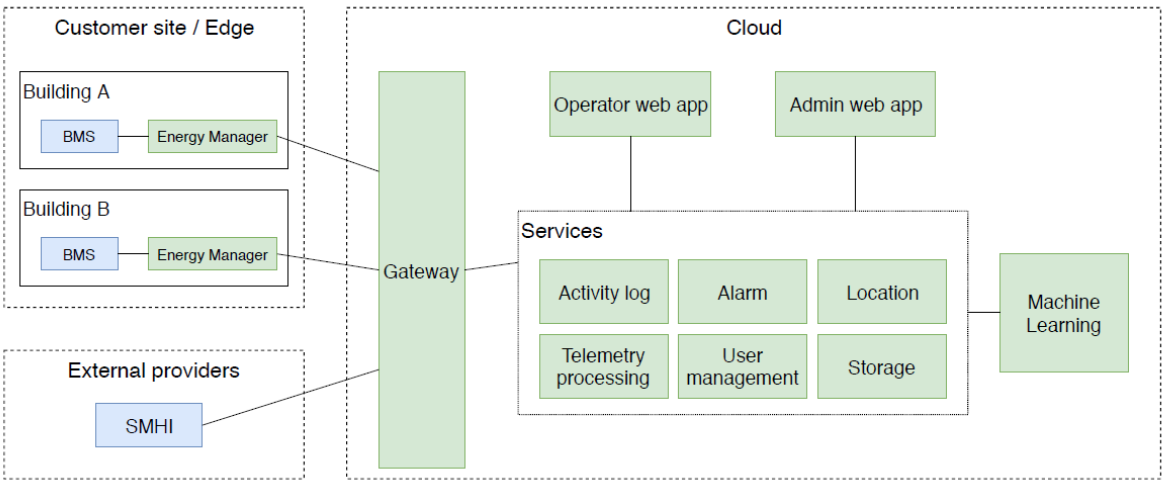
In the mornings and evenings, the heat demand is higher than at other times of the day, resulting in peak loads in the district heating network. At the same time, the room or building temperature often increases due to social behaviour. A peak in the district heating networks means higher costs and a larger impact on the environment. Avoiding to starting extra production due to consumption peaks is always sought from an environmental and cost perspective.

One of the Swedish demonstrators, located in Malmö, evaluates and tests operation of distributed Demand Side Response (DSR) using the building´s envelope thermal inertia (the inbound heat in the house) and the district heating/cooling network´s thermal inertia (the possibility to control the amount of energy in the network). These sources of flexibility aim at optimizing production and distribution. The idea is to shift loads in time, without impacting the comfort and without impacting the overall energy consumption.

The solution is comprised of three layers of functionality, which continuously communicates and operates together:

- Enrolled buildings are connected to a **central cloud platform - ectocloud™-** from which the system is controlled through generating steering signals.
- These signals are communicated to a **local computer - Energy manager -** installed in the recruited buildings.
- The energy manager serves as a local gateway, translating the signals generated in the cloud in order to communicate with the **monitoring system of the building - BMS -** via Modbus. The BMS carries out the steering of the heating system and coordinates and monitors other functionalities such as sensors, actuators ventilation, fire alarm and security system.

The overall solution is referred to as CESO (Customer Energy and System Optimization).



Overview of the CESO solution enabling power control functionality

Thanks to the power control functionality offered by CESO, the district heating DSOs can manually reduce or increase the thermal power demand of connected heating systems. The DSO accesses the system through the operator interface of ectocloud™, where the available aggregated flexibility and the outcome of previous actions are displayed, as shown in the figure below. The system allows the operator to set multiple schedules for desired power control based on available flexibility. The DSO analyses the data and sets the decrease of the thermal power demand before a forecasted consumption peak, for example at 7 AM when everyone takes a shower before work. When the DSO creates a new power control schedule, the power control signals are sent to each Energy Manager, which in turn send offset signals to the connected BMS, reducing (or increasing) the heat demand temporarily. Customer comfort is assured through only allowing temperature changes of +/-0.5 degrees Celsius. Depending on the preference of the DSO, this could allow for e.g. 75 % power reduction for 2 h or 25 % power reduction for 6 h so that the forecasted consumption peak is reduced.

DSO operator interface of the cloud based platform (ectocloudTM)

The green graph is the current heat power demand, and the orange is the outdoor temperature. The DSO can set a schedule using power control to decrease the power in the building (the blue graph) for a number of hours when the demand is high and the temperature is low. In this way the peak is reduced, without any impact in customer comfort.

A SMART CHARGING CONCEPT IS TESTED IN THE FIELD IN THE CZECH REPUBLIC

In the frame of InterFlex, CEZ Distribuce, the biggest Distribution System Operator (DSO) in the Czech Republic, demonstrates a smart charging concept of Electric Vehicles (EVs) and its effect on the distribution grid in case of emergency.

For that purpose, CEZ Distribuce installed non-public smart charging stations in two private areas (Hradec Kralove and Decin). The maximum charging power of the stations can be limited in case of under voltage, under frequency or in case the DSO sends a DSM (Demand Side Management) signal through a narrow band simple one way PLC communication.

The smart solution has already been successfully tested at all charging stations included in the InterFlex project. Charging stations are used only to charge CEZ Distribuce EVs since the operation of public charge points by DSOs is foreseen to be forbidden in Europe based on the proposal of the Clean Energy Package (proposal of the European Commission).

Charging station in Decin area (on the left, smart solution provided by Siemens)
and in Hradec Kralove area (on the right, smart solution provided by Schneider Electric)

GERMAN DEMO SUCCESFULLY MIGRATED ONTO THE NATIONAL SMART METER FRAMEWORK

In InterFlex' demonstrator in Germany, the DSO Avacon directly steers residential and generation assets through its IT platform called Smart Grid Hub (SGH). The SGH is designed to operate fully integrated with the DSOs grid control SCADA on one side and the national smart meter framework (SMFW) on the other.

While the official start date of the smart meter rollout in Germany remains unclear, Avacon has successfully migrated the SGH and its pilot customers onto the SMFW architecture. The SGH will be operational in daily grid operation once the conditions set out by the Federal Office of Information Security (BSI) are met: the availability of certified smart meters, a minimum of three certified smart meter gateways and a certified gateway administration service (GWA).

Currently, two more smart meter gateways remain to be certified to officially launch the roll out of smart meters. Meanwhile InterFlex is already operating on a certified GWA, with certified smart meters and the one certified smart meter gateway that's available on the market today.

As such, the German demonstrator highlights the feasibility of use cases involving small scale flexibility and the potential of a grid wide deployment of smart meters. In doing so, InterFlex explores new ways to improve DSO operations by enabling the direct activation of flexibility offered by private customers. It also empowers customers to participate in emerging flexibility markets and support the energy transition.

Smart meter with smart meter gateway and the control box to be tested in InterFlex

Thank you very much for your interest in our project

This is the end of our 8th Newsletter!
Next one in two months!

Do not forget to visit our website:
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