Programme co-funded by European Union funds (ERDF, IPA, ENI)

Interreg
Danube Transnational Programme
3Smart

Newsletter No.4

Welcome to the 4th newsletter of the project Smart Building – Smart Grid – Smart City (3Smart). Through the links below it brings you descriptions of the performed investments on the five 3Smart pilots to make them ready for evaluation of the developed tool for integrated energy management of buildings and grids. The tool is intended to significantly empower consumers and energy grids in cost efficiency and demand response. We are organizing public pilots presentations in 2019. Please check and save the dates! Happy 2019!

PILOT IN CROATIA	3SMART PILOT BUILDINGS AND GRIDS
PILOT IN SLOVENIA	
PILOT IN AUSTRIA	
PILOT IN BOSNIA AND HERZEGOVINA	
PILOT IN HUNGARY	

PROJECT INFO

Start date	01-01-2017
End date	31-12-2019
Budget in Euro	Overall: 3.791.343,41 ERDF Contribution: 2.684.885,78 IPA Contribution: 537.756,07 ENI Contribution: 0,00
Programme	Interreg Danube Transnational Programme
Call number	Call 1
Priority	Better connected and energy responsible Danube region
Specific objective	Improve energy security and energy efficiency

3SMART MAIN GOAL

Provide a technological and legislative setup for integrated energy management of buildings, energy grids and major city infrastructures in the Danube region

3SMART INNOVATION

Modular software platform that optimally coordinates buildings and energy grids, with easy add-on to the existing automation systems

3SMART VISION

Economically optimal interoperation of energy efficiency measures, renewable energy sources, energy storages, energy distribution grids and major city infrastructures

PROJECT OUTPUTS

- Tool for energy management on building and distribution grid side
- Five pilot actions in different Danube region countries including buildings and grids with intersected technology/regulatory setups
- Strategy to enable city-wide energy management at the regulatory level in the Danube region

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Newsletter No.4

PILOT IN CROATIA: University of Zagreb Faculty of Electrical Engineering and Computing, Unska 3, 10000 Zagreb

Basic facts and initial state:

- 248 controllable heating/cooling zones over 13 floors, covering area of 9.000 m^2
- Heating and cooling system with 370 fan coils; digital room climate control
- Heating energy supplied from the central city heat distribution system via a 1 MW heat exchanger; cooling energy supplied from own 250 kW (electric powered) chiller station
- SCADA system

Total cost of the investment:
200.000 EUR, of which 145.000 EUR funded from the Interreg Danube Transnational Programme

3Smart investment:

- Upgraded control application of room controllers to enable both local and centralized controls without any noticeable change for the end-users in rooms
- Introduced measurements of heating/cooling medium temperatures by fan coils as well as flows and heating energy by floors
- Installed a 32 kWh/10 kW lithium-ion batttery system with controllable charging/discharging power
- Created 3Smart database as a data source/sink for the 3Smart Energy Management System (EMS) with integrated all relevant data from the heating/cooling system, all new sensory data, data from buildings weather station, solar irradiance measurement equipment and photovoltaic plant, building smart meters, weather forecast service and with data exchange with the grid to implement demand response
- Enabled simple, robust and modular changeover (soft switch) between the mode in which climate control is performed on a classical decentralized way as up to now, and the mode in which the newly introduced 3Smart EMS can through its open two-way database issue commands towards the key actuating variables in the building – fan coils' fan speeds in all rooms, starting temperature of the medium from the heating substation, pressure difference on the heating substation medium circulation pump, starting temperature of the medium from the chiller, battery system power

Application of the 3Smart tool on-site:

- Coordinated
  - I. (**building zone level**) predictive control of energies used for cooling/heating individual rooms
  - II. (**central HVAC system level**) predictive control of starting temperatures/flows for the heating and cooling medium for the building, and shaping optimal energy-exchange profile with the district heating grid
  - III. (**microgrid level**) predictive control of the battery system charging/discharging energy that implements control of energy exchange profile with the electricity grid including demand response

  which maintain comfort as required by the end-users and minimize the building energy costs
- Auxilliary prediction and estimation procedures which as a side-effect facilitate and enhance building maintenance
- Interfacing procedures to implement computed commands on existing actuating equipment

Expected effect:
Drastic decrease of building operational costs; return on investment conservatively estimated at 7 years – without consideration of gains from participation in meanwhile expectably established demand response schemes

Public presentation will be held on
3 July 2019

SAVE THE DATE

Please follow further news regarding the event on 3Smart web page

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Newsletter No.4

PILOT IN CROATIA: Hrvatska elektroprivreda d.d., Ulica grada Vukovara 37, 10 000 Zagreb

Basic facts and initial state:

- 242 controllable heating/cooling zones over 9 floors, covering area of 7.800 m^2
- Heating via 288 manually controlled radiators; cooling with 313 fan coils (controlled with local controllers without possibility of integration to the SCADA)
- Heating energy supplied by the local district heating system via 3 substations (2 x 1 MW and 1 x 120 kW heat exchangers); cooling energy supplied from own 1 MW cooling power water chiller station (electric powered)
- Building has no automation at all

Total cost of the investment:
267.000 EUR, of which 177.444 EUR funded from

3Smart investment:

- All offices equipped with controllers for controlling heating and cooling equipment in the room. SCADA system introduced. All controllers and heating/cooling production equipment integrated to the central SCADA system
- Introduced measurement of heating and cooling medium temperatures and energy flows on the floor level (overall 33 new heat meters installed in the building)
- Installed a 32,4 kWh/10 kW lithium-ion battery system with controllable charging/discharging power
- 3Smart database created as a data source/sink for the 3Smart Energy Management System (EMS) with integrated all relevant data from office, floor, HVAC and micro grid level

Application of the 3Smart tool on-site:

- Coordinated
  I. (**building zone level**) predictive control of energy used for heating the individual rooms,
  II. (**central HVAC system level**) predictive control of starting temperature for the heating and cooling medium for the building, and shaping optimal energy-exchange profile with the district heating grid
  III. (**microgrid level**) predictive control of the battery system charging/discharging energy that implements control of energy exchange profile with the electricity grid including demand response

  which maintain comfort as required by end-users and minimize the building energy costs

Expected effect:
Decrease of the building operational costs;
return on investment is estimated at 10 years – without consideration of gains from participation in meanwhile expectably established demand response schemes

Public presentation will be held on
3 July 2019

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Please follow further news regarding the event on 3Smart web page

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Newsletter No.4

PILOT IN CROATIA: Electricity distribution grid of Hrvatska elektroprivreda d.d., around pilot buildings

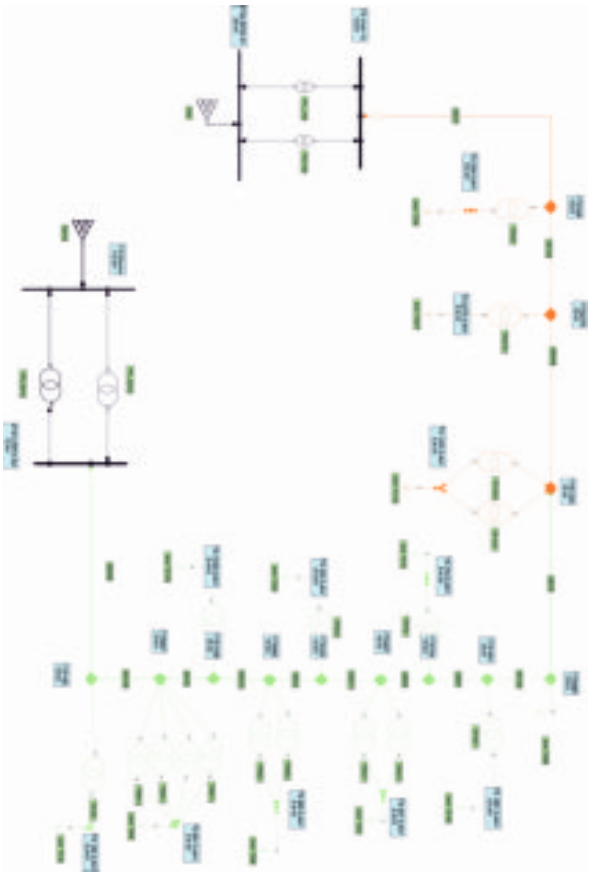
Basic facts and initial state:

- Pilot locations are two close 10 kV distribution network feeders supplied from different substations, delivering electricity to different types of end-consumers
- UNIZGFER and HEP building are of similar size in terms of peak load and electric energy used
- At the beginning of the project only the day-ahead electricity market at the power exchange was operational, with low liquidity and no access for the end-consumers. End-consumers have time-of-use tariffs defined by their supplier
- The DSO does not have the tools (and does not do it in real-life) for optimizing grid planning by taking end-users flexibility into account. There is no methodology for encouraging end-users to exhibit flexibility in order to help the grid (and the DSO)

Total cost of the investment: 60. 000 EUR, of which 51.000 EUR funded from the Interreg Danube Transnational Programme

3Smart investment:

- Grid-side servers for newly developed tools.



Application of the 3Smart tool on-site:

- Short-term modules:
  - I. Day-ahead module for optimal management of building flexibility, driven by long-term contract with the DSO
  - II. Intra-day module for triggering the flexibility based on real-time measurements extracted from DSO's SCADA system (at the beginning of the designated feeder)
- Long-term modules:
  - I. Annual: Contracting flexibility provided by end-users, defining reservation and utilization costs and "negotiating" these with the end-users
  - II. Multiannual: Defining the need for flexibility in the distribution network based on investment triggers

Expected effect: More efficient planning and operation of the distribution network, concept for the methodology to encourage the end-users to assist the system, reduction of end-users electricity bills due to flexibility services for the DSO
Public pilot presentation date: **3 July 2019**

Programme co-funded by European Union funds (ERDF, IPA, ENI)

Interreg
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Newsletter No.4

PILOT IN SLOVENIA: Primary School and Sports centre, Lapajnetova 50, 5280 Idrija

Basic facts and initial state:

- 44 classrooms in primary school and 2 gyms in neighbouring sports centre building
- Heating system includes 275 radiators in both buildings
- Heating energy supplied from the boiler room, connected to the buildings, which supplies many other buildings with heat energy
- Heating regulated by boiler automation controlling mixing valve, one for each building

Total cost of the investment:
214.000 EUR, of which 160.500 EUR funded from the Interreg Danube Transnational Programme

3Smart investment:

- Changed valves on all radiators and hydraulic balancing of the system
- 162 radiators equipped with wireless controlled heads and temperature sensor for returning water. The rest of radiators in utility rooms, hallways and some offices equipped with thermostat heads
- Room temperature sensor and presence detector installed in every clasroom and gym
- Established wireless network to connect radiator valves and all sensors to the gateway which is connected to the 3Smart EMS database server
- Installed 30 kW photovoltaic plant with basic weather station on the roof of the primary school and connected to database
- Installed cogenerator of 90 kW heating and 50 kW electrical power in the boiler room next to the buildings
- PC database server installed, new optical connection between database server, internet, gateway and boiler room installed and separate IP address for 3Smart communications ordered
- Domestic hot water tank 4.000 l upgraded with 35 kW electrical heaters
- GUI for heating control installed

Application of the 3Smart tool on-site:

- Coordinated
  - I. (**building zone level**) predictive control of energies used for heating individual classrooms
  - II. (**central HVAC system level**) predictive control of starting temperatures for the heating medium for the building, and shaping optimal energy-exchange profile with the district heating grid
  - III. (**microgrid level**) predictive control of CHP output energy and DHW tank heaters as controllable load that implements control of energy exchange profile with the electricity grid including demand response

  which maintain comfort as required by the end-users and minimize the building energy costs
- Auxilliary prediction and estimation procedures which as a side-effect facilitate and enhance building maintenance
- Interfacing procedures to implement computed commands on existing and newly introduced actuating equipment

Expected effect:
Significant decrease of building operational costs;
Improving comfort for end-users;
Achieve feasibility for the EMS model to expand to other municipality-owned buildings

Public presentation will be held on:
14 November 2019

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Please follow further news regarding the event on 3Smart web page

Programme co-funded by European Union funds (ERDF, IPA, ENI)

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Newsletter No.4

PILOT IN SLOVENIA: Electricity distribution grid of Elektro Primorska d.d. around pilot buildings

Basic facts and initial state:

- Pilot location is supplied by the 20 kV distribution network feeder and transformer substation in the premises, delivering electricity to different types of end-consumers
- Primary school and sports centre are interconnected in terms of network and connected to the same metering point towards the distribution system operator (DSO)
- At the beginning of the project no measurements apart from measurements of some end-consumers at the end of the LV feeder were operational or even available
- The DSO does not have the tools for optimizing grid planning by taking end-users flexibility into account. There is no methodology for encouraging end-users to exhibit flexibility in order to help the grid (and the DSO)

Total cost of the investment: 21. 000 EUR, of which 17.850 EUR funded from the Interreg Danube Transnational Programme

3Smart investment:

- Grid-side servers for newly developed tools.

Application of the 3Smart tool on-site:

- Short-term modules:
  I. Day-ahead module for optimal management of building flexibility, driven by long-term contract with the DSO
- Long-term modules:
  I. Annual: Contracting flexibility provided by end-users, defining reservation and utilization costs and »negotiating« these with the end-users
  II. Multiannual: Defining the need for flexibility in the distribution network based on investment triggers

Expected effect: More efficient planning and operation of the distribution network, concept for the methodology to encourage the end-users to assist the system with the help of flexibility services for the DSO and reduction of end-users' electricity bills

Public pilot presentation date: **14 November 2019**

Programme co-funded by European Union funds (ERDF, IPA, ENI)

Interreg
Danube Transnational Programme
3Smart

Newsletter No.4

PILOT IN AUSTRIA: Primary School, Hauptstraße 1, 7522 Strem

Basic facts and initial state:

- Central heating system with 3 heating circuits
- Heating with 42 radiators (manually controlled) and 1 fan coil (controlled with a manual switch)
- Heating energy supplied by the local district heating system based on renewable energy sources (local biomass heating plant and biogas CHP plant)
- Electricity supplied by electricity grid of the local DSO Energy Güssing

Total cost of the investment: 50.000 EUR, of which 42.500 EUR funded from the Interreg Danube Transnational Programme

3Smart investment:

- It was necessary to upgrade the heating system in the school building by implementing room controllers, actuators on the radiators, temperature sensors, energy valves, etc. as well as a central controller, that enables a manageable heating system
- 9 controllable heating zones / 1 non-controllable zone (sanitary area) over 1 floor (500 m²) have been realized at the pilot building
- On electricity side a smart meter was installed to monitor the electricity consumption of the building
- Investments also were done on the IT side, by installing a master computer, where the 3Smart database is integrated for data collection from the sensors, and as a necessary link for the operation of the 3Smart energy management modules

Application of the 3Smart tool on-site:

- Coordinated
  - I. (**building zone level**) predictive control of energy used for heating the individual rooms
  - II. (**central HVAC system level**) predictive control of the starting temperature in heating for shaping heat consumption from the district heating
  - III. (**microgrid level**) prediction of energy exchange with the electricity grid

Expected effect:
Decrease of the operational heating costs; increase the comfort of the building users; creating a more balanced system based on the demand response with the district heating grid

Public presentation will be held on:
13 June 2019

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Newsletter No.4

PILOT IN AUSTRIA: Retirement and Care Centre, Kapellenstraße 24, 7522 Strem

Basic facts and initial state:

- 114 rooms with zone control system / 1 floor (3.000 m²)
- 4 heating circuits (floor heating & cooling) and 2 zones that are interconnected by a central regulation system
- 53 floor heating circuit distributors
- central element for the HVAC level on heating side is the district heating transfer station and on cooling side the chiller
- 170 kWp PV plant (70 kWp south-oriented, 100 kWp east-west-oriented)
- SCADA system

Total cost of the investment:
65.000 EUR, of which 55.250 EUR funded from the Interreg Danube Transnational Programme

3Smart investment:

- Upgrade of the existing control system and creating a new controller that enables control without any noticeable change for the end-users in the building
- Implementation of measurements for heating/cooling medium temperatures for the floor heating/cooling system
- Installation of a 24 kWh salt-water battery storage system with controllable charging/discharging power
- Integration of the 3Smart database in the existing system as data source/sink for the 3Smart energy management system for all necessary data from the building, weather station, photovoltaic plant, storage system, smart meters, etc. and as a necessary link for the operation of the 3Smart energy management modules

Application of the 3Smart tool on-site:

- Coordinated
  - I. (**building zone level**) predictive control of energy used for heating/cooling of the individual rooms in the selected 3Smart control area of the building
  - II. (**central HVAC system level**) predictive control of starting temperature for the heating/cooling medium of the building;
  - III. (**microgrid level**) predictive control of battery system charging/discharging energy

Expected effect:
Decrease of the operational heating and electricity costs; increase the comfort of the building users;
creating a more balanced system based on the demand response with the district heating grid and the electricity grid

Public presentation will be held on:
13 June 2019

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Newsletter No.4

PILOT IN AUSTRIA Electricity distribution grid of Energy Güssing in Strem (pilot area)

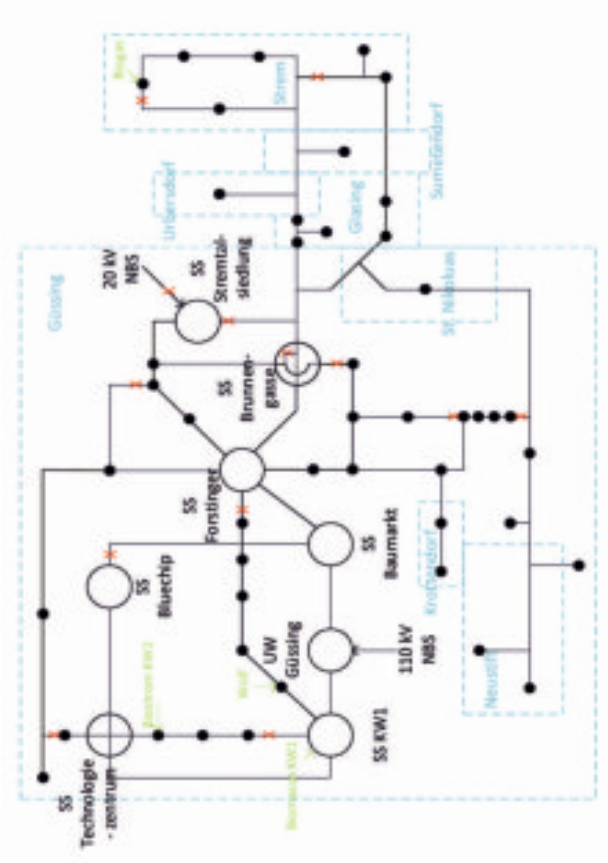
Basic facts and initial state:

- Pilot buildings are connected to 0.4 kV grid; transformer stations (20 kV) are close to pilot buldings and connected to main grid in Güssing via a single feeder (7 km overhead line)
- Each of the two pilot buildings in Strem has its own metering point towards the DSO Energie Güssing; retirement and care centre building is one of the largest consumers on the feeder and there is also a separate connection point for the centre's 170 kWp PV plant
- Near the two pilot buildings, on the same grid feeder, there are 1.5 MW PV plant and a 500 kW (electrical power) biogas plant
- Because of rising power production in Strem and a single feeder from main grid in Güssing "power grid management" is mandatory required
- No energy management system/software was available for grid planning. Also no dynamic load measuring existed. Continous measurement is planned to be introduced during the project lifetime (not funded from 3Smart)

Total cost of the investment: 30. 000 EUR, of which 17.000 EUR funded from the Interreg Danube Transnational Programme

3Smart investment:

- Server for the grid-side modules and for communication with building-side servers on the pilot buildings.



Application of the 3Smart tool on-site:

- Short-term modules:
  I. Day-ahead module for optimal management of building flexibility, driven by long-term contract with the DSO
- Long-term modules:
  I. Annual: Contracting flexibility provided by end-users, defining reservation and utilization costs and “negotiating” these with the end-users
  II. Multiannual: Defining the need for flexibility in the distribution network based on investment triggers

Expected effect: More efficient planning and operation of the distribution network, concept for the methodology to encourage the end-users to assist the system, reduction of end-users electricity bills due to flexibility services for the DSO
Public pilot presentation date: **13 June 2019**

Programme co-funded by European Union funds (ERDF, IPA, ENI)

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Newsletter No.4

PILOT IN BOSNIA AND HERZEGOVINA: JP EPHZHB d.d. Mostar, Vuciji Brig b.b., 80240 Tomislavgrad

Basic facts and initial state:

- 26 controllable heating/cooling zones over 2 floors, covering area of about 1.000 m^2
- Heating and cooling system with 29 fan coils; digital room climate control
- Heating energy supplied from the heat pump with 75 kW nominal heat power (27 kW nominal electric power) and electrical boiler with 88 kW nominal heat and electrical power; cooling energy supplied from the heat pump with 73 kW nominal cooling power (27 kW nominal electric power)

Total cost of the investment:
226.500 EUR, of which 192.500 EUR funded from the Interreg Danube Transnational Programme

3Smart investment:

- PV plant 49.8 kWp, battery storage system 32 kWh/10 kW lithium-ion with controllable charging/discharging power
- Heat meters for measuring heating/cooling energy, temperatures, flow for several key points, electrical energy meters for measuring parameters of electrical energy for several key points
- Compact room automation stations for fan coil control, room operator units for fan coils, compact room automation stations for air handling units control, room operator units for air handling units control
- Pyranometers for extraction of direct and diffuse component of solar irradiance from 2 measurements of global solar irradiance, weather forecast service for prediction of direct and diffuse component of solar irradiance
- DDC equipment
- Building management system – SCADA
- 3Smart database as a data source/sink for the 3Smart Energy Management System (EMS) with integrated all relevant data including data exchange with the grid to implement demand response
- Simple, robust and modular changeover (soft switch) between the mode in which climate control is performed on a classical decentralized way as up to now, and the mode in which the newly introduced 3Smart EMS can through its open two-way database issue commands towards the key actuating variables in the building

Application of the 3Smart tool on-site:

- Coordinated
  I. (**building zone level**) predictive control of energies used for cooling/heating individual rooms
  II. (**central HVAC system level**) predictive control of starting temperatures for the heating and cooling medium for the building and shaping optimal energy-exchange profile with the district heating grid
  III. (**microgrid level**) predictive control of the battery system charging / discharging energy that implements control of energy exchange profile with the electricity grid including demand response

  which maintain comfort as required by the end-users and minimize the building energy costs
- Auxiliary prediction and estimation procedures which as a side-effect facilitate and enhance building maintenance
- Interfacing procedures to implement computed commands on existing actuating equipment

Expected effect:
Decrease of electrical power peak of the building; decrease of electrical energy consumption of the building; decrease of electrical energy usage from the grid by using electrical energy from PV plant and battery storage system when technically and economically justified

Public presentation will be held on:
18 July 2019

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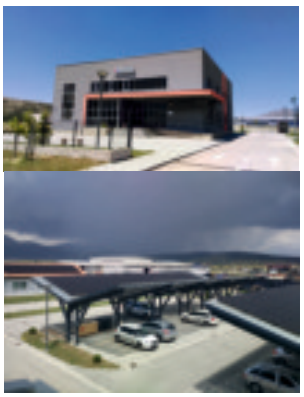

Please follow further news regarding the event on 3Smart web page

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Newsletter No.4

PILOT IN BOSNIA AND HERZEGOVINA: Electricity distribution grid of JP EPHZHB d.d. Mostar, around pilot building

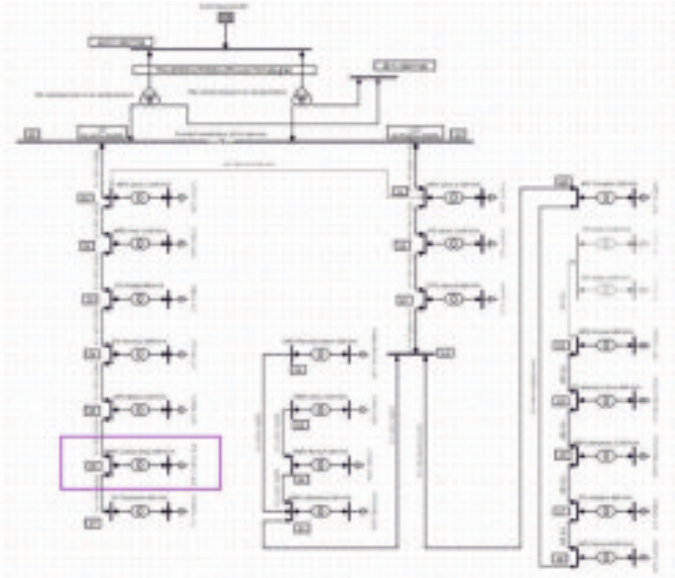
Basic facts and initial state:

- Pilot location is connected to low voltage network which is supplied from substation 10(20)/0,4 kV. Substation is part of 10 kV MV feeder
- EPHZHB building has its own metering point towards the distribution system operator (DSO)
- The power exchange market in Bosnia and Herzegovina is not yet established
- EPHZHB has professional tool for grid modelling which is used for grid-side modules
- The DSO does not have the tools (and does not do it in real-life) for optimizing grid planning by taking end-users flexibility into account. There is no methodology for encouraging end-users to exhibit flexibility to help the grid (and the DSO)

Total cost of the investment: 3.000 EUR, of which 2.550 EUR funded from the Interreg Danube Transnational Programme

3Smart investment:

- Creation of grid model for implementing long-term and short-term 3Smart grid management modules



Application of the 3Smart tool on-site:

- Short-term modules:
  I. Day-ahead module for optimal management of building flexibility, driven by long-term contract with the DSO
- Long-term modules:
  I. Annual: Contracting flexibility provided by end-users, defining reservation and utilization costs and “negotiating” these with the end-users
  II. Multiannual: Defining the need for flexibility in the distribution network based on investment triggers

Expected effect: More efficient planning and operation of the distribution network, concept for the methodology to encourage the end-users to assist the system, reduction of end-users' electricity bills due to flexibility services for the DSO
Public pilot presentation date: **18 July 2019**

Programme co-funded by European Union funds (ERDF, IPA, ENI)

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Newsletter No.4

PILOT IN HUNGARY: E.ON Tiszántúli Áramhálózati Zrt., Kossuth L. u. 41, 4024 Debrecen

Basic facts and initial state:

- 5 joint buildings with around 150 rooms
- Heating and cooling system with 250 fan coils and 4 heating/cooling substations
- Heating energy supplied from the central city heat distribution system; cooling energy supplied from own water chiller units (electric powered, one per each heating/cooling substation)
- No building automation, energy management, or renewable energy production

Total cost of the investment:
256.000 EUR, of which 217.600 EUR funded from the Interreg Danube Transnational Programme

3Smart investment:

- Zone sensors have been installed in 114 rooms to measure room temperature and fan coil return medium temperature
- Calorimeter, buffer tank temperature sensor, water chiller control, electricity consumption measurement and forward medium temperature control have been introduced in every heating/cooling substation
- 22.41 kWp photovoltaic plant was installed along with two smart-grid-ready three-phase inverters
- Electrical heater units, water chillers and PV inverters have been equipped with control options for load-shifting and demand side control
- 3Smart database and building management software have been created to provide manual control/supervision and to interact with the 3Smart Energy Management System (EMS). All relevant data from every system mentioned earlier and also from other data sources such as buildings weather station, weather forecast service, smart meter has been brought together in one central system
- Each control system has been equipped with changeover (soft switch) possibility which enables smooth switch between previous mode operation and 3Smart control

Application of the 3Smart tool on-site:

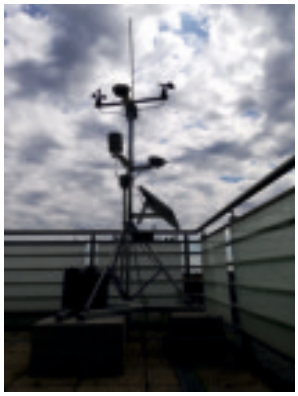
- Coordinated
  - I. (**building zone level**) prediction of rooms heating/cooling energy consumption,
  - II. (**central HVAC system level**) predictive control of forward temperatures for the heating and cooling medium for the building, and for the water chiller units
  - III. (**microgrid level**) predictive control of the electrical heating units, the water chillers and the PV plant that implements control of energy exchange profile with the electricity grid including demand response

  which maintain comfort as required by the end-users and minimize the building energy costs
- Auxilliary prediction and estimation procedures which as a side-effect facilitate and enhance building maintenance
- Provides detailed data analysis options for the building electricity consumption

Expected effect:
Drastic decrease of building operational costs; return on investment conservatively estimated at 7 years – without consideration of gains from participation in meanwhile expectably established demand response schemes

Public presentation will be held on:
5 September 2019

SAVE THE DATE



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Newsletter No.4

PILOT IN HUNGARY: Electricity distribution grid of E.ON Tiszántúli Áramhálózati Zrt. Debrecen

Basic facts and initial state:

Total cost of the investment: 33. 500 EUR, of which 28.475 EUR funded from the Interreg Danube Transnational Programme

3Smart investment:

- Smart meters for moitoring MV line and LV parameters
- Methodology and conception for grid-side energy management system is elaborated
- User-friendly applications are developed for data collection on both grid- and building-side
- Smart meter on medium voltage line is installed and incorporated into the data collection process
- Day-ahead and intra-day prices are coming regularly and are stored in database
- Shiftable loads / consumptions are identified and equipped with control automation system
- Pilot site is ready to accept modules

Application of the 3Smart tool on-site:

- Short-term modules:
  I. Day-ahead module for optimal management of building flexibility, driven by long-term contract with the DSO
  II. Intra-day module for triggering the flexibility based on real-time measurements from grid smart meters
- Long-term modules:
  I. Annual: Contracting flexibility provided by end-users, defining reservation and utilization costs and “negotiating” these with the end-users
  II. Multiannual: Defining the need for flexibility in the distribution network based on investment triggers

Expected effect: Encourage customers to be involved into Active Network Management in order to mitigate the network constraints, and reach more cost-effective operation of the buildings.
Using the flexbility services makes the DSO more effective in terms of distribution network planning and operation
Public pilot presentation date: **5 September 2019**