

Upgrade of a typical office building automation system for enabling open energy management services

Mario Vašak, Antonio Starčić, Vinko Lešić, Anita Martinčević

University of Zagreb Faculty of Electrical Engineering and Computing

mario.vasak@fer.hr

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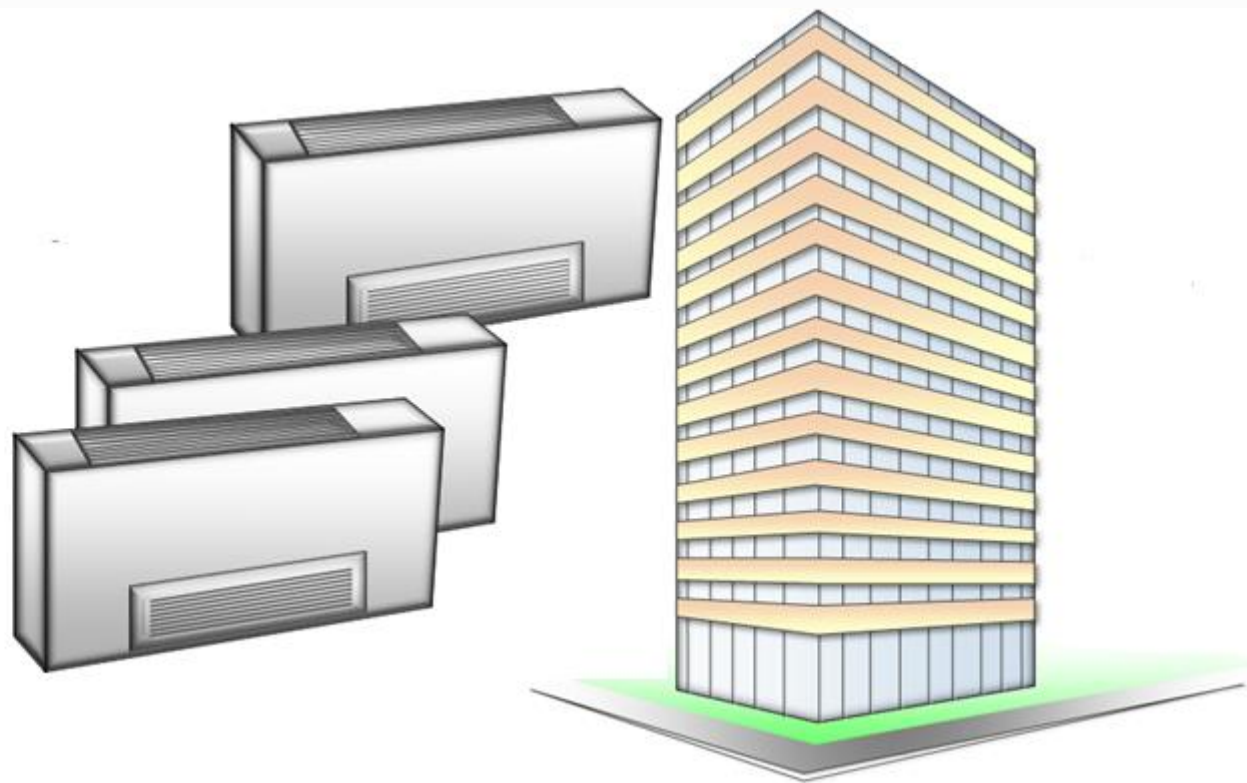


Project co-funded by the European Union

Outline

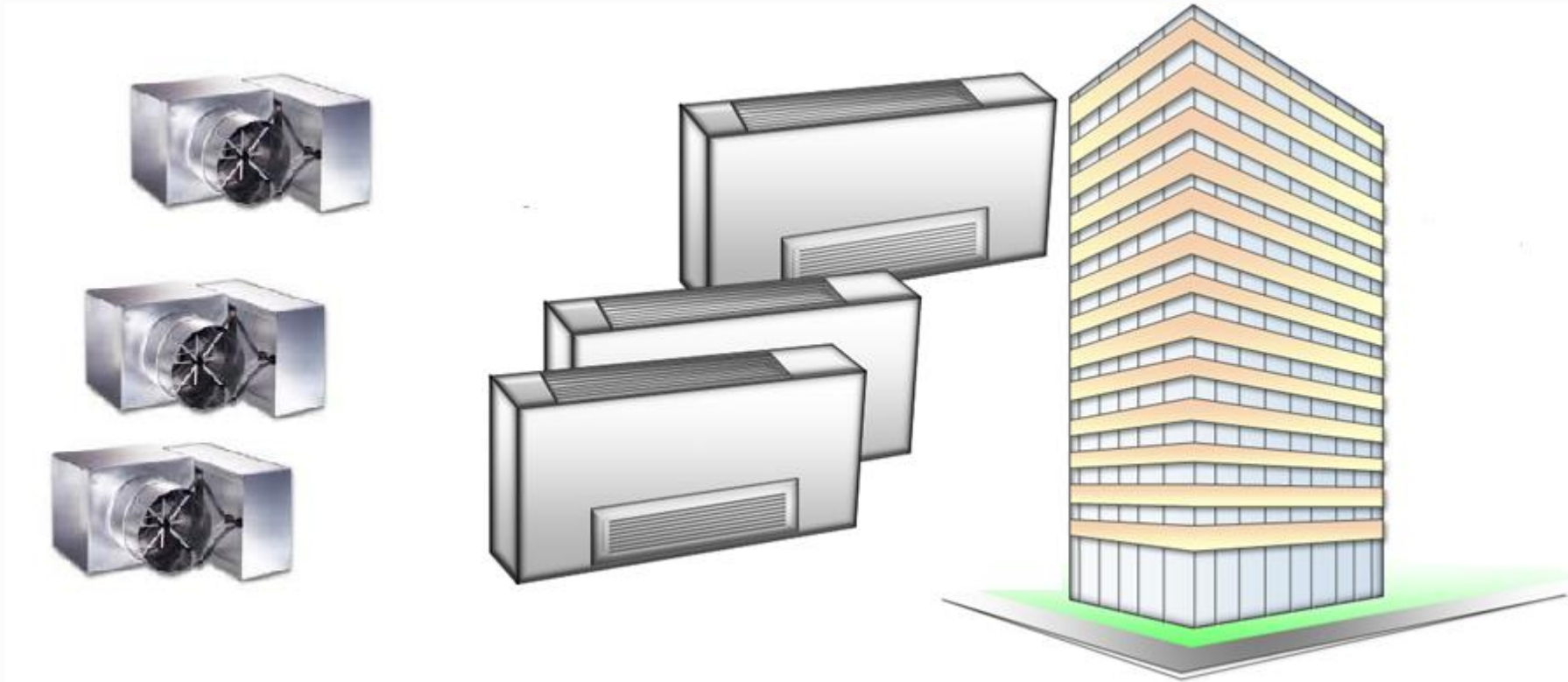
- Modular energy management of buildings – the concept
- Requirements on the interventions in buildings
- Interventions on the UNIZGFER building
- Information system for modular energy management in UNIZGFER building

Classic commercial buildings



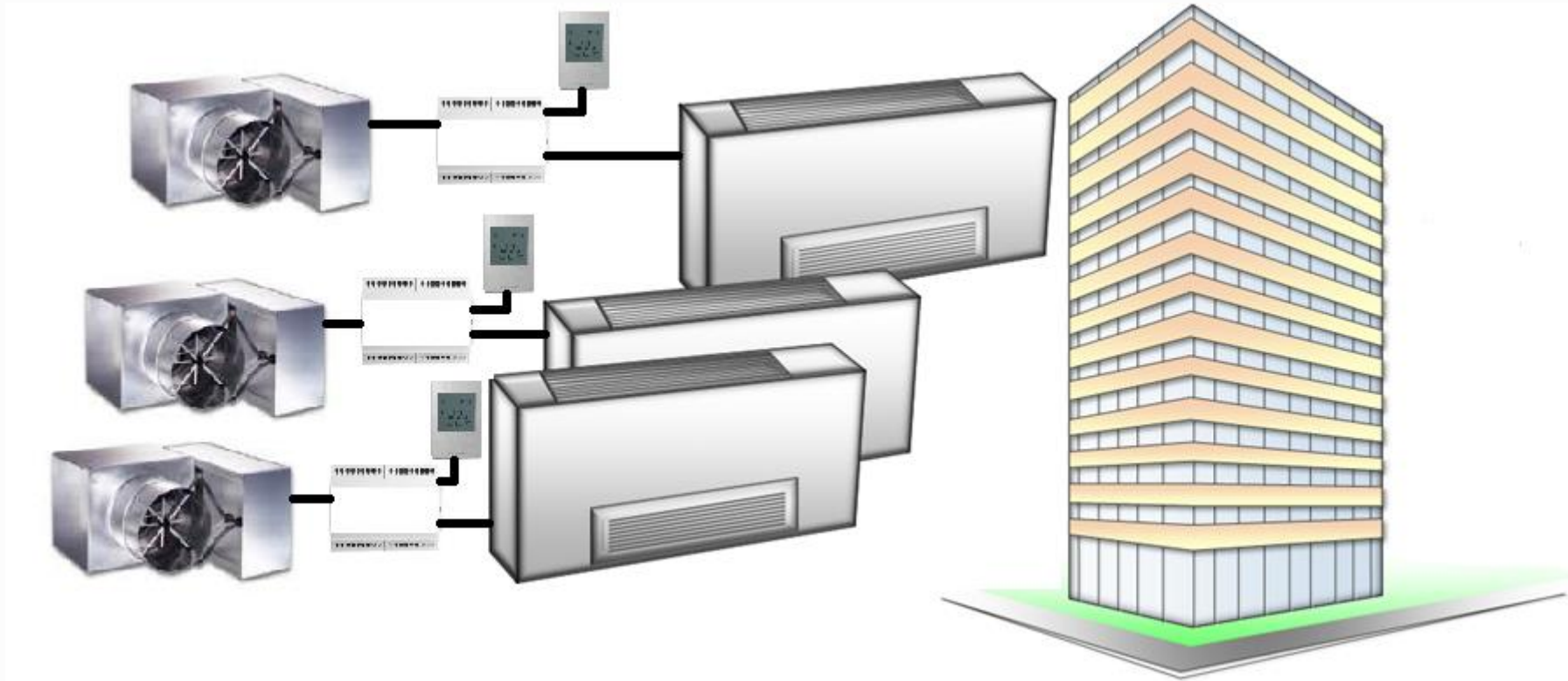
Comfort actuators in rooms: fan coils

Classic commercial buildings



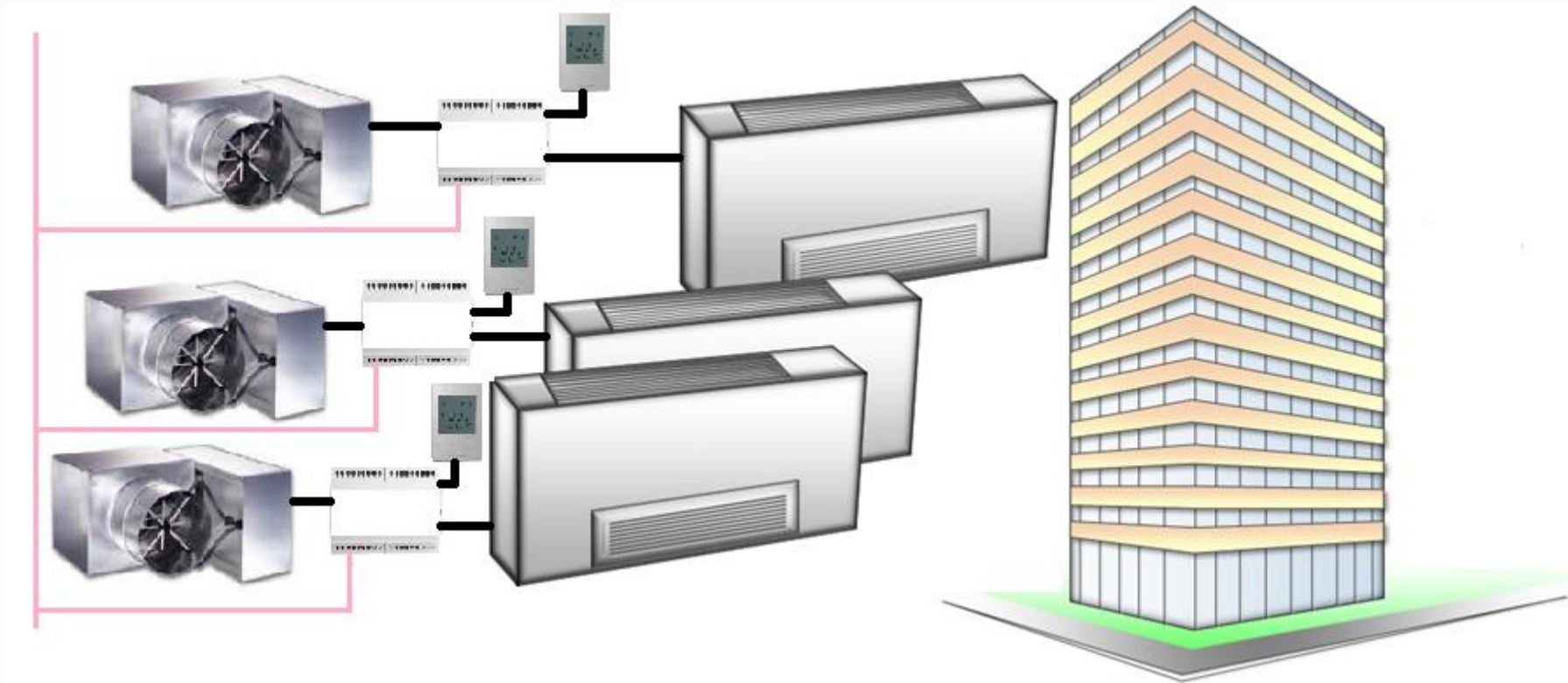
Comfort actuators in rooms: fan coils, VAV boxes or both

Classic commercial buildings



Local digital room controllers perform comfort control

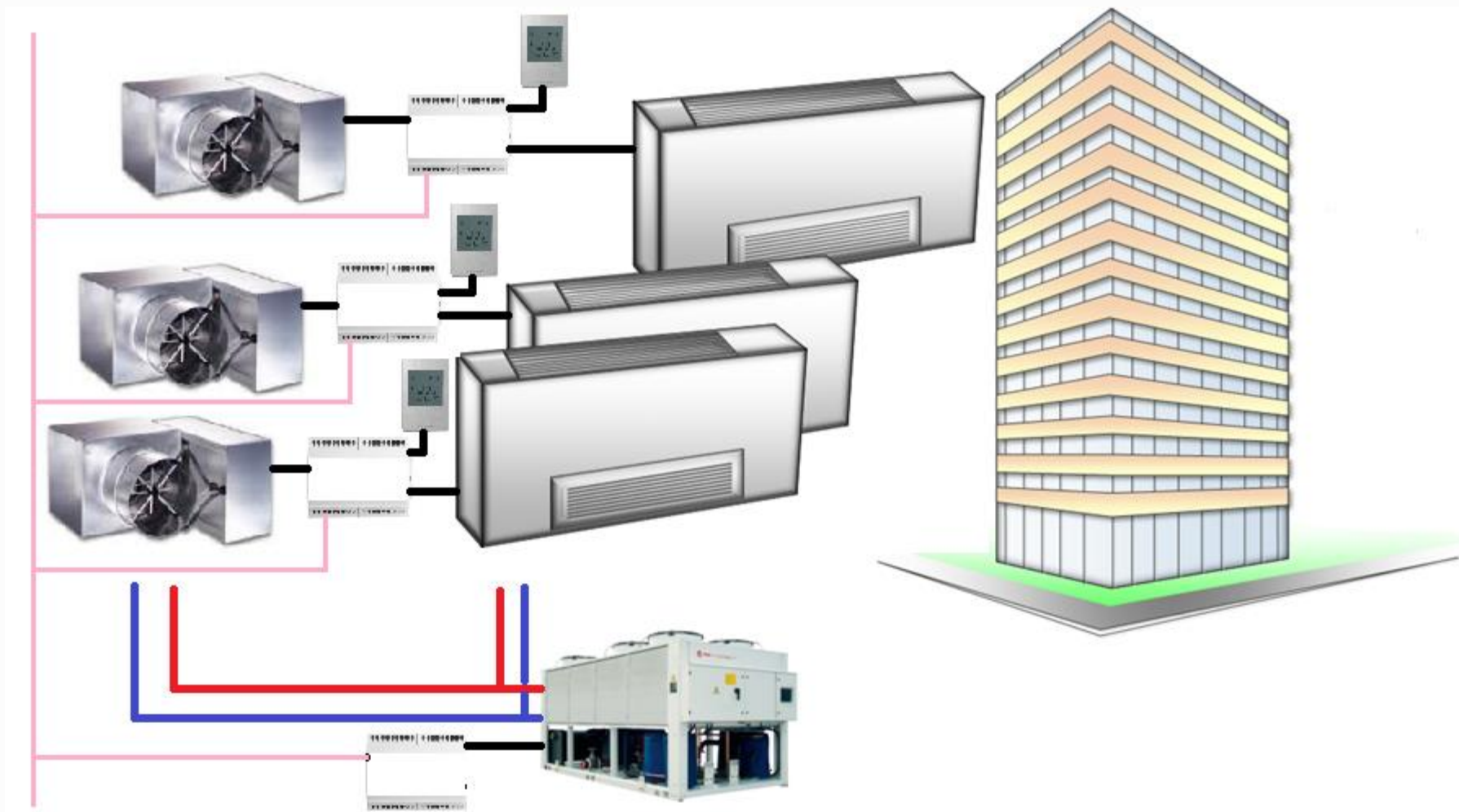
Classic commercial buildings



Local digital room controllers perform comfort control

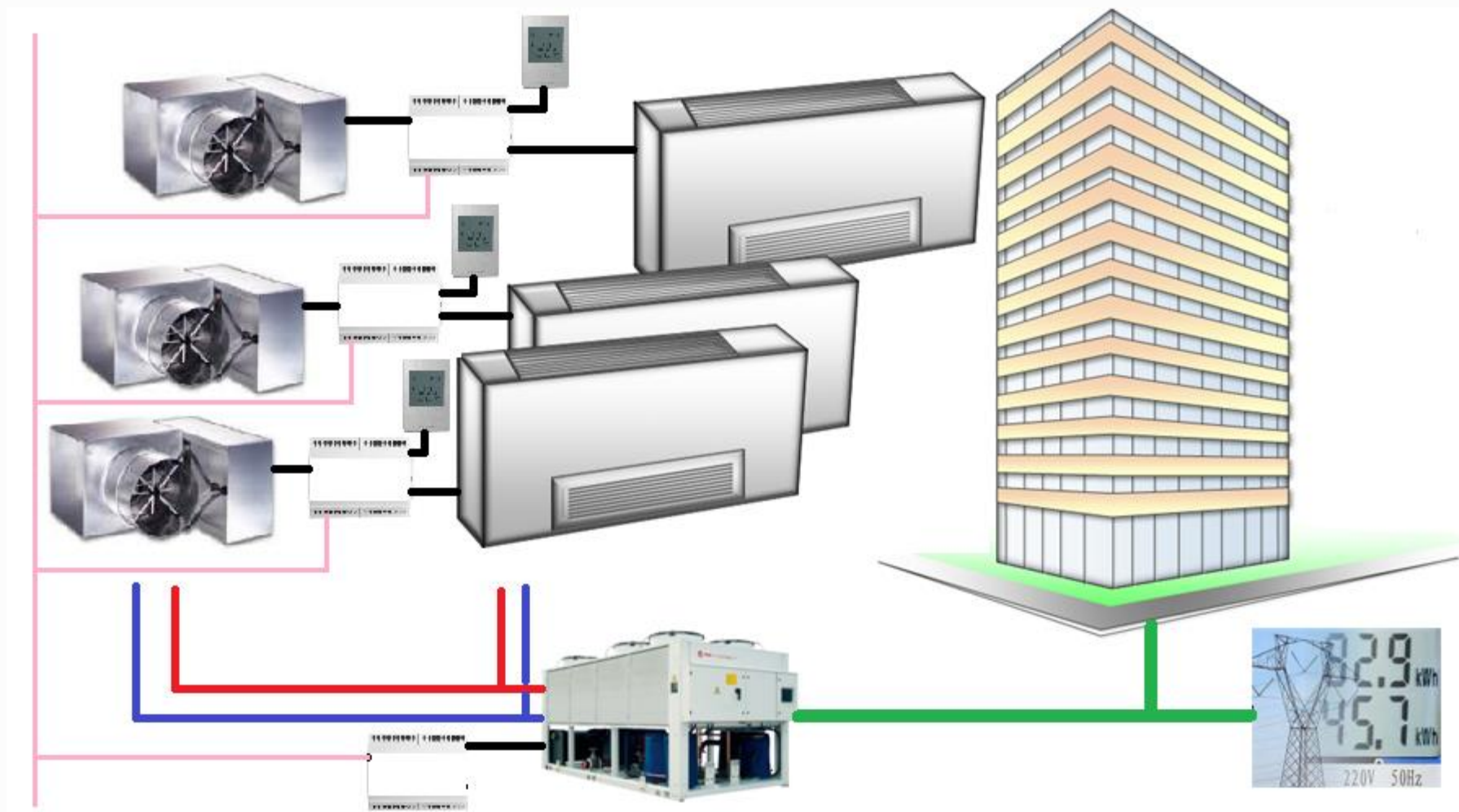
Networked for enabling central data acquisition

Classic commercial buildings



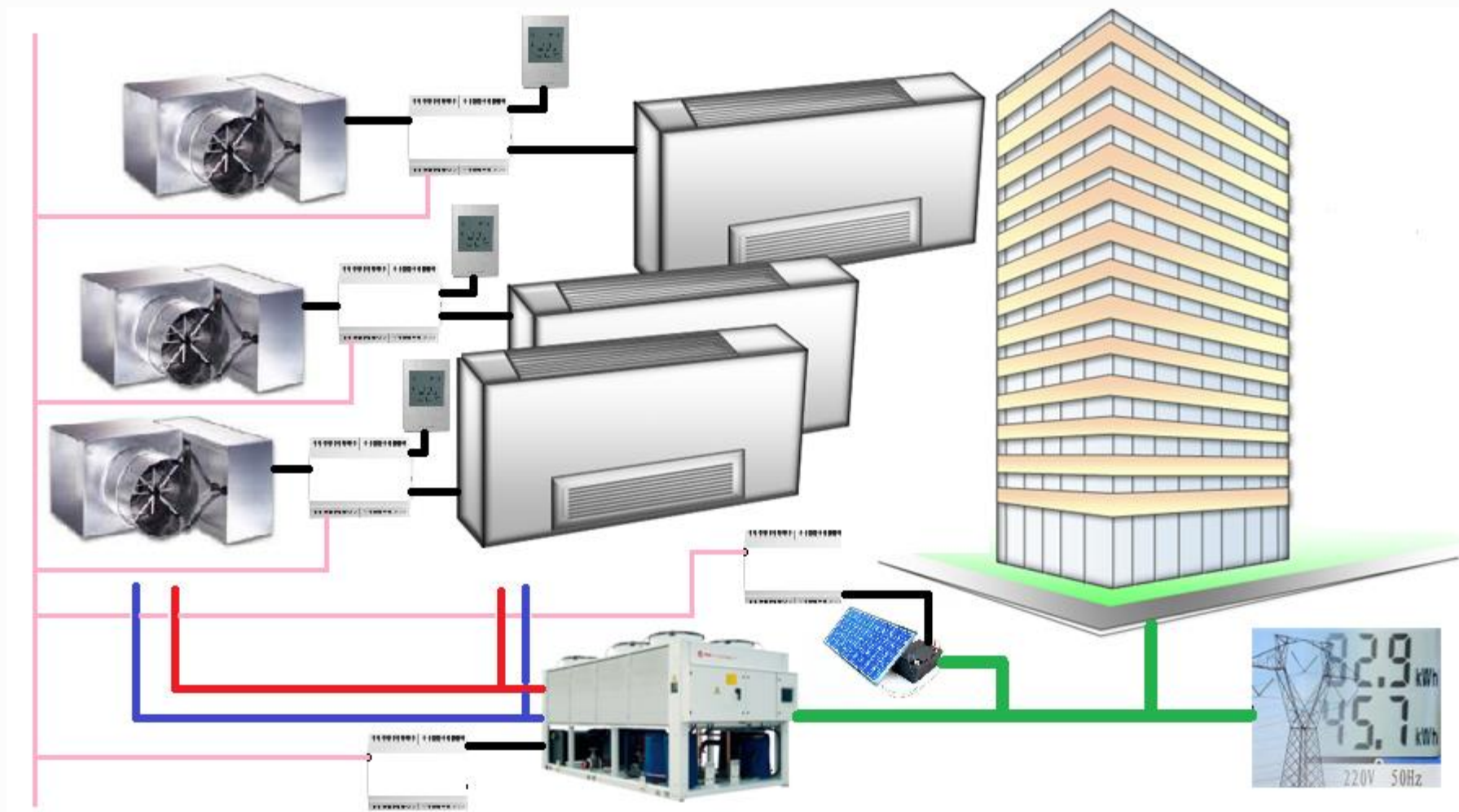
Controlled units for production of conditioning media...

Classic commercial buildings



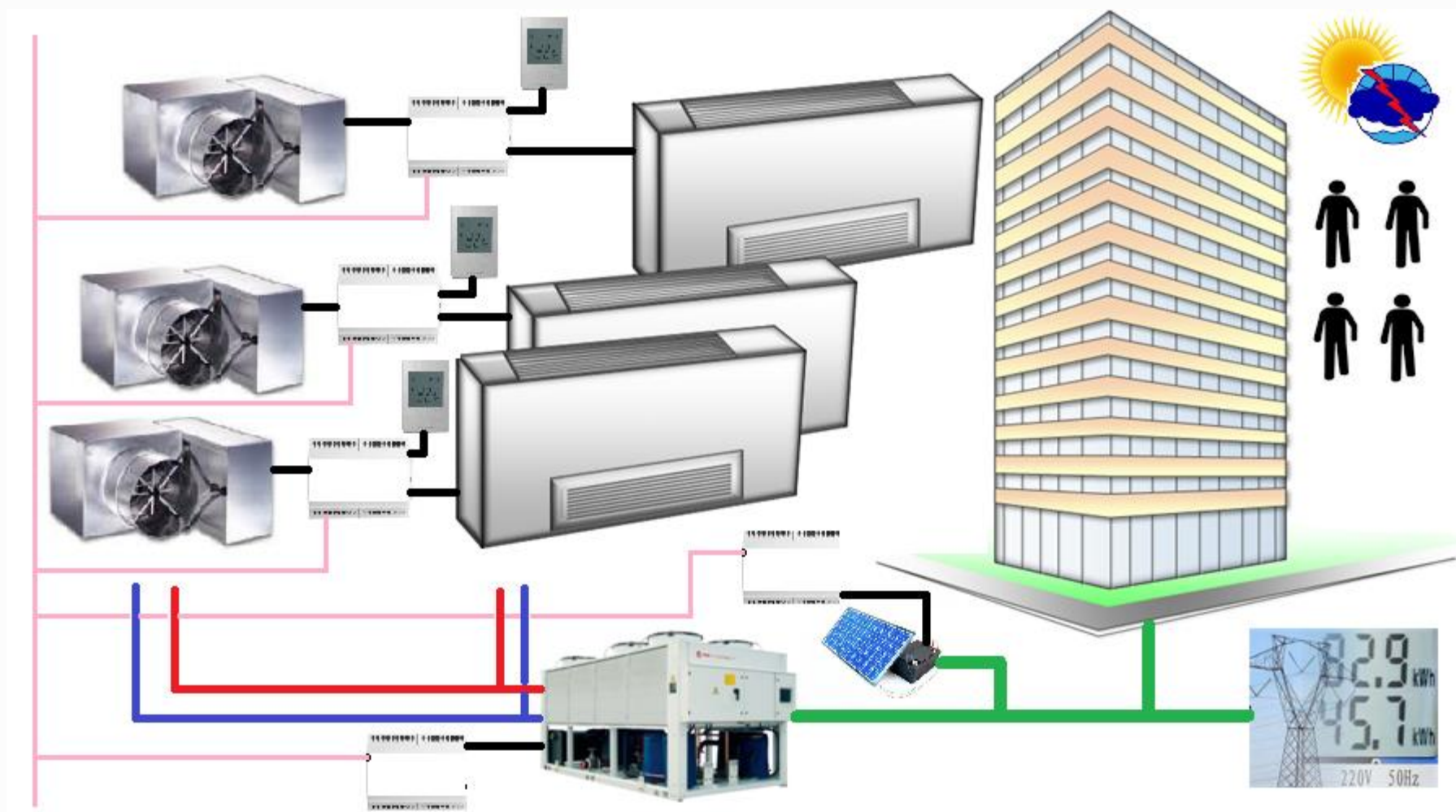
Connected to energy distribution grids

Classic commercial buildings



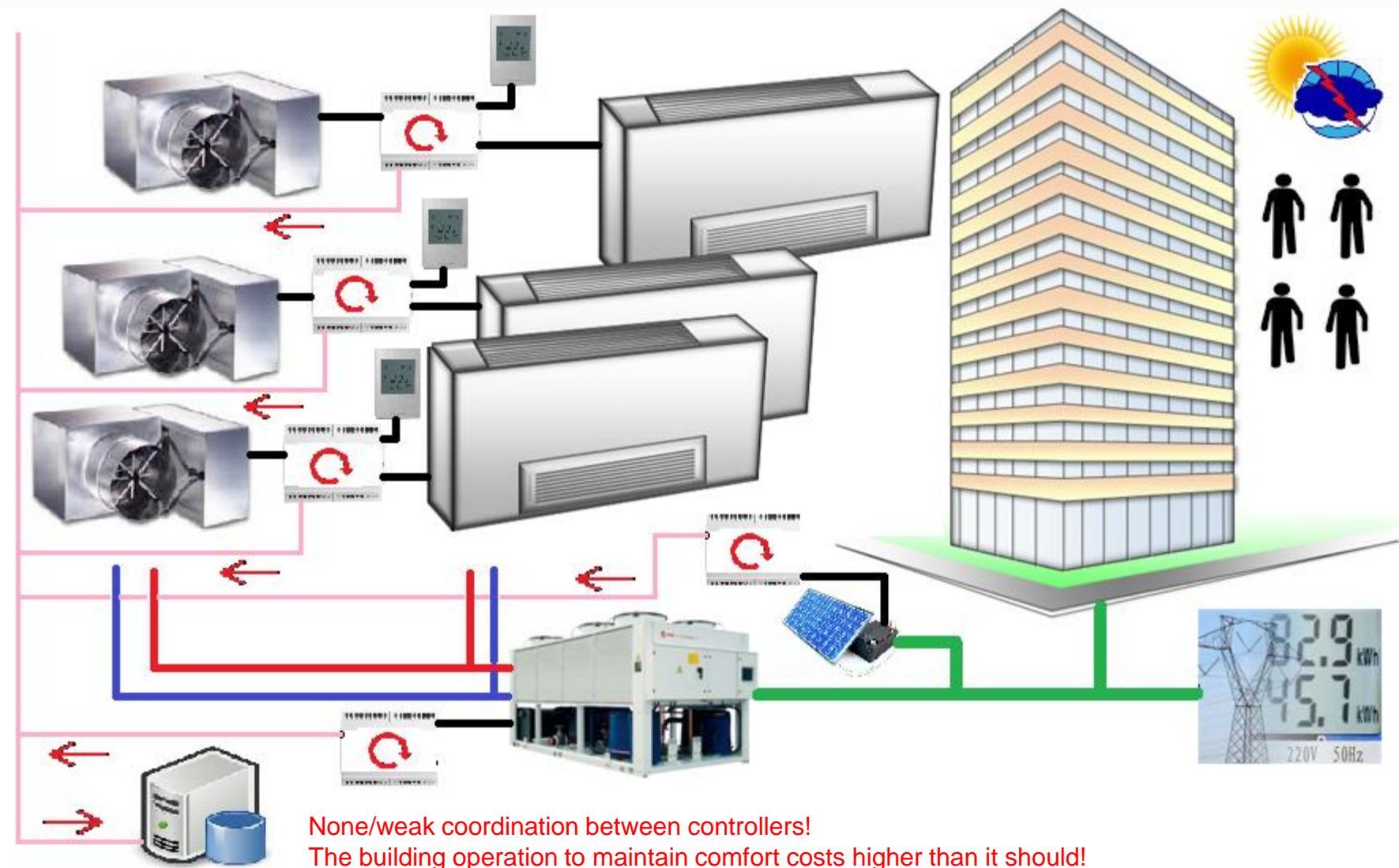
Local energy production and controllable storage

Classic commercial buildings

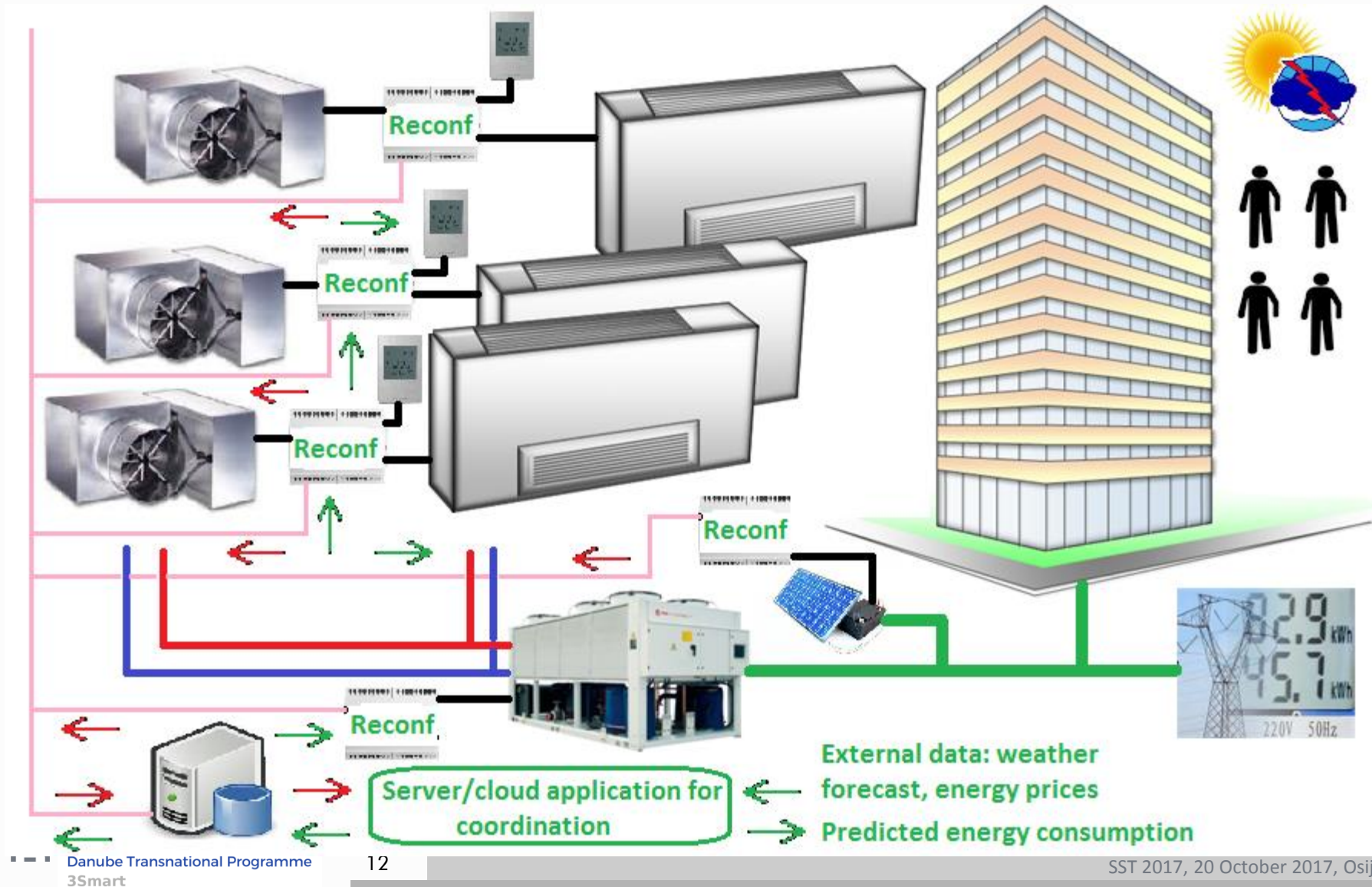


Weather and occupants

Classic commercial buildings

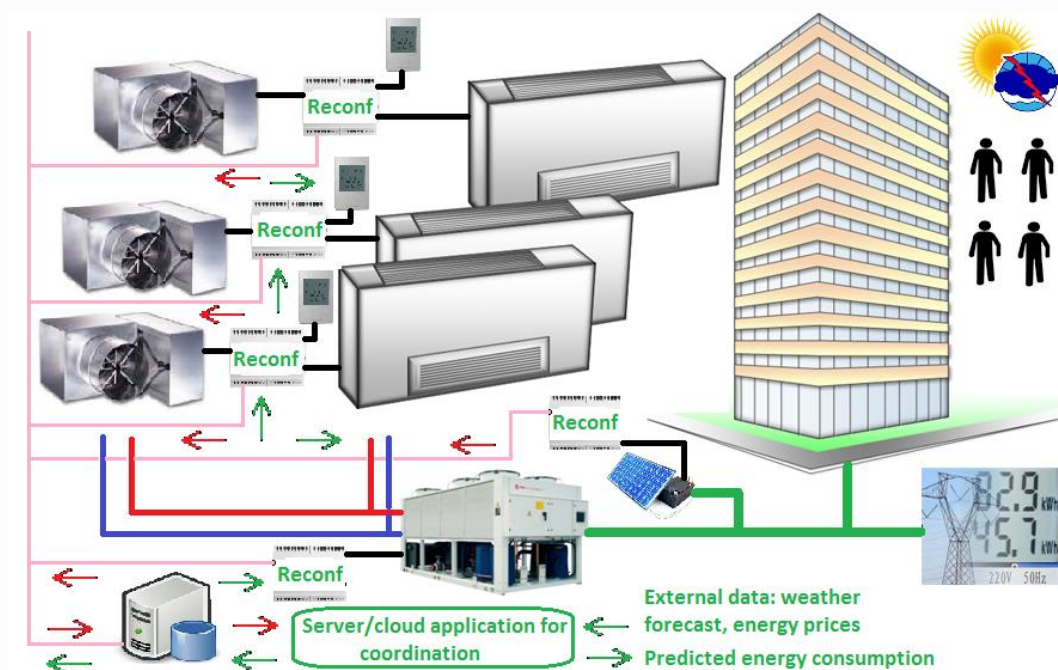


Introduction of coordination within the building



Modular energy management in buildings

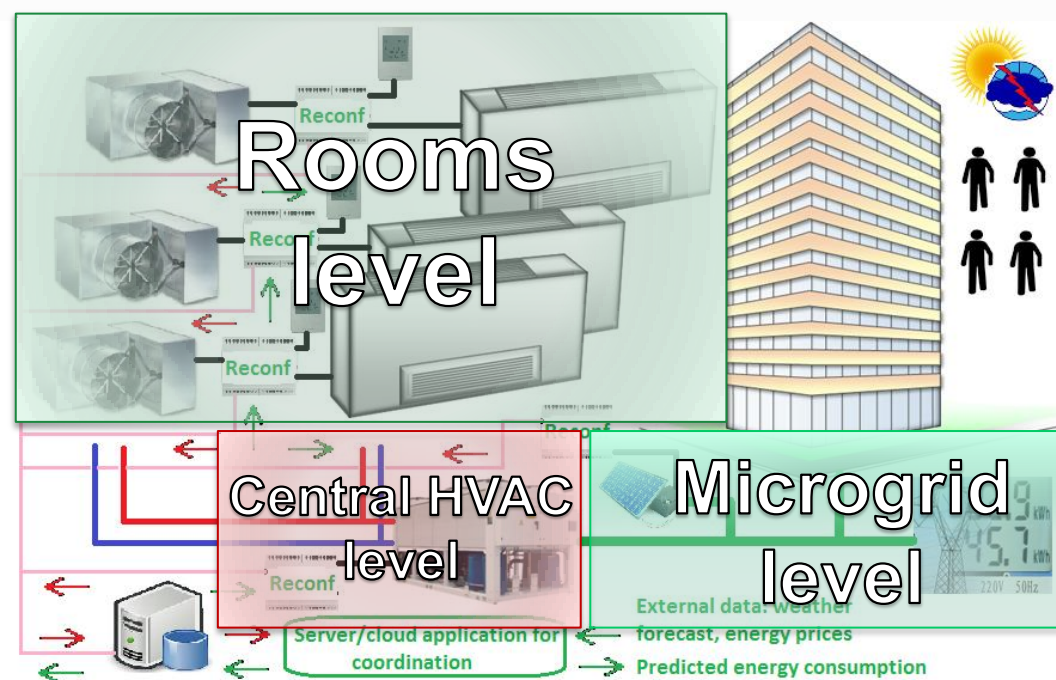
- Modularity of the coordination service
 - Separate modules for different building levels



- Mutually coordinated in any configuration

Modular energy management in buildings

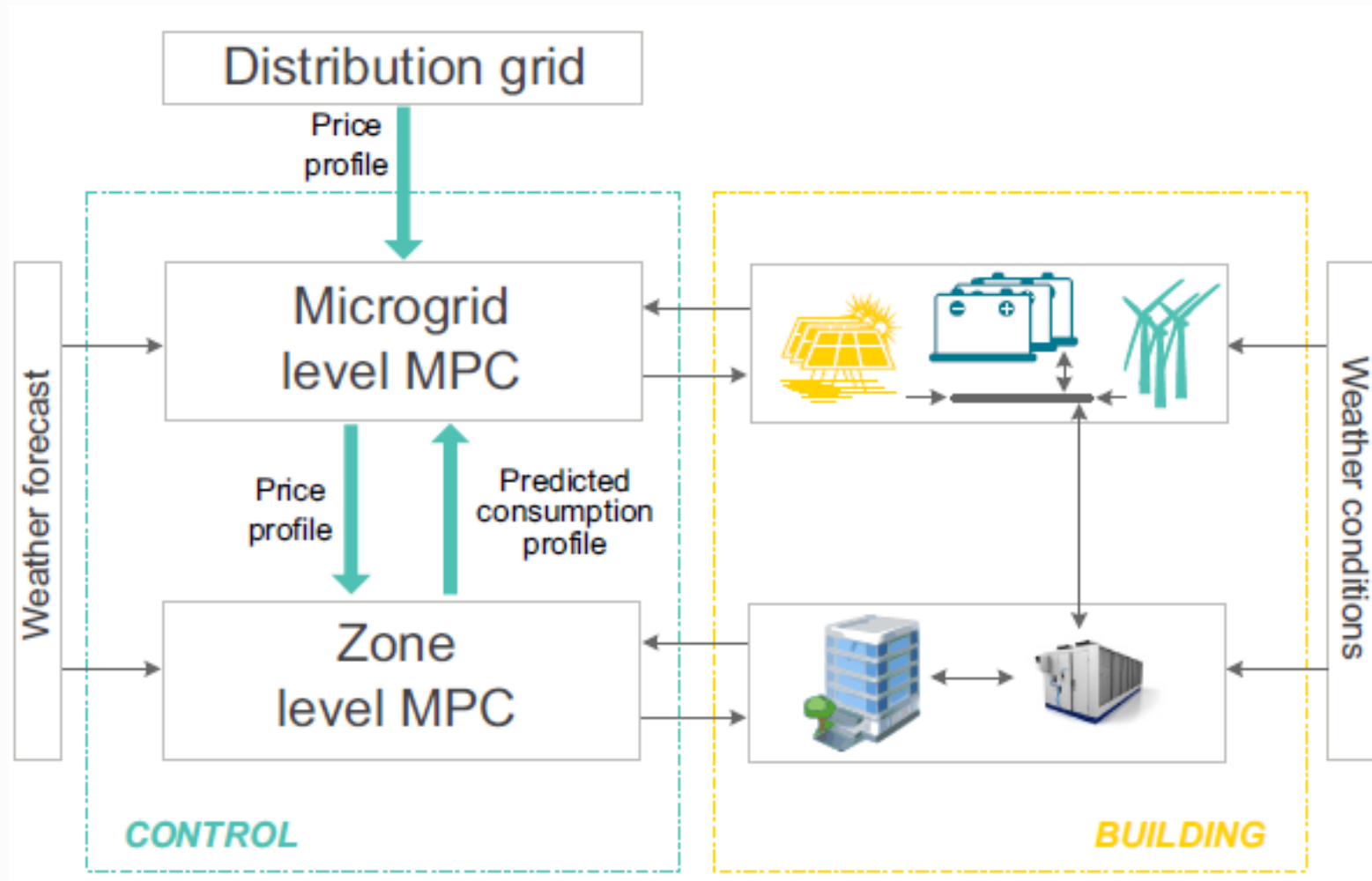
- Modularity of the coordination service
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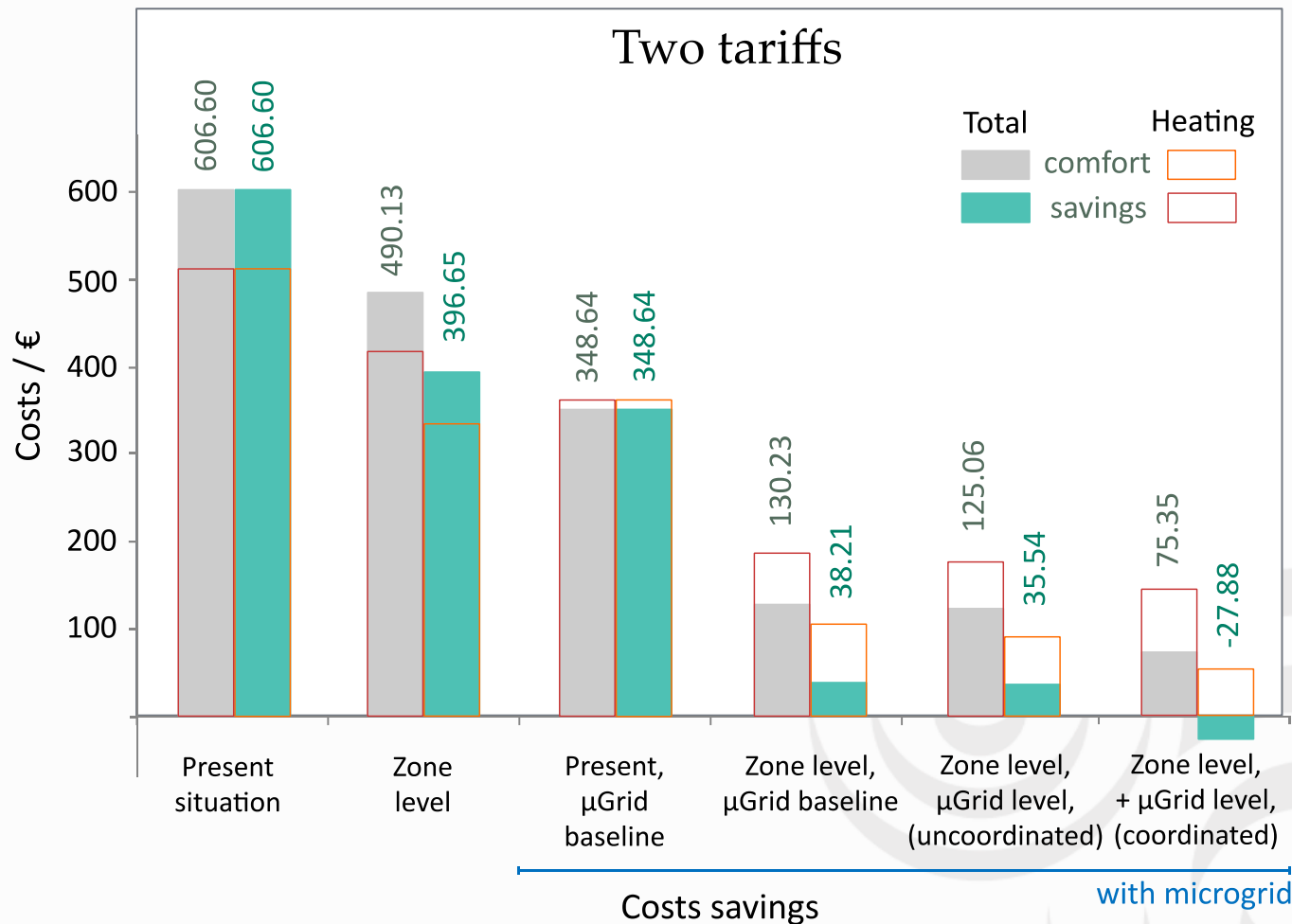
- Mutually coordinated in any configuration

More info: <http://www.interreg-danube.eu/approved-projects/3smart/section/deliverables> (D4.1.1)

Case study simulation results (1)



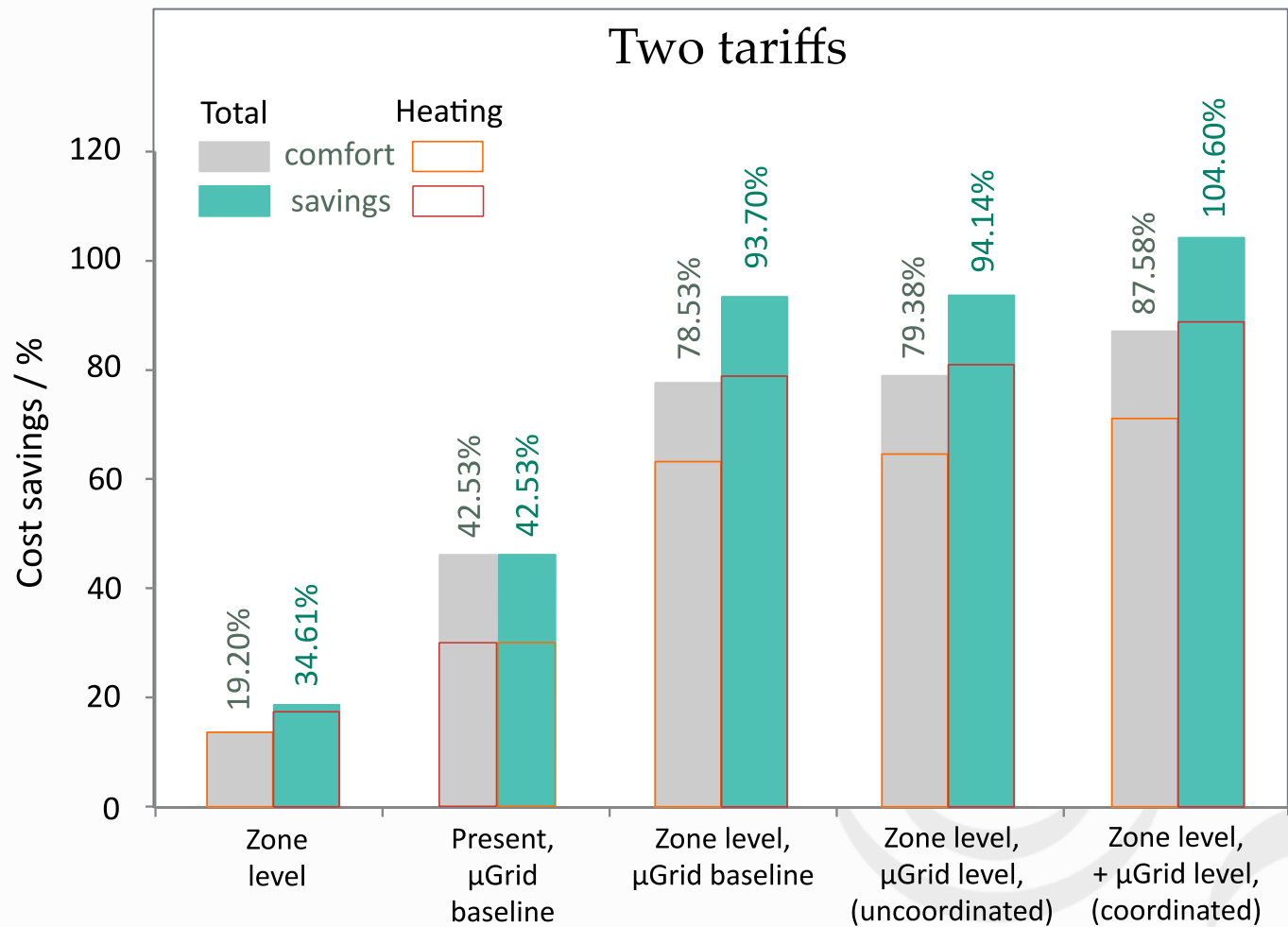
Case study simulation results (2)



- FER building, 9th floor
- Weather 2014
- Commercial prices (current situatuion)

More details in: Lešić, Vinko; Martinčević, Anita; Vašak, Mario. **Modular energy cost optimization for buildings with integrated microgrid.** *Applied energy.* 197 (2017) ; 14-28

Case study simulation results (3)

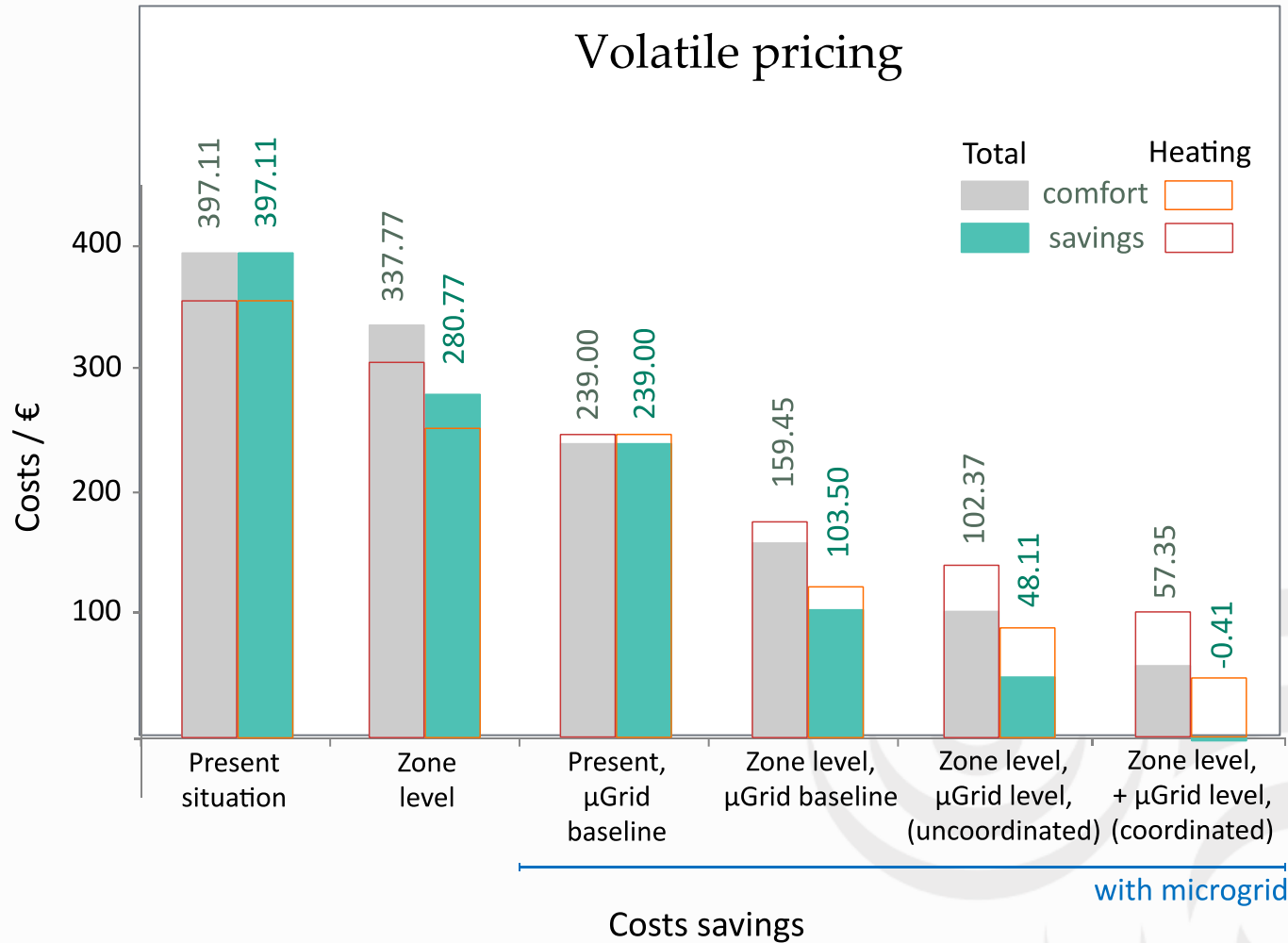


- FER building, 9th floor
- Weather 2014
- Commercial prices (current situatuion)
- Relative to present situation (%)

Costs savings percentage

More details in: Lešić, Vinko; Martinčević, Anita; Vašak, Mario. **Modular energy cost optimization for buildings with integrated microgrid.** *Applied energy*. 197 (2017) ; 14-28

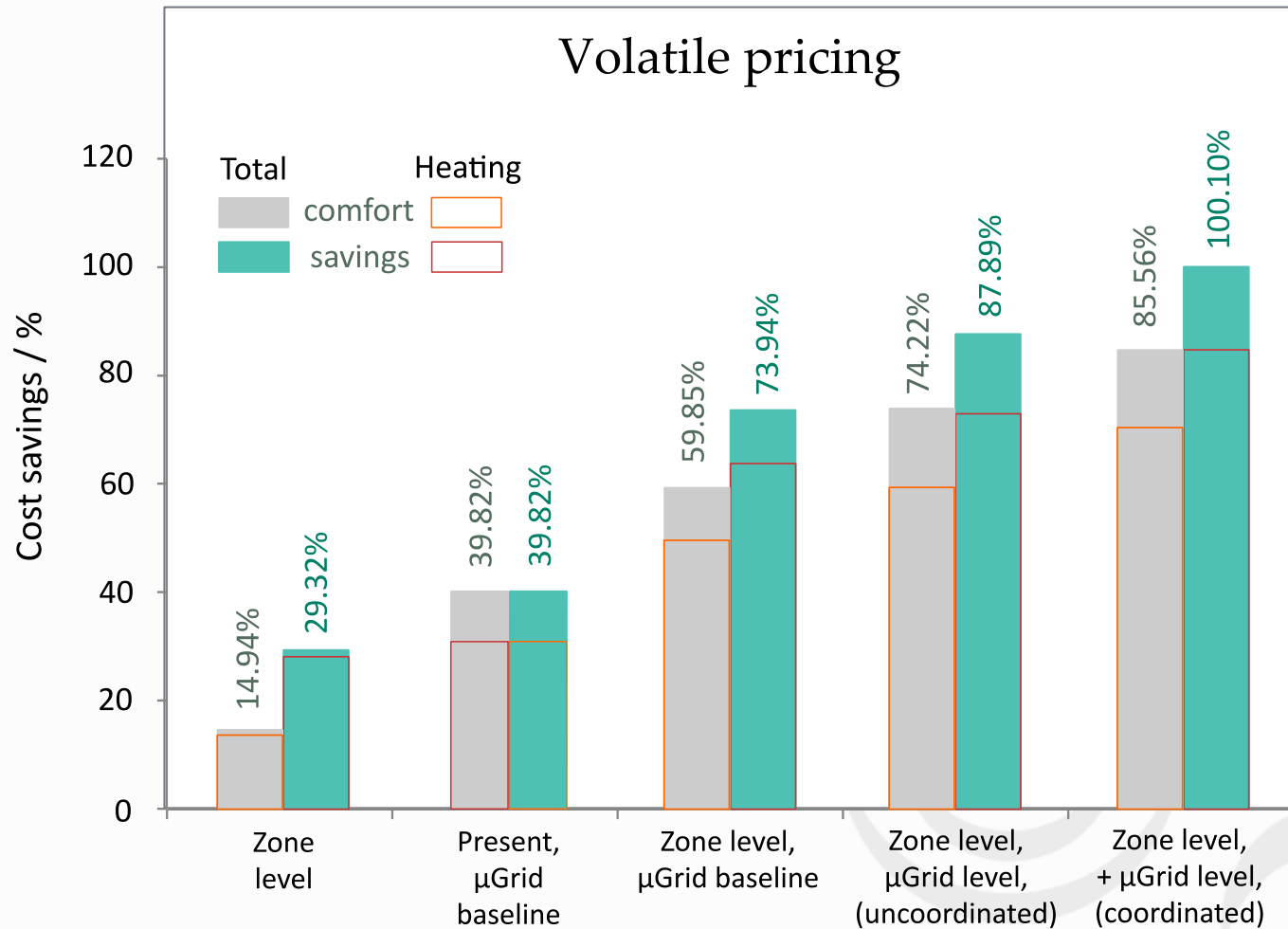
Case study simulation results (4)



- FER building, 9th floor
- Weather 2014
- Energy market prices (EPEX 2014, no duties)

More details in: Lešić, Vinko; Martinčević, Anita; Vašak, Mario. **Modular energy cost optimization for buildings with integrated microgrid.** *Applied energy*. 197 (2017) ; 14-28

Case study simulation results (5)



- FER building, 9th floor
- Weather 2014
- Energy market prices (EPEX 2014, no duties)
- Relative to present situation (%)

Costs savings percentage

More details in: Lešić, Vinko; Martinčević, Anita; Vašak, Mario. **Modular energy cost optimization for buildings with integrated microgrid.** *Applied energy*. 197 (2017) ; 14-28

Requirements on the interventions in the building

- Gradual takeover of control by the EMS
 - selectable up to the level of individual rooms
- Easy software-based roll-back to the decentralized control configuration if necessary
- Data sampling from different sources including existing SCADA with ~ 1 min refresh period
- Data from the database towards SCADA can propagate to the field level and be implemented as commands

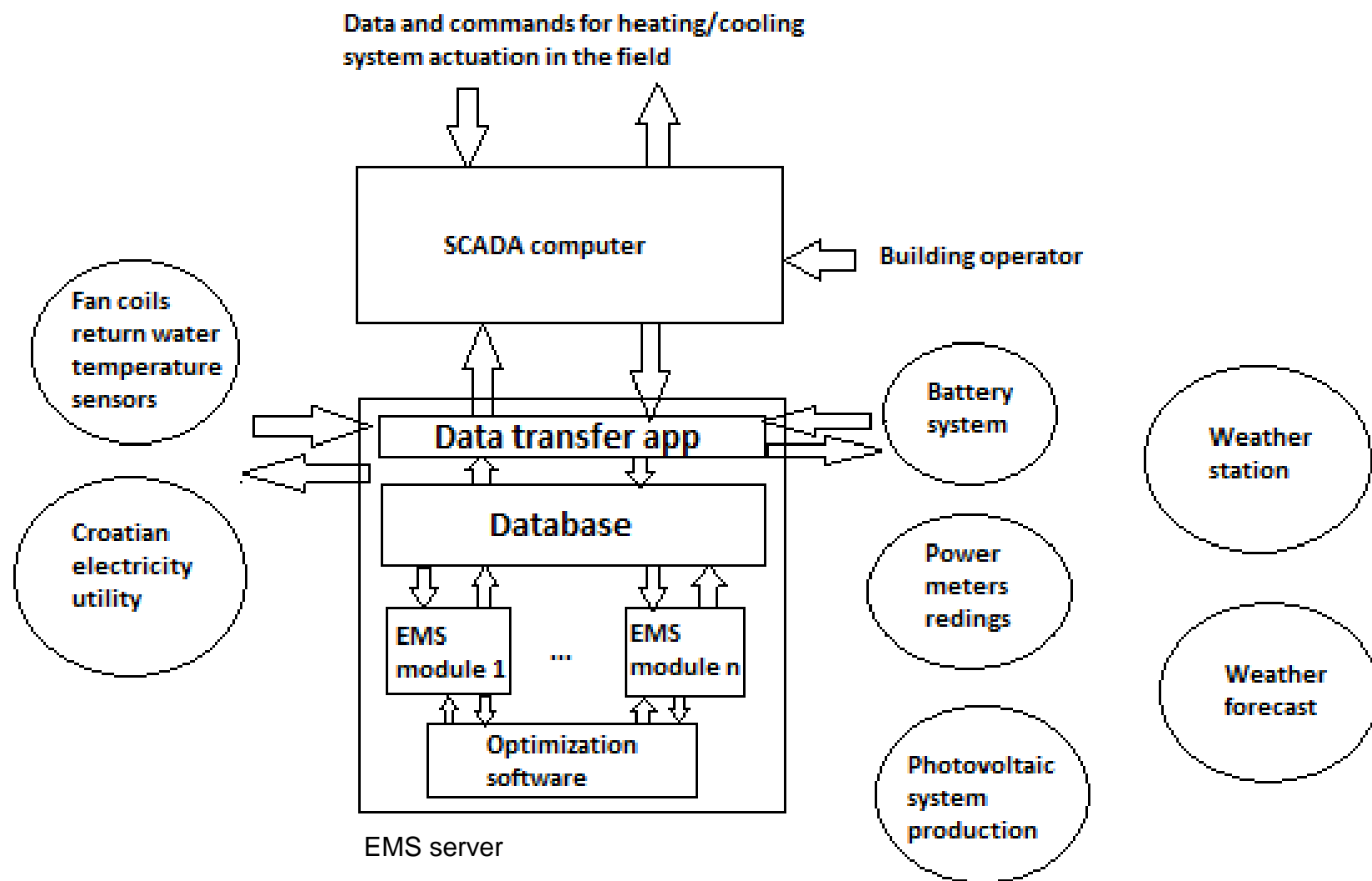
Interventions on the UNIZGFER building

- Existing:
 - 248 rooms with Siemens RXC 21.1/21.5 (12 floors + ground floor)
 - 368 Trane fan coils
 - 1000 kW heating substation
 - 200 kW chiller
 - DESIGO SCADA (integrating RXCs and chiller)
 - 21,5 kWp photovoltaic plant
 - weather station including solar irradiance measurement equipment
 - prototype weather forecast for the UNIZGFER building location from DHMZ

Interventions on the UNIZGFER building

- Room level:
 - upgraded RXC 21.1/21.5 software
 - temperature sensor for return water of each fan coil (368); existing twisted pairs from controllers network utilized
 - updated SCADA
- Floor level:
 - calorimeters for each floor integrated in SCADA
- Central HVAC level:
 - heating substation integrated in SCADA
- Microgrid level:
 - 32 kWh Li-ion battery system with controllable power converter
 - power meters installed
- EMS information system including EMS data base
- Communication with electricity utility (DSO; HEP ODS)

Structure of the information system for EMS



Conclusion

- Non-invasive building-upon the existing automation system in buildings
 - coordination between building systems
 - enabling flexibility of demand towards the grid
- EMS constitutes of configurable modules that can be adapted for the building at hand
- General approach for creation of the information system for the EMS
- Example of the interventions on UNIZGFER building (3Smart project pilot) presented

Acknowledgement

The presented research results are obtained within the project Smart Building – Smart Grid – Smart City (3Smart)

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PROJECT WEB PAGE

www.interreg-danube.eu/3smart

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