

# Project development experience: DTP project Smart Building – Smart Grid – Smart City (3Smart)

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DTP thematic event related to 3rd call opening, Prag

14 December 2018



UNIVERSITY OF ZAGREB  
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ENGINEERING  
AND COMPUTING

Project co-funded by the European Union

# The 3Smart project

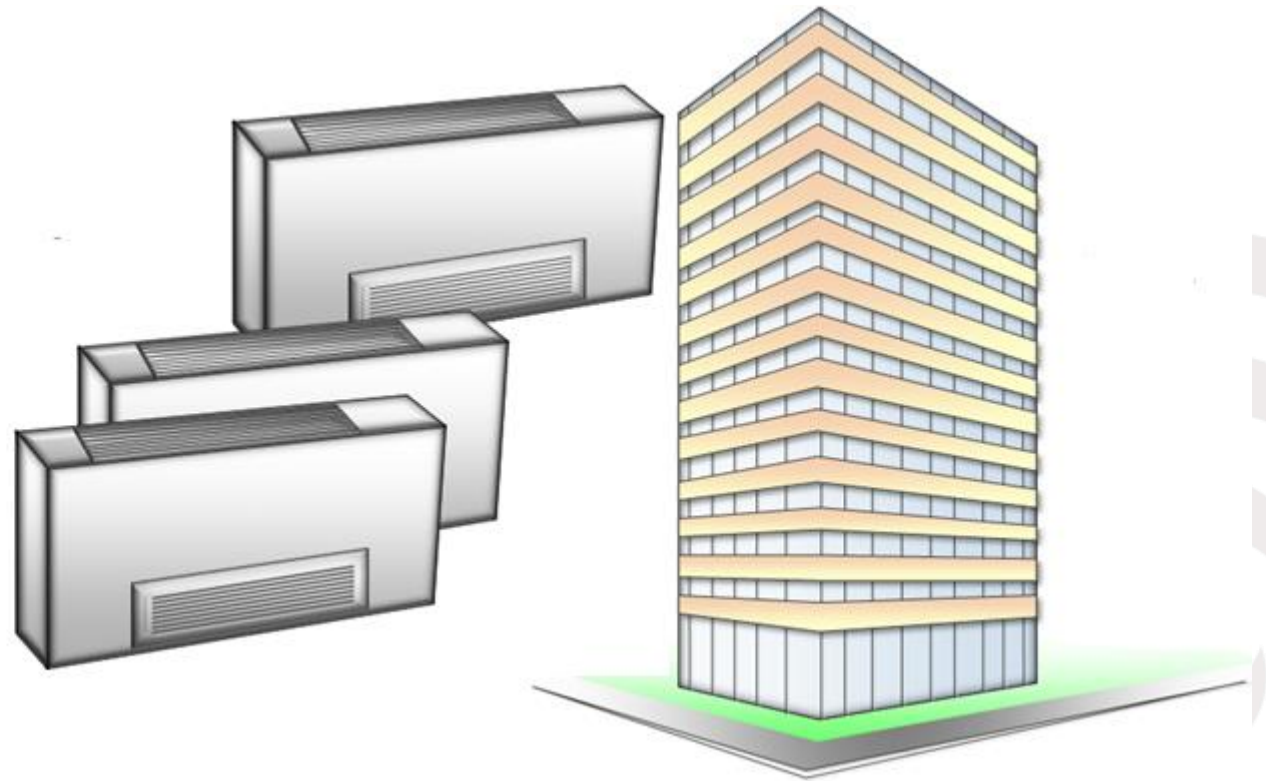
- Integrated real-time energy management of buildings and energy distribution grids, including demand response
  - modular software tool applicable to different buildings and grids configurations in the DR
  - pilots in 5 different countries comprising buildings and electricity distribution grids; tool demonstration & CBAs
  - strategy for removal of regulatory and other barriers related to real-time integrated energy management of buildings and grids including demand response
  - smart city upscale strategy

## 3Smart basic facts

- Lead partner: University of Zagreb Faculty of Electrical Engineering and Computing
- 9 ERDF partners (from Croatia, Slovenia, Austria, Hungary)
- 3 IPA partners (from Serbia and Bosnia and Herzegovina)
- 5 ASPs (from Croatia, Slovenia, Bosnia and Herzegovina, Hungary)
- 1/1/2017-30/6/2019
- Budget: 3.79 M€

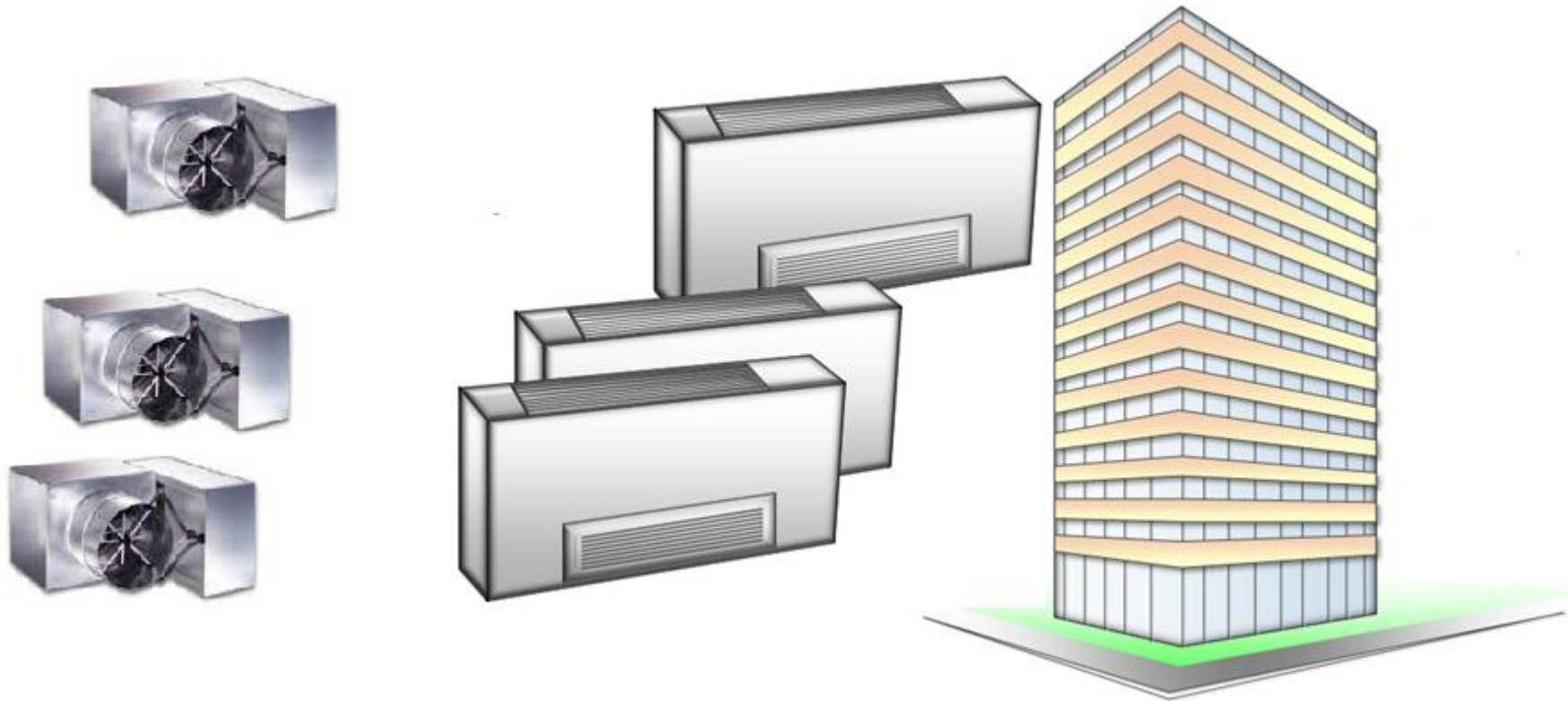
# 3Smart in short

# Classic commercial buildings



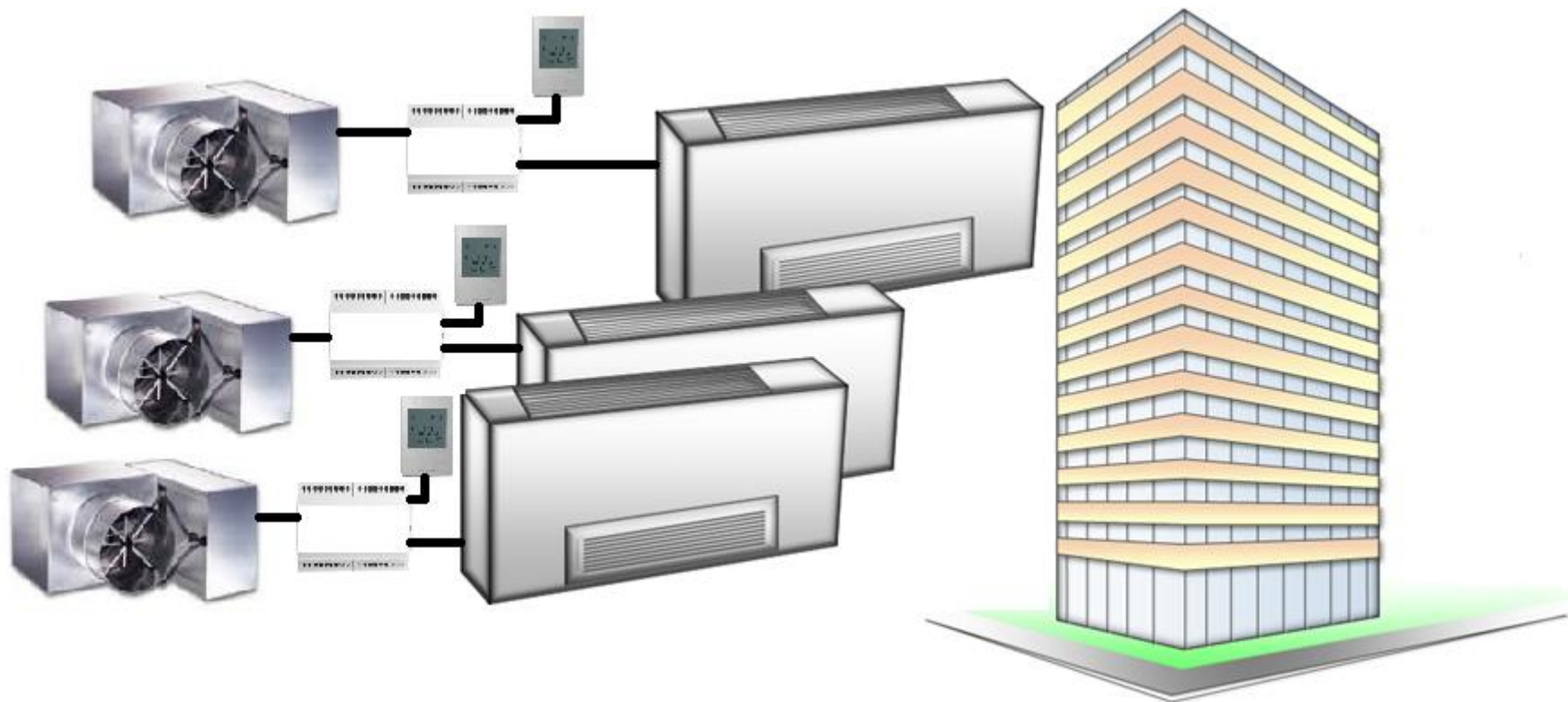
Comfort actuators in rooms: fan coils

# Classic commercial buildings



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

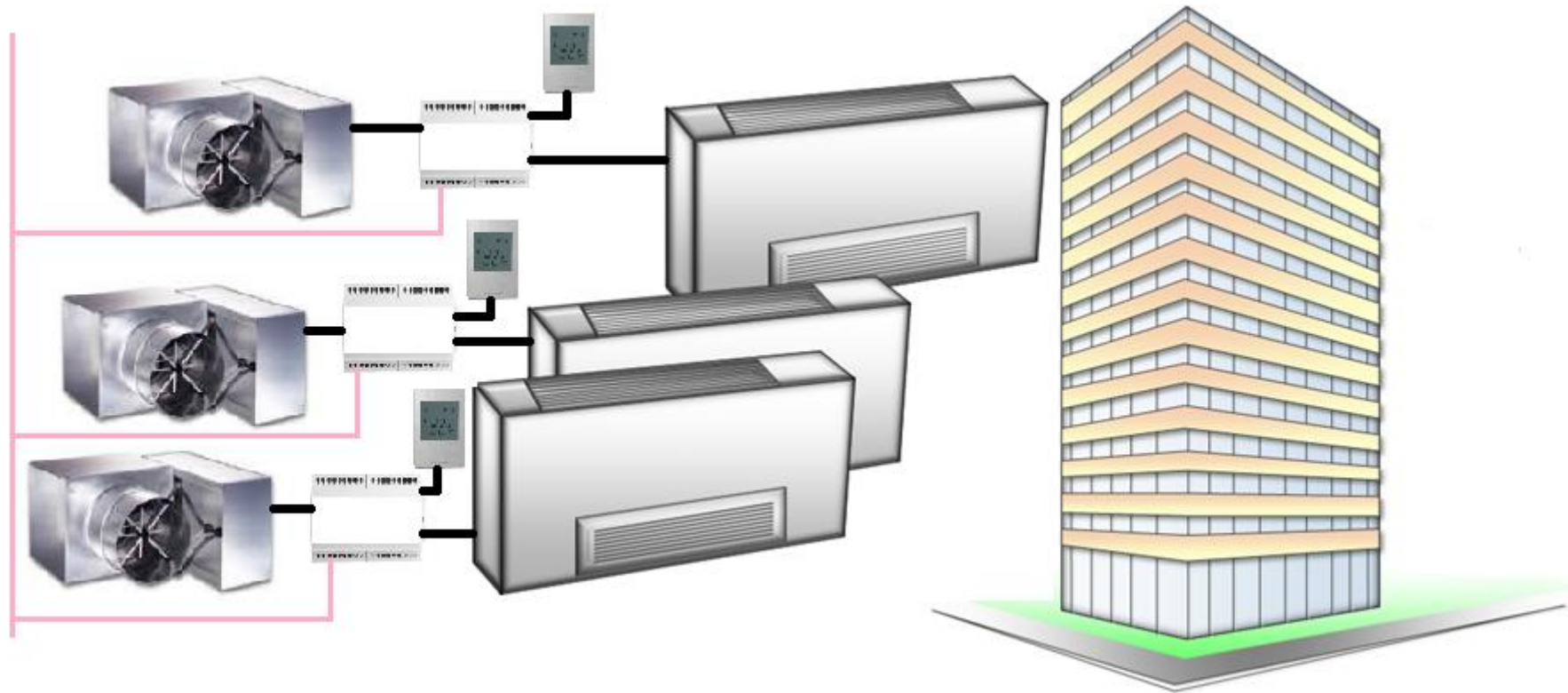
# Classic commercial buildings



Local digital room controllers perform comfort control



# Classic commercial buildings

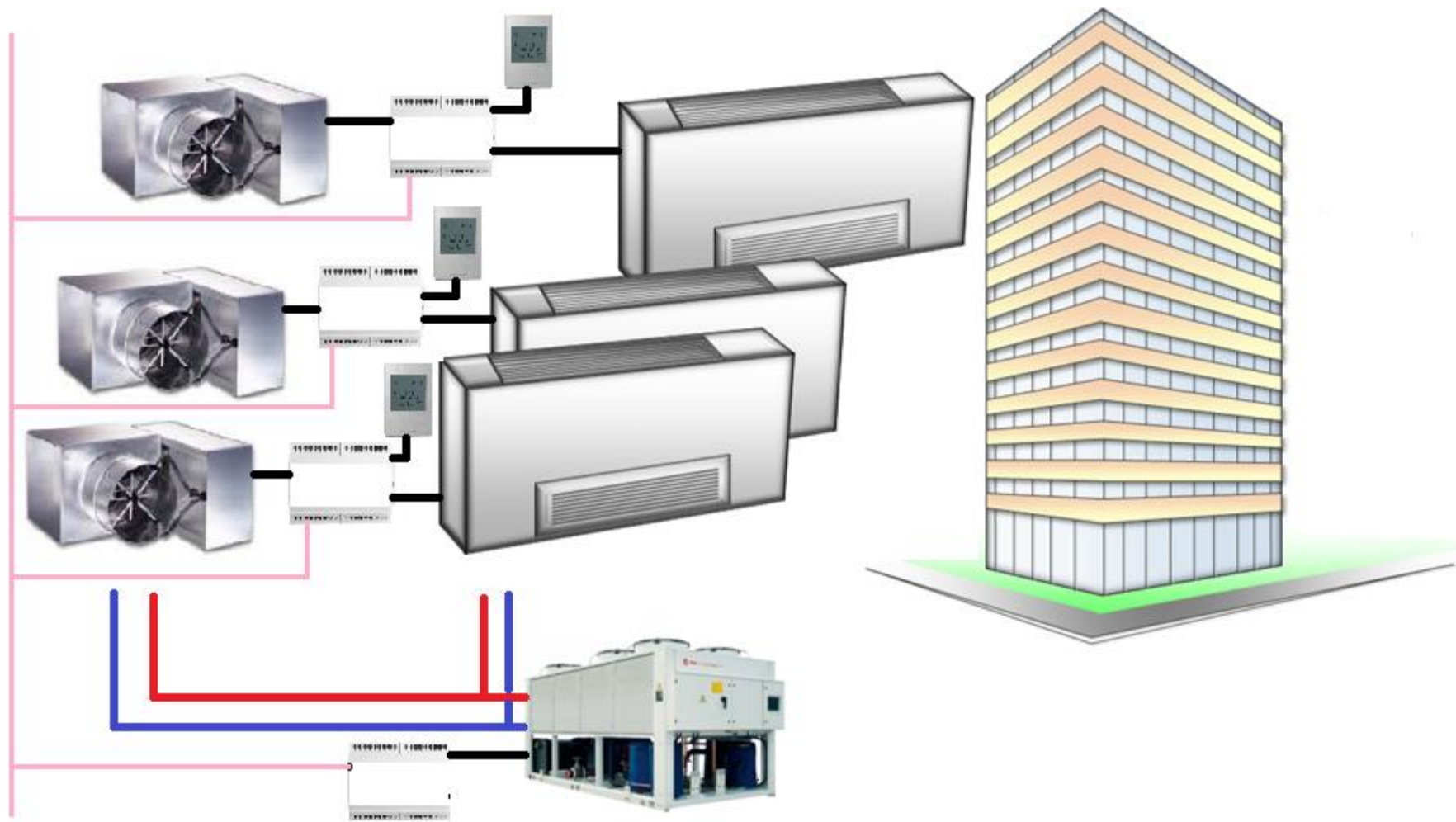


Local digital room controllers perform comfort control

Networked for enabling central data acquisition

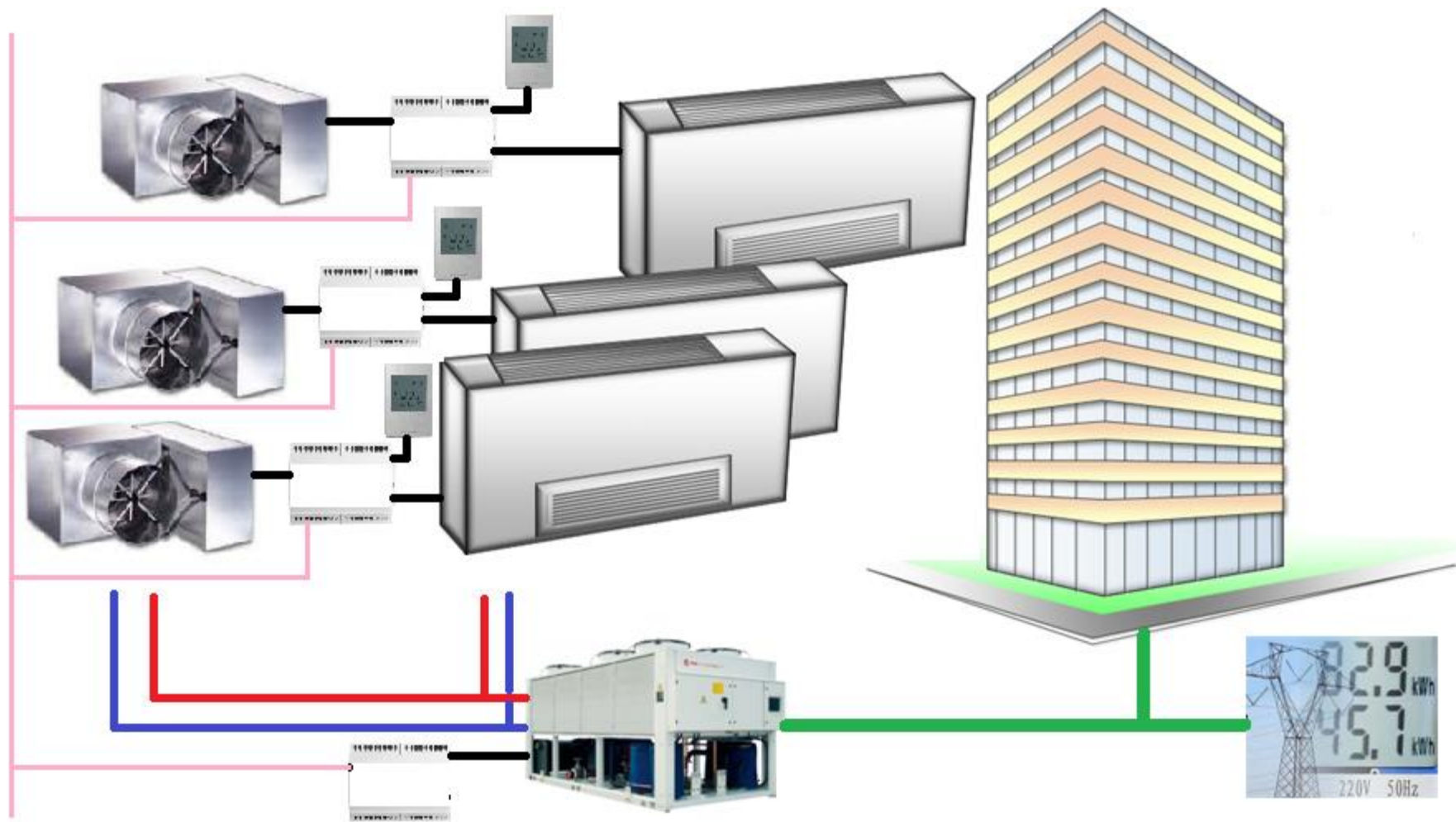


# Classic commercial buildings



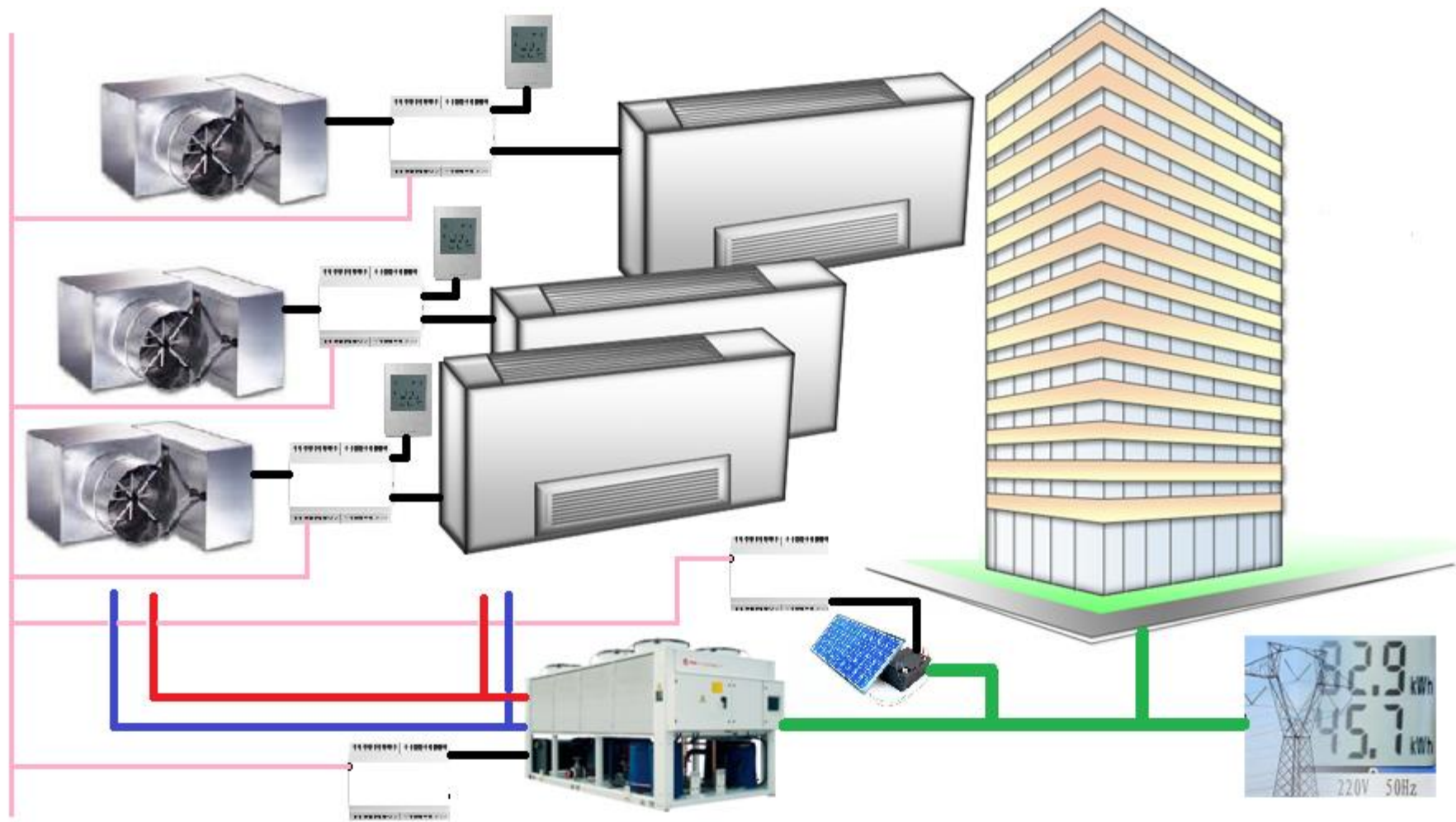
Controlled units for production of conditioning media...

# Classic commercial buildings



Connected to energy distribution grids

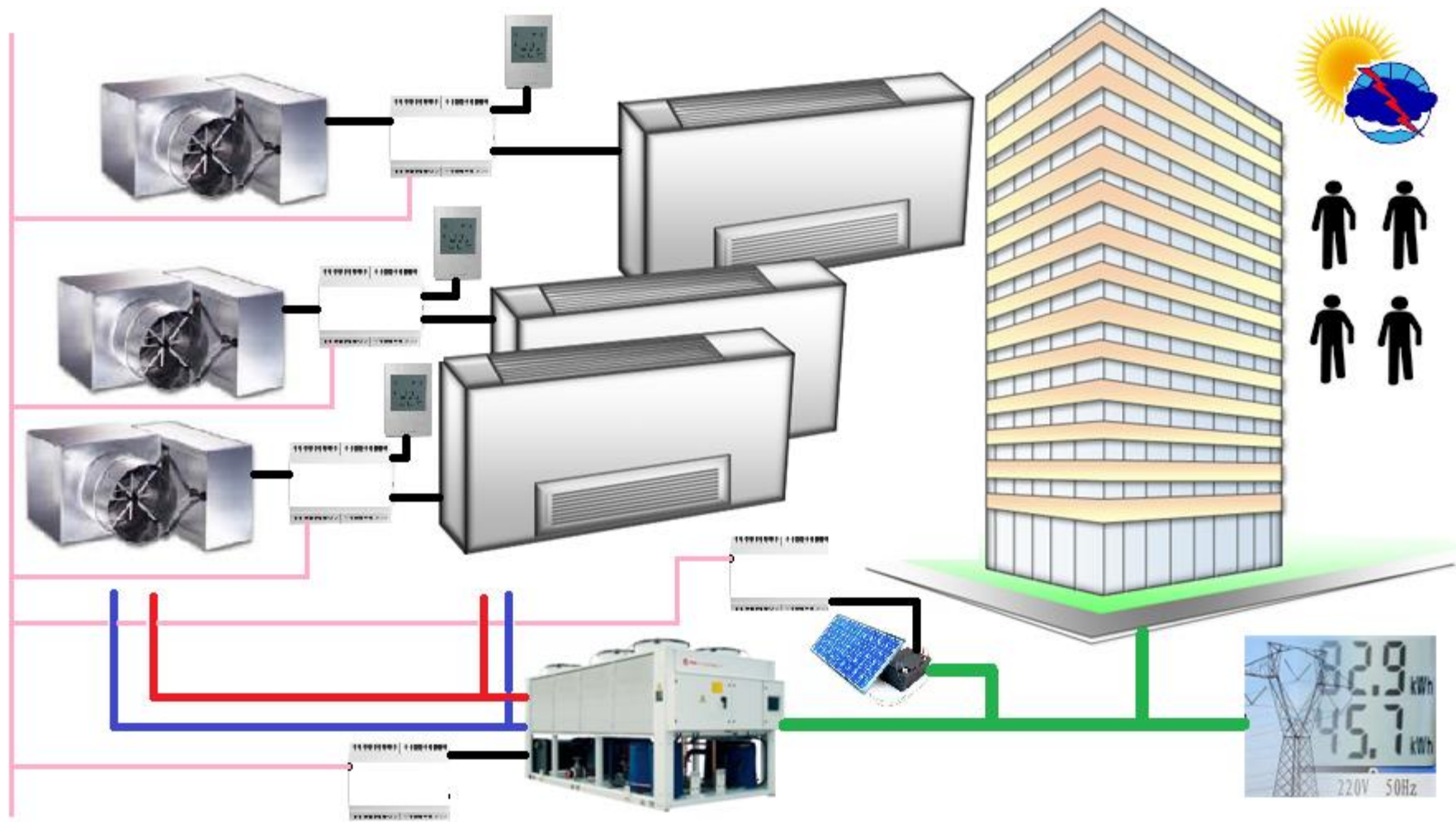
# Classic commercial buildings



Local energy production and controllable storage

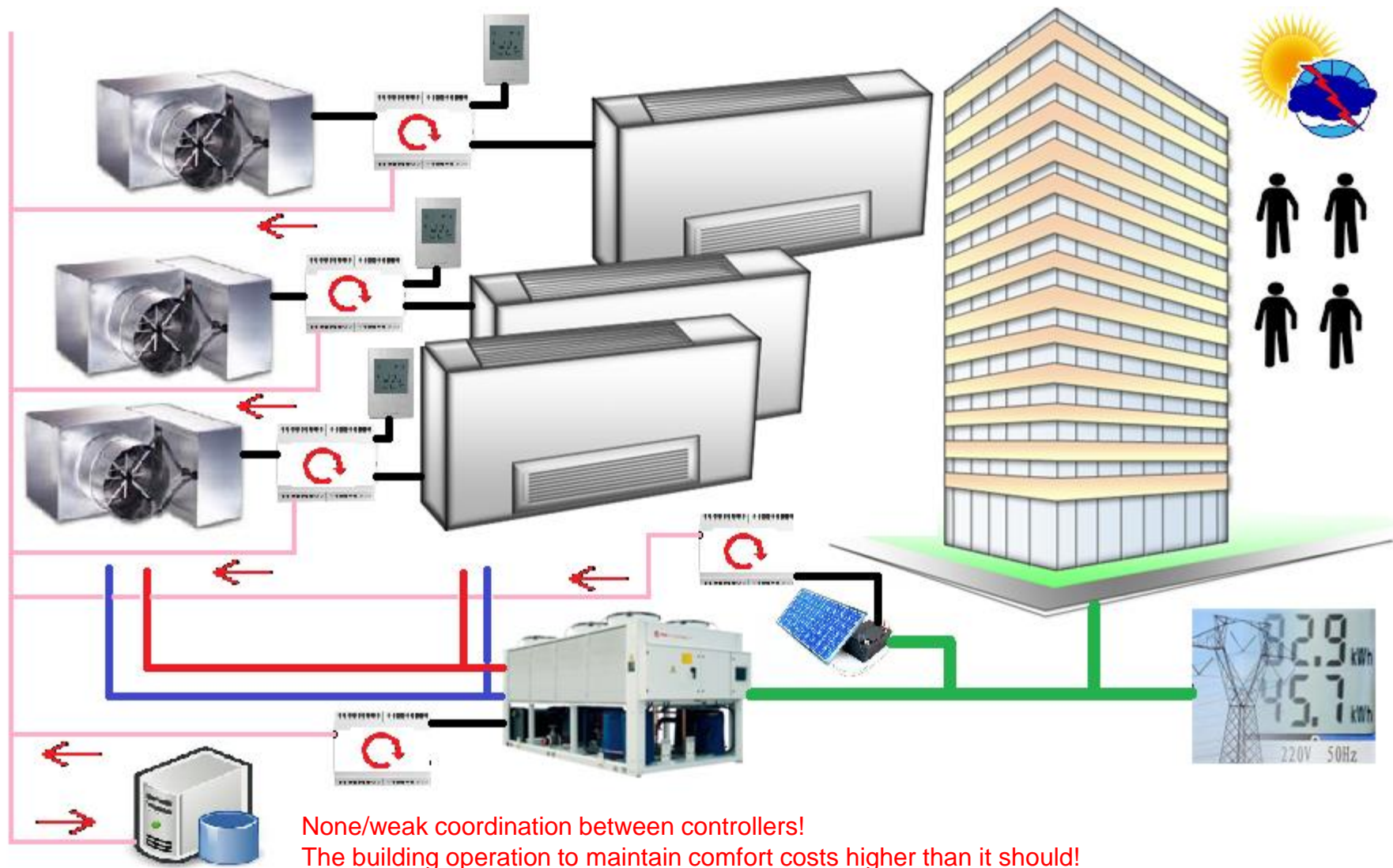


# Classic commercial buildings



Weather and occupants

# Classic commercial buildings



# Project drivers – buildings

- Buildings are an orchestra of many individual technical systems
  - in buildings without coordination all those systems are simply reactive to local variables or time-programmed
    - e.g., heating in the zone is on/off when thresholds are reached
    - batteries are filled in the night and discharged during the day
      - the shape of energy exchange with utility grids is coincidental and non-controllable

## Project drivers – utility grid

- Many such non-controllable buildings coincidentally produce large peaks and sags of energy consumption on the grid
  - peaks result in progressively higher losses in the grid and may overload the grid equipment
  - high variance of energy consumption makes it difficult to assure proper supply conditions (voltage)
  - distributed generation may induce overvoltage
  - increased expenses for the grid, reluctance to renewable energy integration



# What if?

- ...if we can orchestrate the building subsystems
  - such that energy consumption is reduced and energy exchange with the grids becomes controllable while the comfort remains intact

## What if...

- ...if the grid assigns different energy costs to different times of consumption and communicates it to the building in advance
  - ... and the building through the coordination mechanism adapts to these prices by selecting the one energy exchange profile that keeps the comfort intact and has the lowest cost
- ...and in this way by summing up many buildings the grid reshapes its load profile
  - ... and reduces energy losses while increases its equipment lifetime

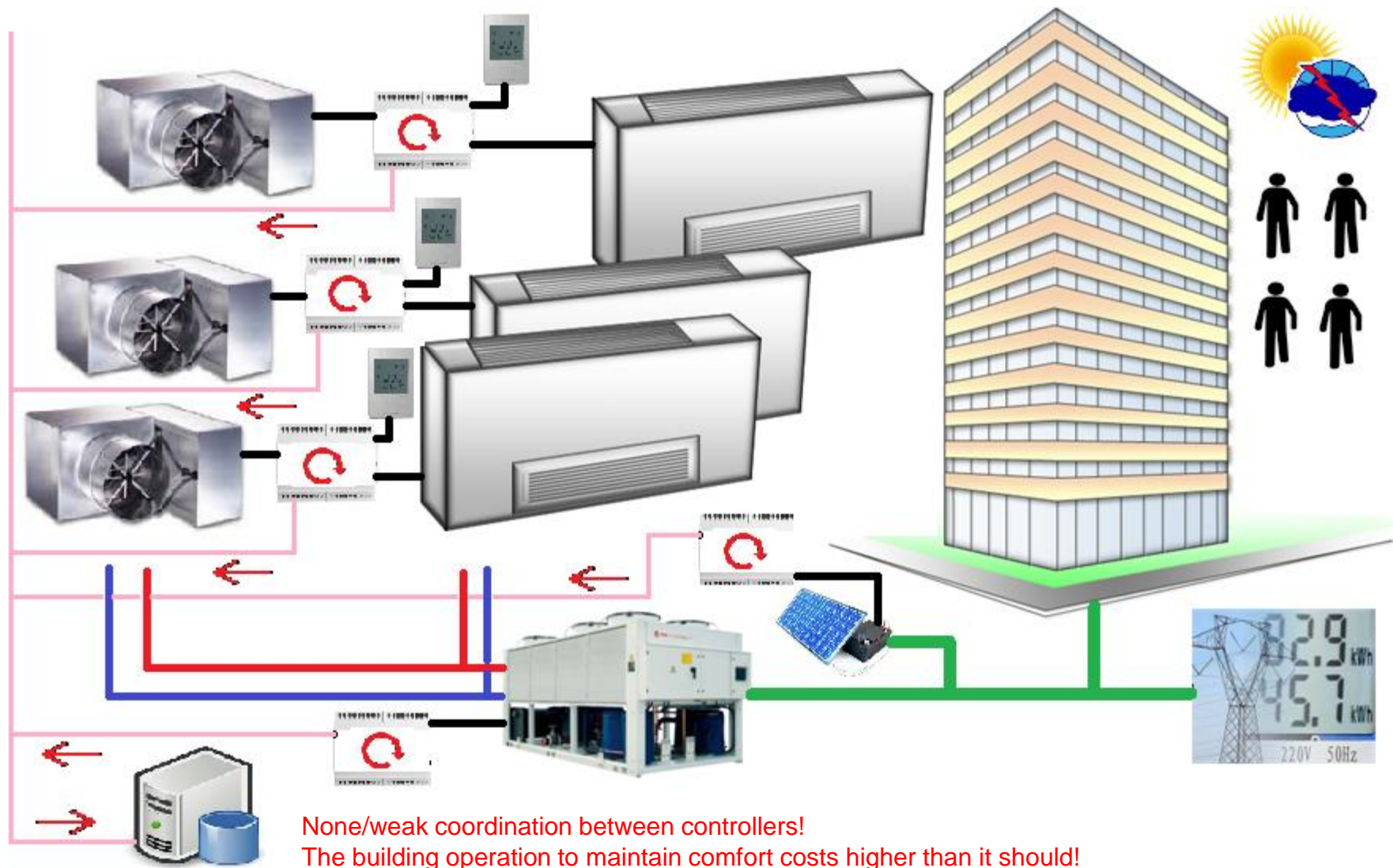
# Grid-building coordination (1)

- Coordination within the building, within the grid and between the building and the grid **is technically possible**
- ...how we do it?
  - Predictive control and mathematical optimizations
  - Exploiting their naturally featured market-based mechanisms for correlating prices and consumptions

## Grid-building coordination (2)

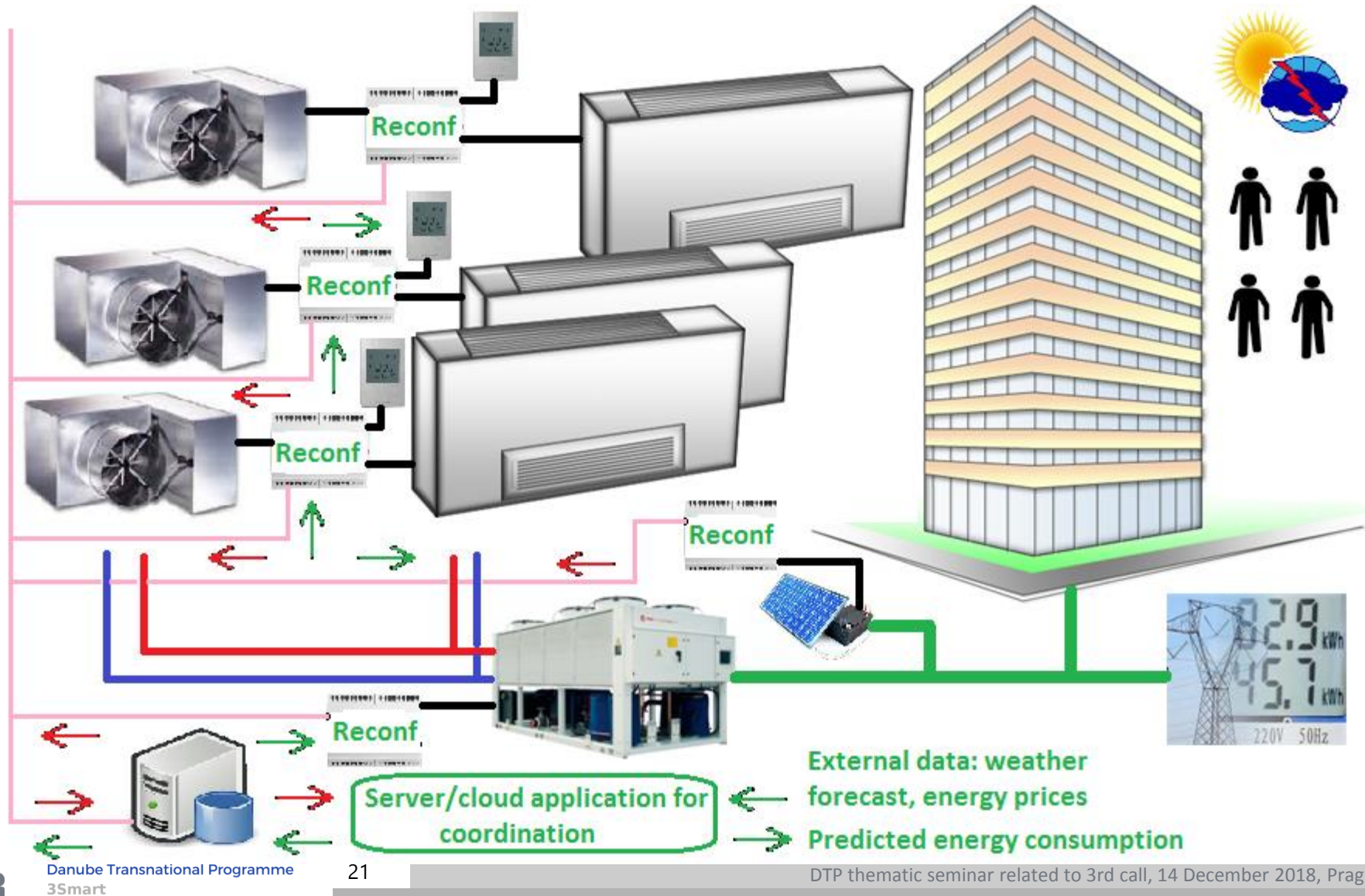
- ...but
- ...can we make it economically viable?
  - If we can easily impose coordination over the existing systems in their variety, yes! → needed energy management tool adaptable to different building configurations
- ...are we allowed to do it?
  - If we can align with regulatory framework and remove barriers → need to influence the regulatory framework on technically sound basis

# Classic commercial buildings



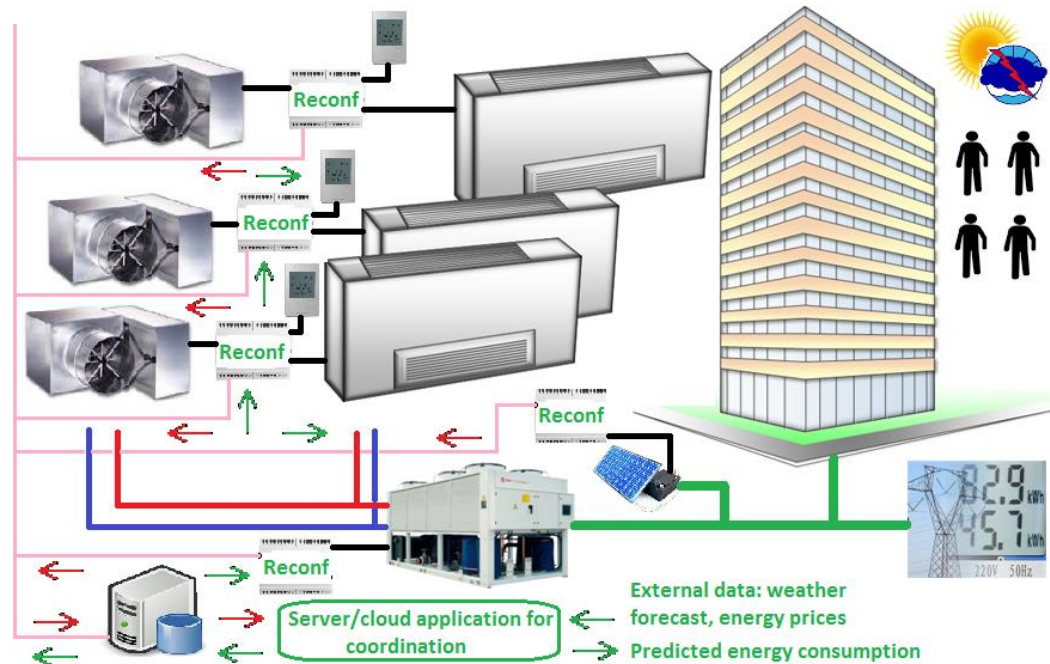


# Grid-building coordination (1)



# Grid-building coordination (2)

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

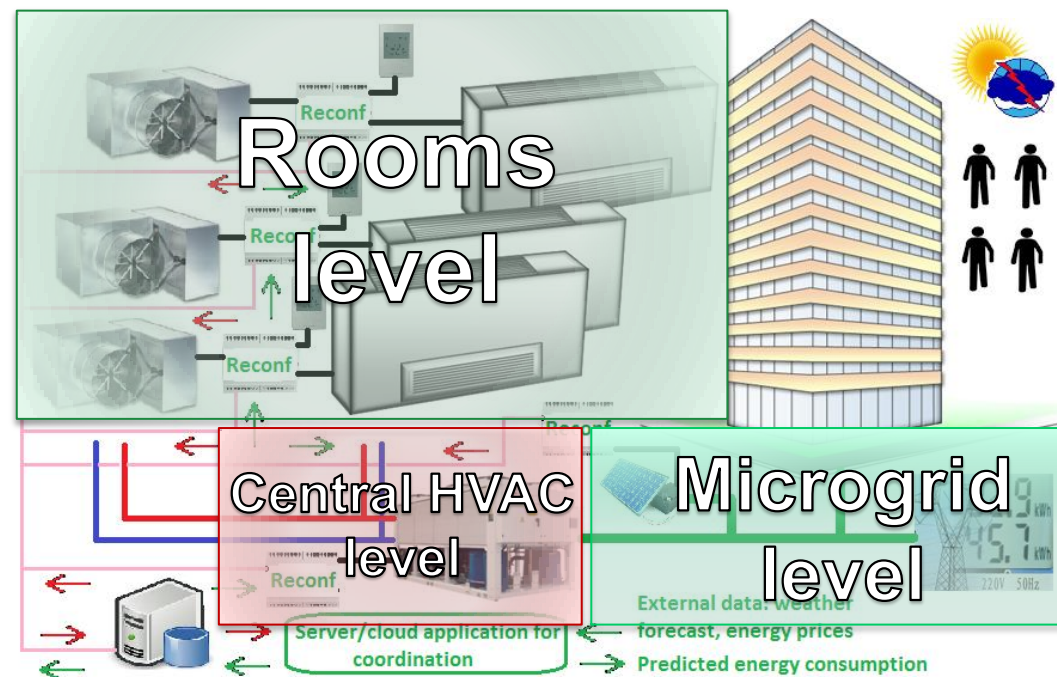


- Mutually coordinated in any configuration



# Grid-building coordination (3)

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



- Mutually coordinated in any configuration

# 3Smart proposal forming

# 3Smart intervention logic (1)

- 3Smart overall objective:
  - provide a technological and legislative setup for cross-spanning energy management of buildings, energy grids and major city infrastructures in the Danube region

## 3Smart intervention logic (2)

- 3Smart specific objectives:
  - SO1. Enable energy management between buildings and distribution grids
    - cross-spanning energy management tool
  - SO2. Demonstrate effectiveness and feasibility of modular energy management
    - pilots in HR, SI, AT, HU and BA
  - SO3. Enable take-up of the platform in buildings, grids and infrastructures
    - strategy to influence the regulatory framework, strategy for EMS take-up on city scale, training, stakeholders engagement, cost-benefit analyses

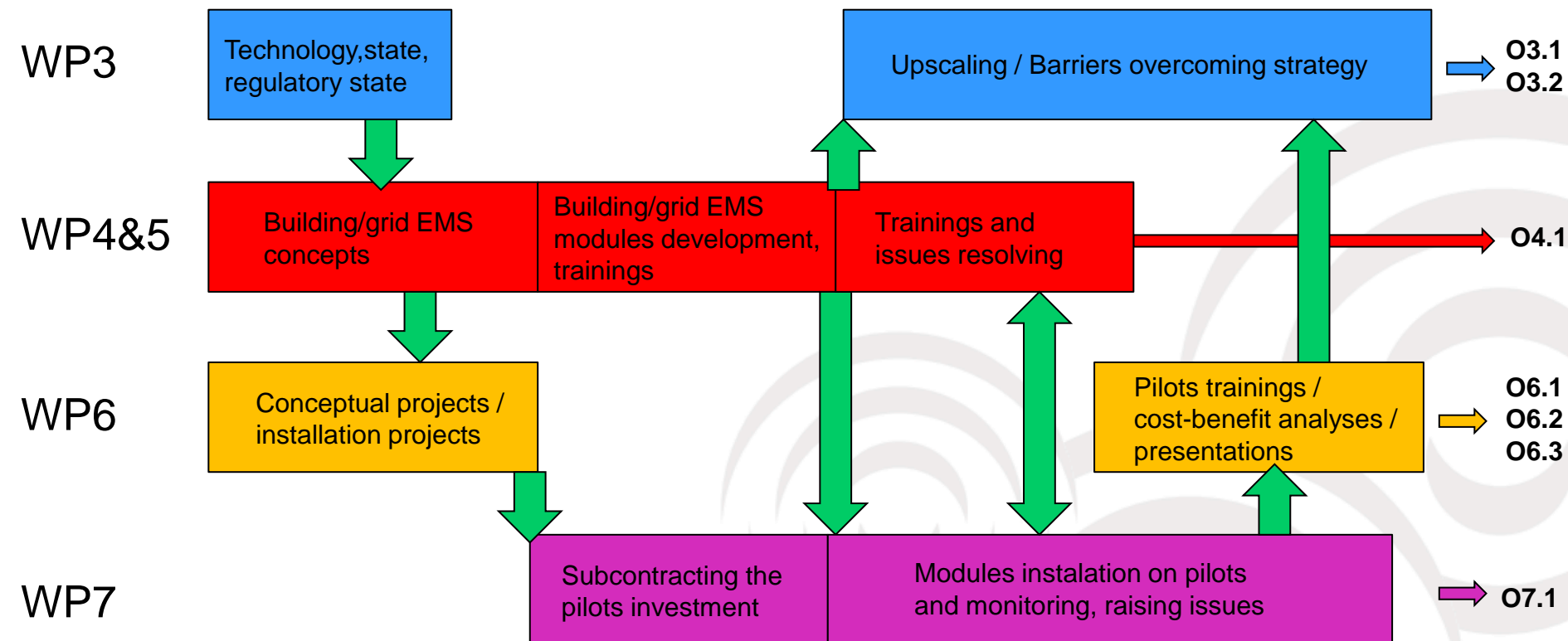
## 3Smart intervention logic (3)

- Technical workpackages
  - WP3. Energy management system (EMS) regulation/technology
  - WP4. Building-side EMS
  - WP5. Grid-side EMS
  - WP6. Pilots development
  - WP7. Pilots execution

## 3Smart intervention logic (4)

- Project outputs:
  - Modular cross-spanning energy management tool (WP4&WP5, related to SO1.)
  - Pilot-deployed energy management platform (WP7, related to SO2.)
  - Transnational training activities (WP6, related to SO2.)
  - Cost-benefit analysis of the EMS (WP6, related to SO2.)
  - Presentation of pilots results to stakeholders (WP6, related to SO2.)
  - Strategy to influence regulatory framework (WP3, related to SO3.)
  - Strategy of EMS take-up on city scale (WP3, related to SO3.)

# 3Smart activities and timing





## 3Smart partners structure

- Sought roles within each DR country (DTP ideas platform):
  - developer (university, company, development agency)
  - building owner
  - distribution system operator (DSO)
  - energy regulatory agency as ASP
- Final result
  - HR: university (with building) + DSO (with building) + ASP energy regulatory agency
  - SI: municipality (with buildings) + company + DSO + ASP local energy agency + ASP research institute
  - AT: development agency + municipality (with buildings) + DSO
  - BA: university + DSO (with building) + ASP energy regulatory agency
  - HU: university + DSO (with building) + ASP energy regulatory agency
  - RS: university (providing lacking expertise)

## 3Smart budget forming

- Installing clear rules for allocating costs to partners within activities
  - units of engagement for different results of activities
  - units of travels
  - units of organization costs etc.
- Technical discussions of preliminary activities on pilots for pilot investment budget shaping
- Created more detailed table of costs than required by the DTP
  - This table is constantly used during the execution

## 3Smart link to EUSDR

- EUSDR PA2 “Encourage more sustainable energy”
  - high percentage of renewables penetration requires the instruments in place for demand side management in ensuring energy balance and security of energy supply

# 3Smart capitalization

- Previous projects:
  - ERDF ENHEMS-Buildings, EraNet FlexChEV, SEE GeoSEE, FP7 SUNSEED, ERDF REGENERERG, etc.
- Enrolling new projects:
  - ERDF PC-ATE-Buildings (developing the tool further towards commercial take-up by companies)
- Interaction with other DTP energy-related projects, and with projects from other programmes

## 3Smart vision

- Enabled economically optimal interoperation of energy efficiency measures and renewable energy sources in buildings that interact with smart energy distribution grids
- Initiated installation of distributed storages to improve energy security in the Danube region
- High share of renewable energy in the energy mix

# Acknowledgement

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

Project co-funded by the European Union through Interreg Danube Transnational Programme (DTP1-502-3.2-3Smart), in the amount of maximum 3.222.641,90 EUR.

## PROJECT WEB PAGE

[www.interreg-danube.eu/3smart](http://www.interreg-danube.eu/3smart)

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