Urban regeneration - different perspective

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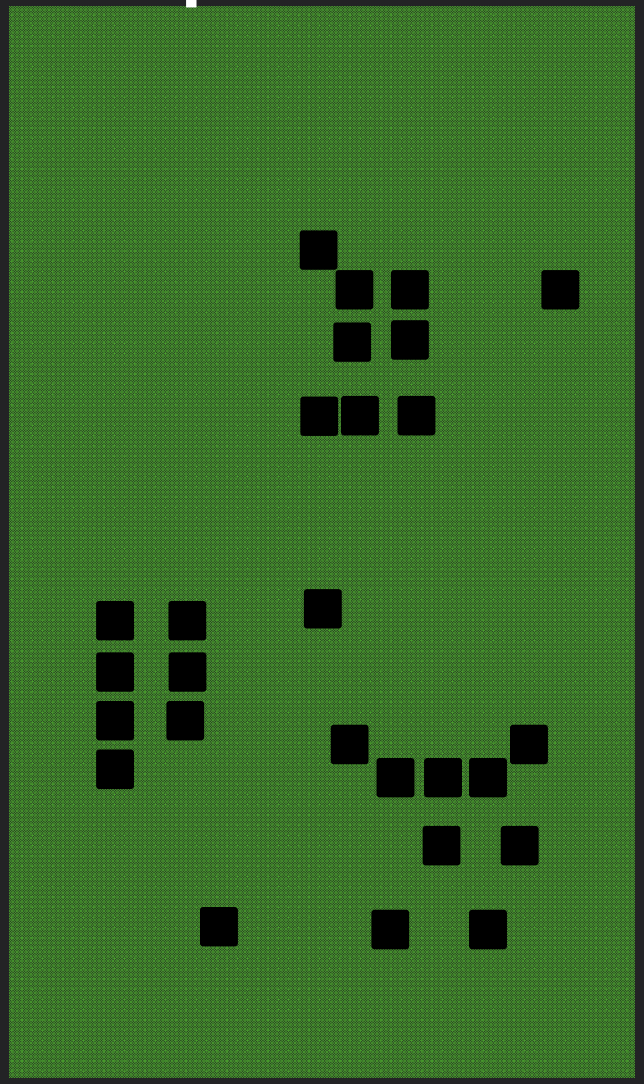
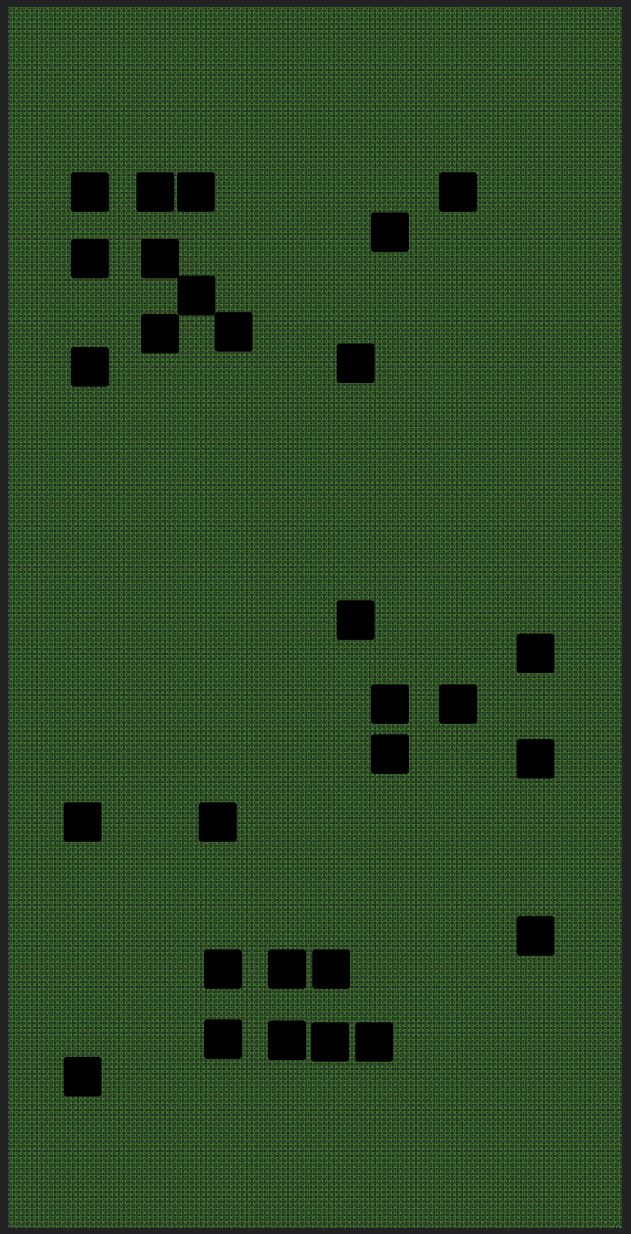


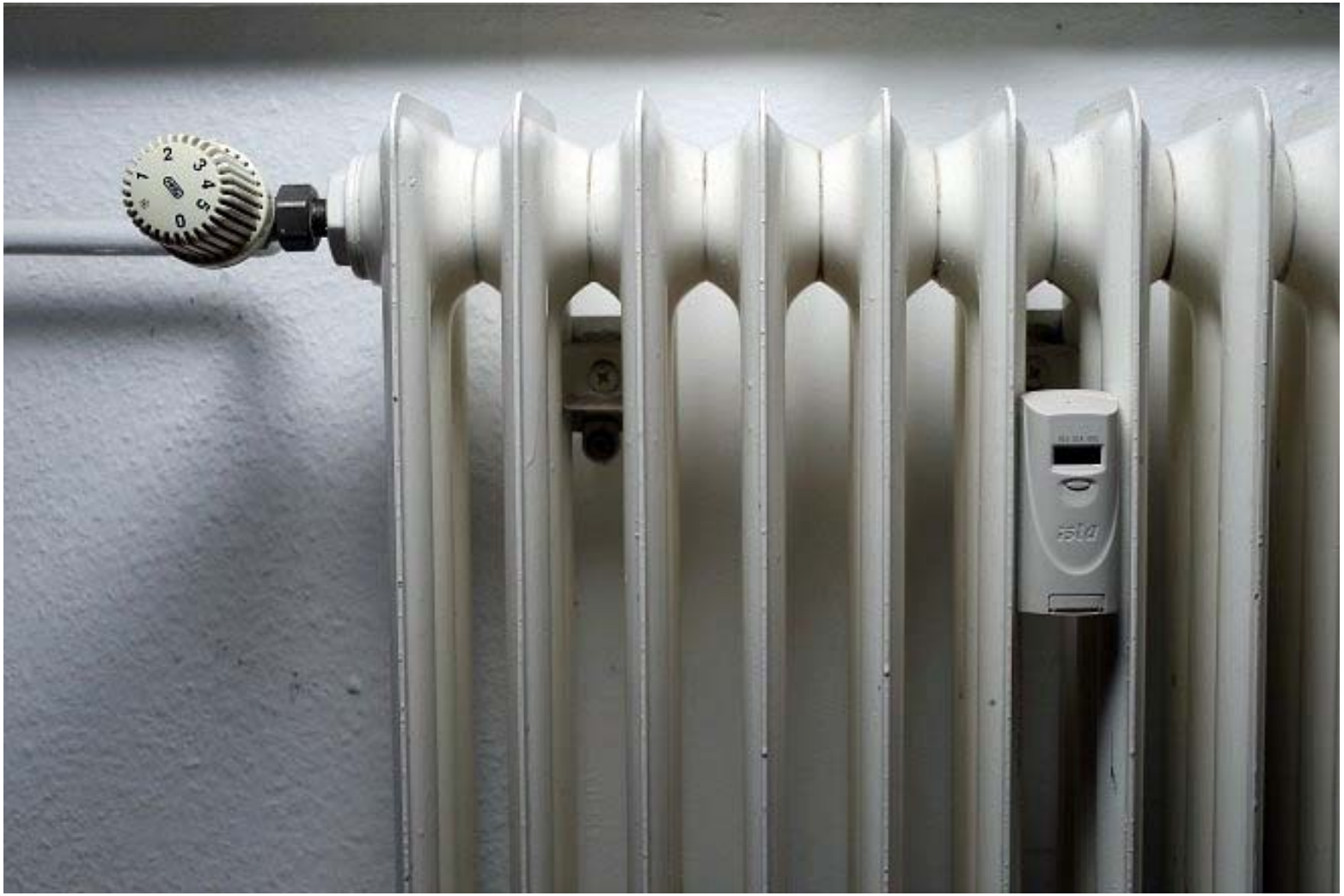


FosterREG Final Conference

Zagreb, 11. 05. 2017.

The reality

What do we do?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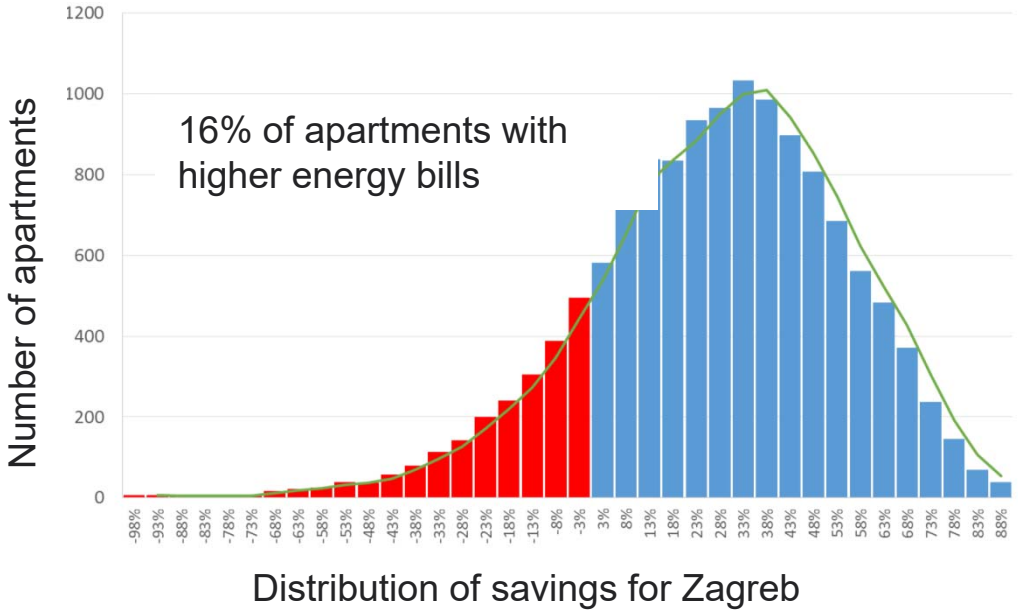
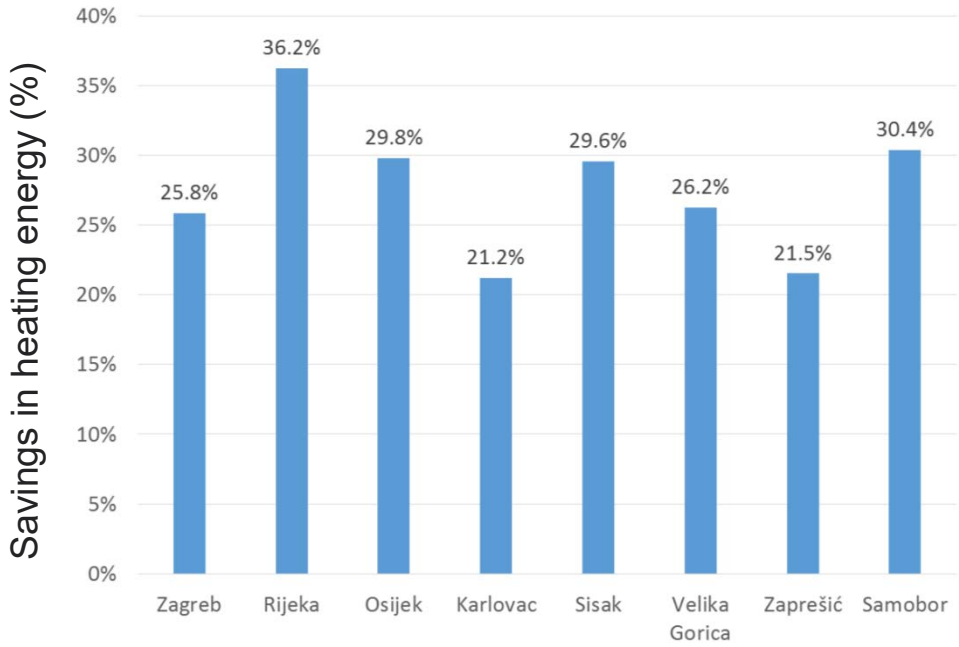
Heat cost allocators

Study on cost effectiveness:

- 8 cities, 276 buildings with 22.475 units
- savings were evaluated based on real measurements





For Zagreb, Osijek and Sisak (80% of total delivered heating energy):

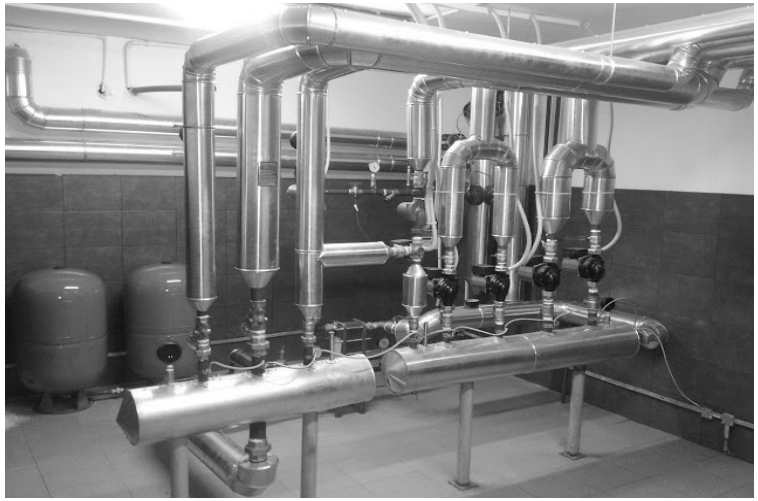
Positive NPV only for buildings that consume >170 kWh/m^2 (minimal set of equipment or >220 kWh/m^2 (full set of equipment)

Ekonomski institut. 2017. Ekonomska isplativost korištenja razdjelnika topline u višestambenim zgradama u Republici Hrvatskoj

Now for real…

What do we do?

The source



How do we enable this?

PV - Installed Capacity

Now:

EU total (2014)*: 89.000 MW
Croatia**: 50 MW

The plan:

1.000 MW of new residential PV installations within 10 years (100 MW each year)

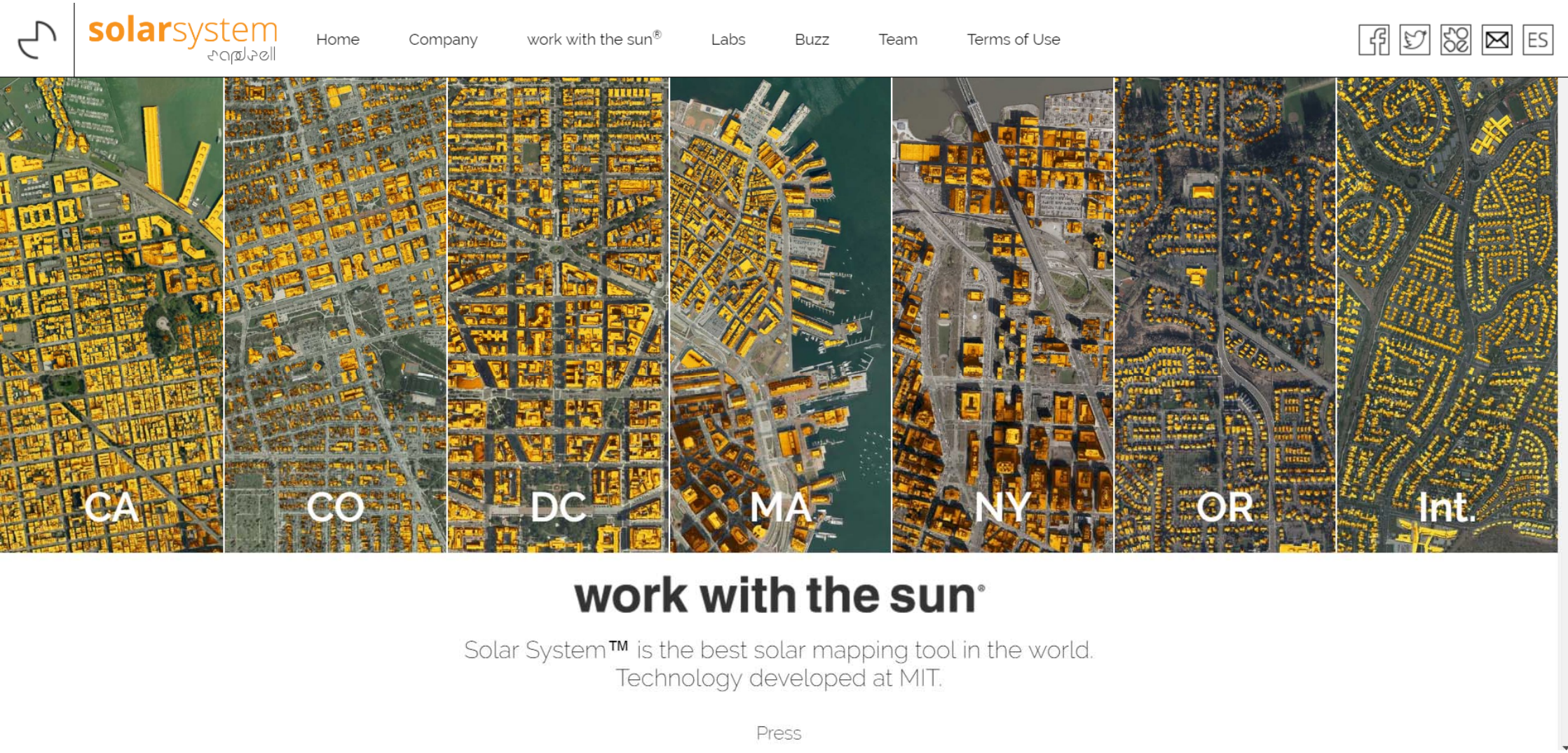
FOND ZA ZAŠTITU OKOLIŠA
I ENERGETSKU UČINKOVITOST

*http://ec.europa.eu/eurostat/statistics-explained/index.php/Electricity_and_heat_statistics#Installed_electrical_capacity

** http://www.eihp.hr/wp-content/uploads/2016/12/Energija2015.pdf

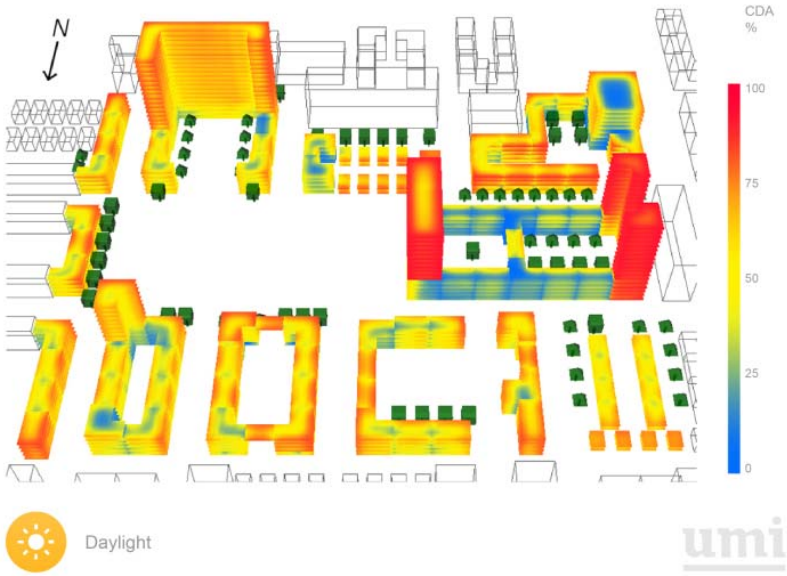
What is my potential as a building?

Actually, Google, MIT was first!



https://www.mapdwell.com/en/solar

What is my potential as a neighborhood?



UMI is a Rhino-based design environment for architects, urban planners and real estate developers interested in modeling the environmental performance of neighborhoods and cities with respect to operational and embodied energy use, walkability and daylighting potential.

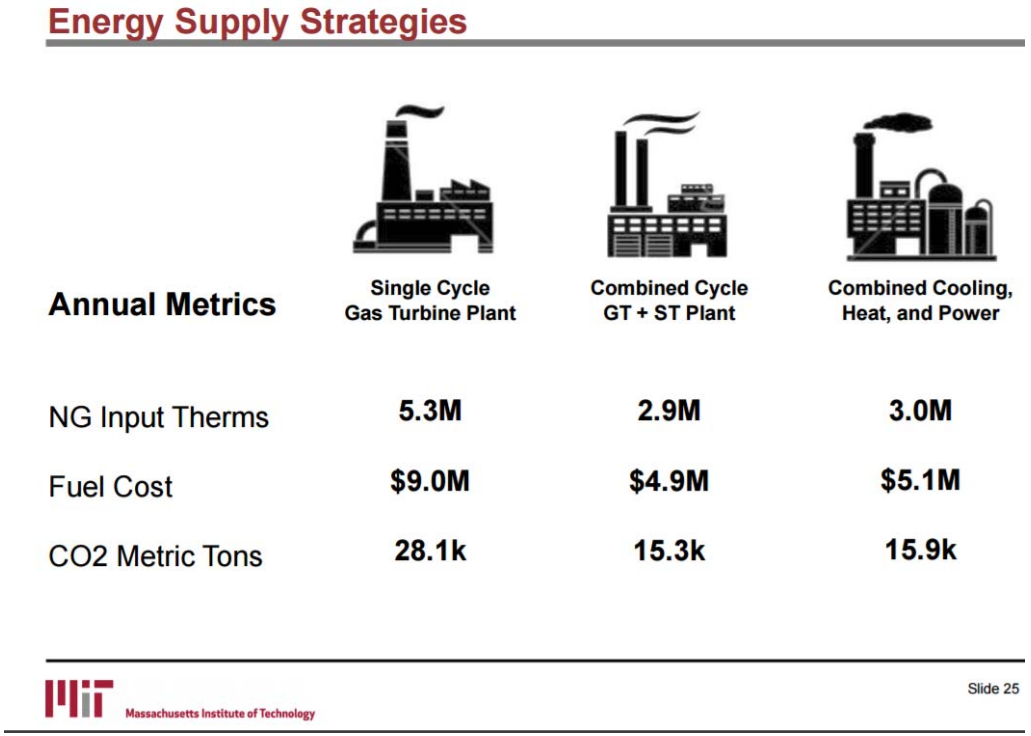
https://architecture.mit.edu/building-technology/project/urban-modeling-interface

What is my potential as a neighborhood?

Boston Citywide Energy Model

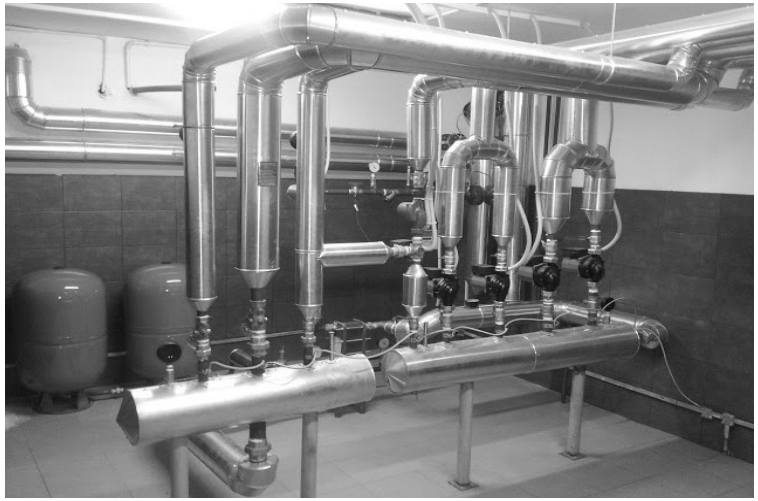
Analysis performed by MIT Sustainable Design Lab. The authors collaborated with the Boston Redevelopment Authority (BRA) and local building experts to develop a citywide model based on the official GIS dataset of the city

Proposal on Kuwait Neighborhood Planning



Analysis performed by MIT Sustainable Design Lab. http://web.mit.edu/SustainableDesignLab/projects/UMIverse/2016_Kuwait_NewNeighborhood/2016_Kuwait_NewNeighborhood.pdf

District heating network



Zagreb district heating network

Patrik Macek/PIXSELL

Supply:	heating and domestic hot water
Length:	more than 200 km
Size:	over 90.000 apartments
Capacity:	1.120 MW
Age:	more than 40 years old
Losses:	approx. 12%

Planned projects: Renovation of district heating network in Zagreb and Osijek

EU Funds: 80 mil. EUR*

Result: heat losses (for Zagreb) **from 12% to about 8%** in 2023

EGE 4/2002. Komerčki Z., Marović, M., Bavoljak D.: *Razvitak toplinarstva u Republici Hrvatsoj od 2000 do 2025. godine*

*www.strukturnifondovi.hr

District heating substation

District heating substation

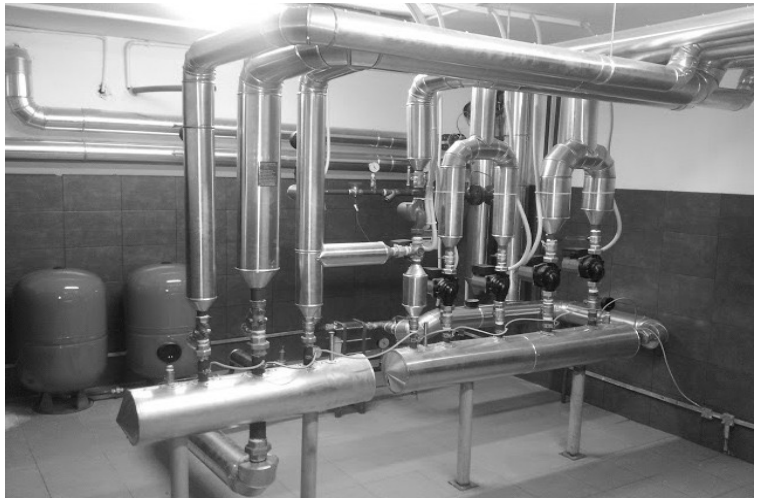
Project: Standardized district heating substations

Goal: Modernization and improvement in flexibility

Planned improvements:

- Possibility of integration with renewable energy sources at the building location
- Possibility to chose optimal heating regime using secondary side temperature control
- Separate measurements for heating and domestic hot water
- Modern control that enables remote metering and optimization of relevant heating parameters
- Simplification and shortening of the design process

Demand side



Energy renovation investments

EU allocated resources:

Industry:	60 mil EUR
Tourism and services:	40 mil EUR
Residential buildings:	100 mil EUR
Public buildings:	212 mil EUR
Public lighting:	20 mil EUR

Energy monitoring

ISGE system – monitoring and the analysis of energy and water consumption in public buildings

Other vendors used in individual buildings

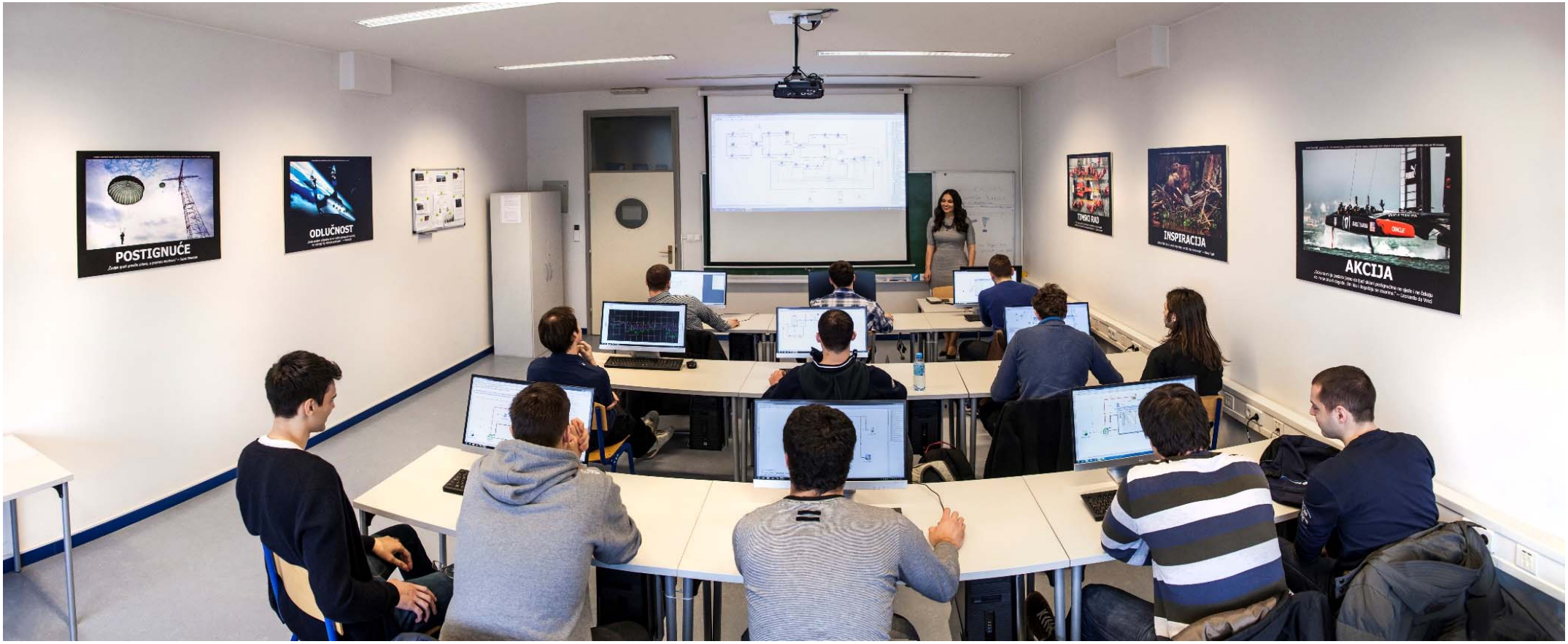
http://www.apn.hr/informacijski-sustav-za-gospodarenje-energijom--isge.aspx

Goal?

Use the data.

Laboratory for energy efficiency

- Energy modeling
- System optimization
- Advanced building control
- Experimental measurements
- Big data analysis
- Passive heating and cooling



Energy simulation software

TRNSYS 17

MATLAB

System Advisor Model

NREL

DesignBuilder SOFTWARE

INTEGRA CAD

Ax3000

Ladybug

Honeybee

CoolVent
The Natural Ventilation Simulation Tool by MIT

DIVA
Environmental Analysis for Builings

Project team

Igor Balen
Full Professor

Alan Rodić
PhD Candidate

Ivan Šimić
Lab assistant

Nenad Ferdelji
Assistant Professor

Darko Smoljan
Assistant Professor

Tea Žakula
Head of Lab, Assistant Professor

Goal: use building energy data for

City energy modeling

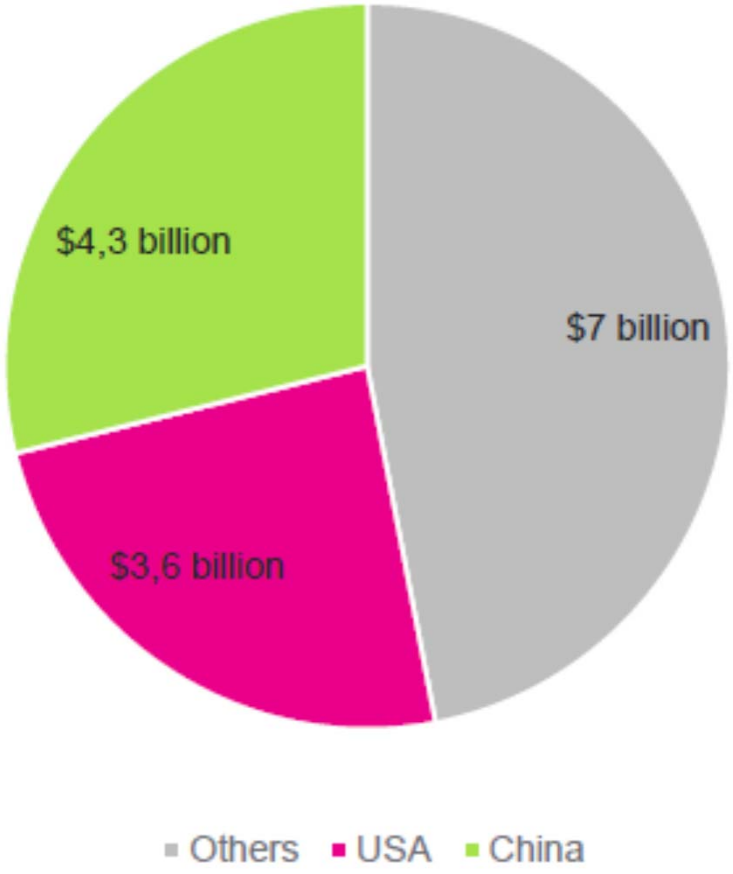
Portfolio evaluation

Projections about investments and savings

Predictions about hourly energy use

Smart grid

Smart grid investments in 2013.



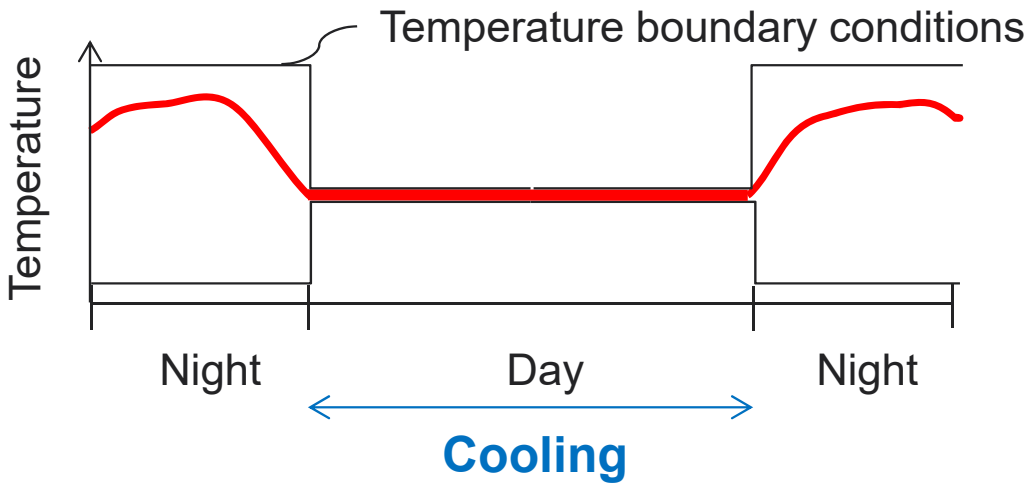
Bloomberg New Energy Finance

The global smart grid market is expected to cumulatively reach over $400 billion by 2020.

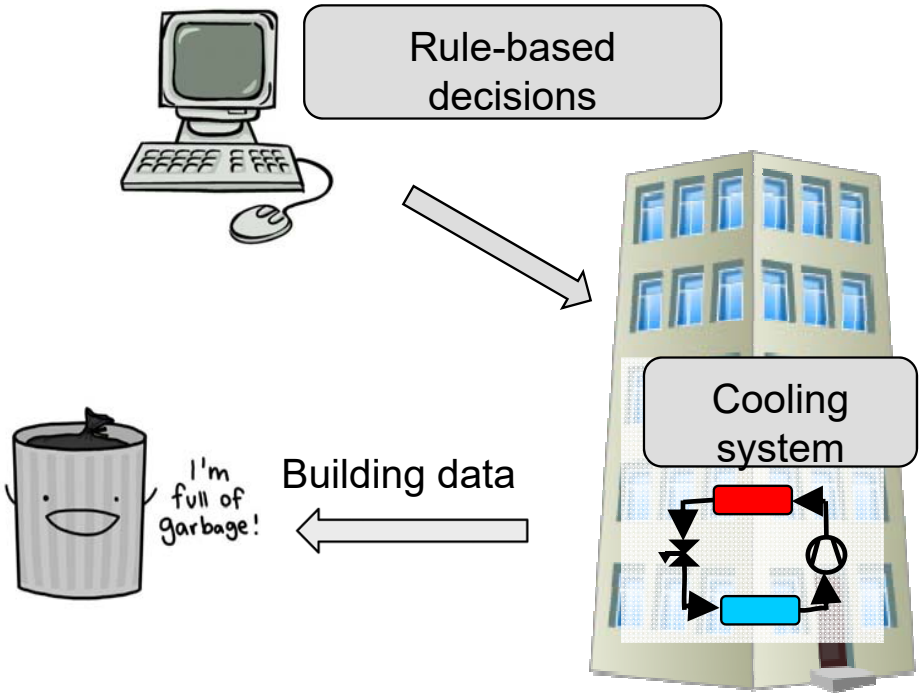
Charlene Fowler, “Smart Grid Market to Surpass $400 Billion Worldwide by 2020,” Greentech Media, 13 August 2013

Conventional cooling

Room temperature

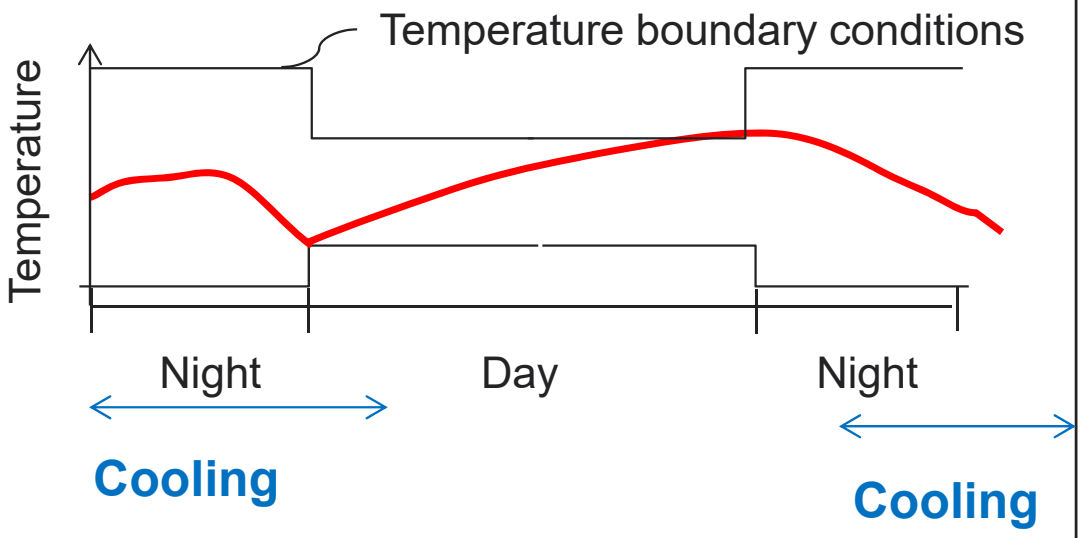


Information flow



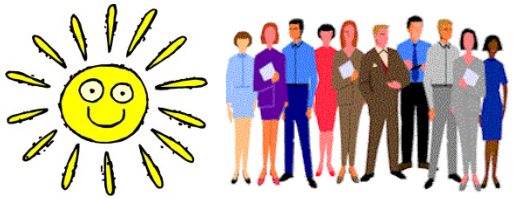
Model predictive control

Room temperature



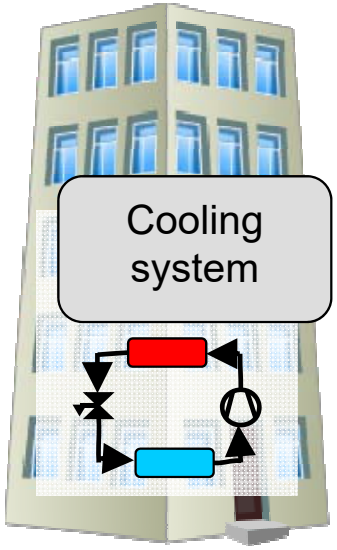
Information flow

Prediction of weather data and building use



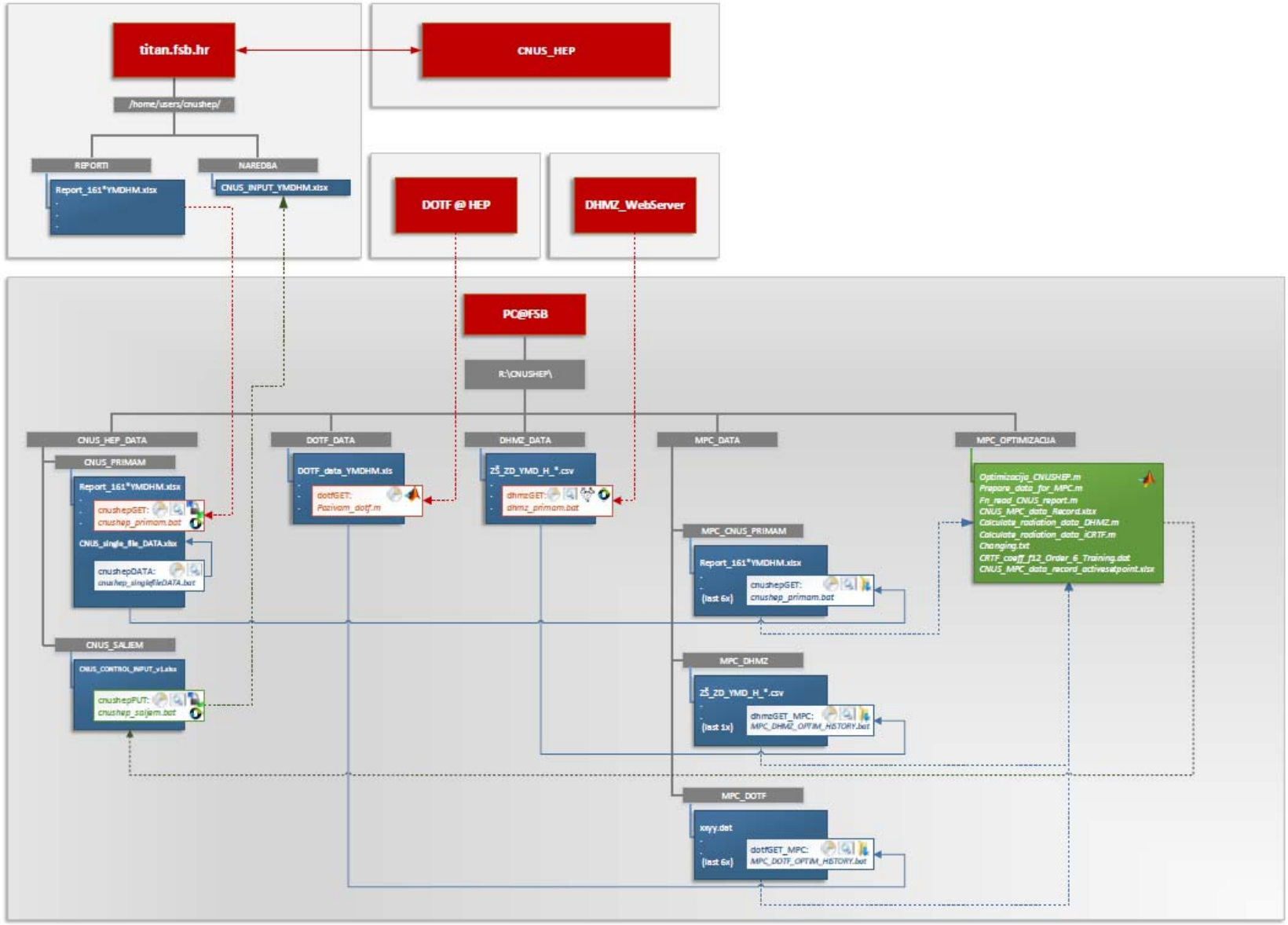
Optimization/based decisions – lowest price/lowest energy consumption

Building data

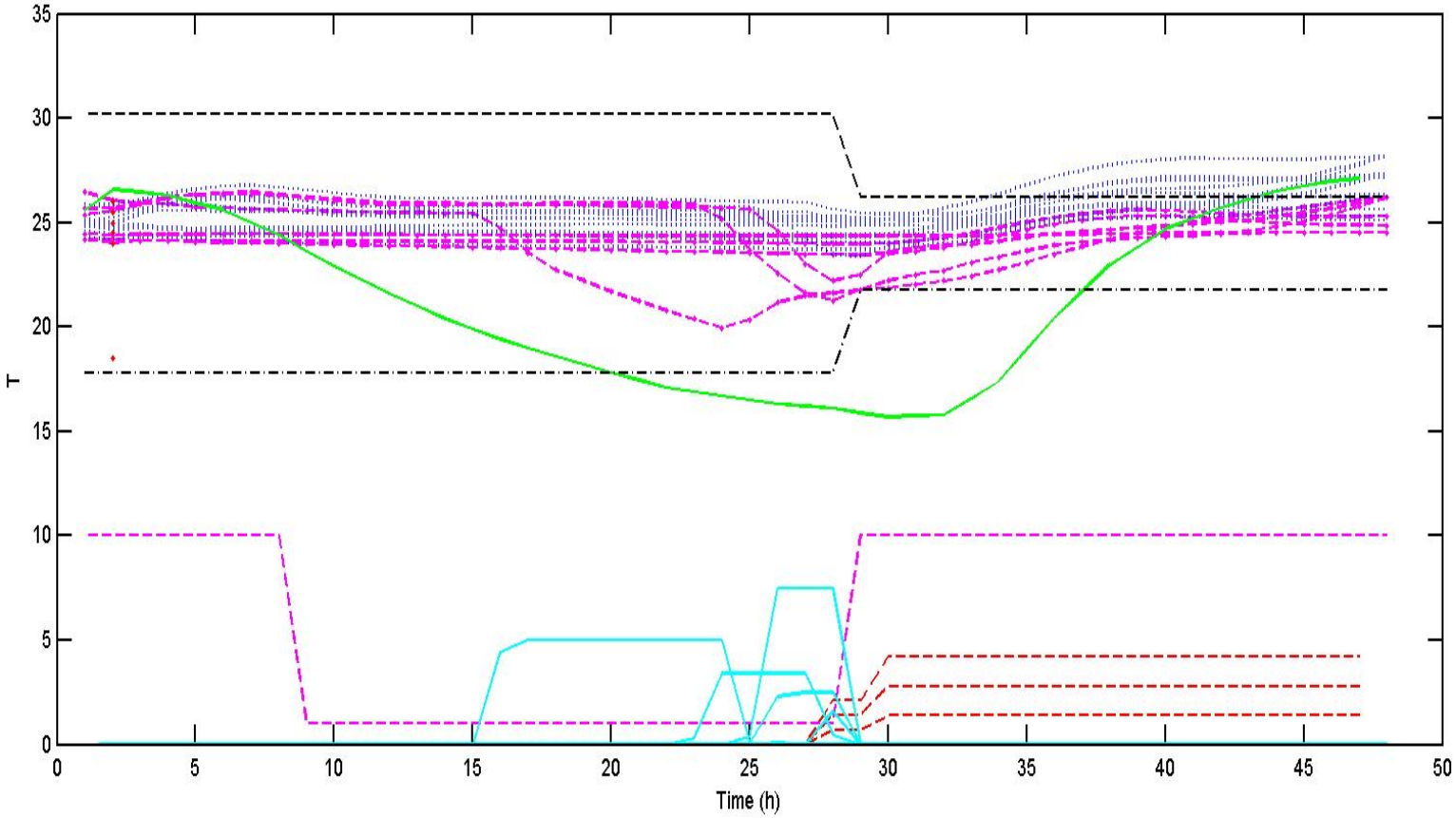


Living laboratory

Algorithm flowchart MPC@HEP



Real-time optimization



Room temperature [ºC]

Upper temperature boundary [ºC]

Lower temperature boundary [ºC]

Outside temperature [ºC]

Fancoil cooling rate [kW]

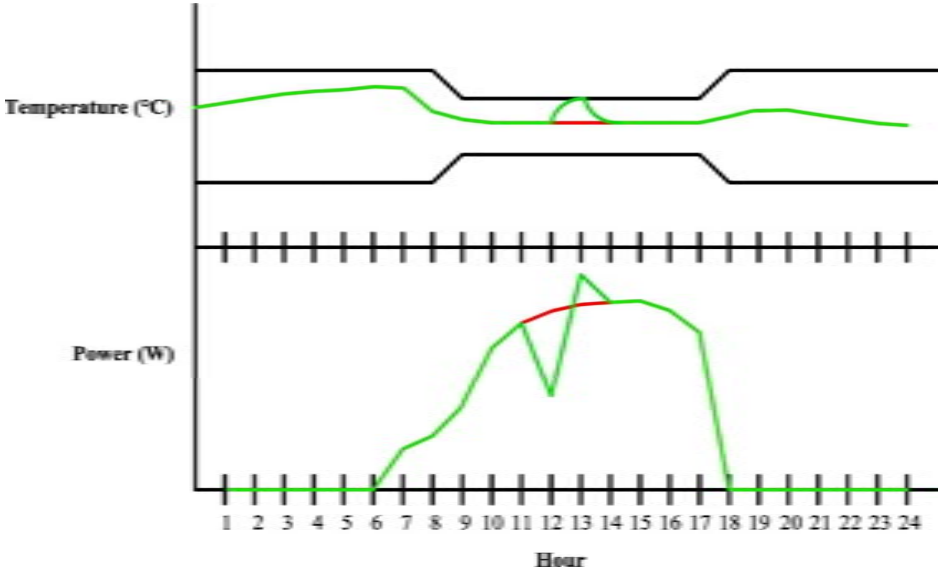
Internal heat loads [kW]

Virtual price (non-dimensional)

Demand side participation in smart grids.

Demand-response

Demand-response of a system with conventional control

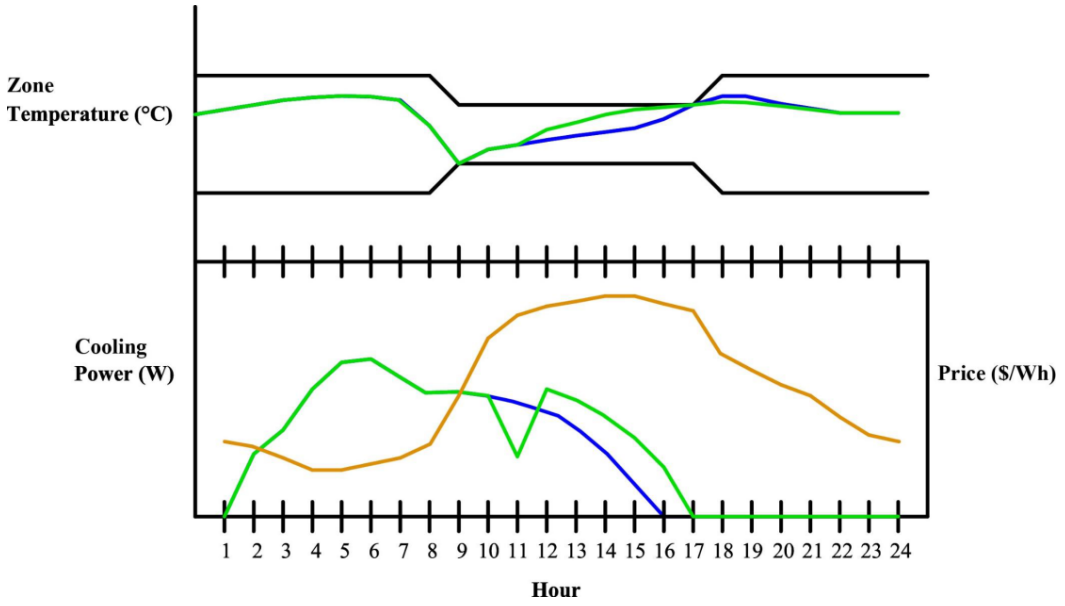


normal operation

optimal operation

response to the operator's signal

Demand-response of a system with MPC



Blum D., Zakula T., Norford L. 2015. **Opportunity cost quantification for ancillary services provided by heating, ventilating, and air-conditioning systems**. *IEEE Transactions on Smart Grid*, Volume PP, Issue 99.

To be continued…

Thank you!

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