Energy

VPP
Valsts pētījumu programma

Achieving Positive Energy Block in historic urban environment: simulation and evaluation of alternative scenarios

Prof.Andra Blumberga, Ruta Vanaga, Ritvars Freimanis, Juris Antužs

Institute of Environment and Energy Systems

Riga Technical university

6th International Conference on Smart Energy Systems, 6-7 October 2020

VPP-EM-EE-2018/1-0003
IMPROVEMENT OF BUILDING ENERGY EFFICIENCY TECHNOLOGIES (I-BEET)

Positive Energy Blocks (PEB)

Consist of several buildings

(new, retro-fitted or a combination of both)

Buildings actively manage their energy consumption and the energy flow between them and the wider energy system

PEB have an annual positive energy balance

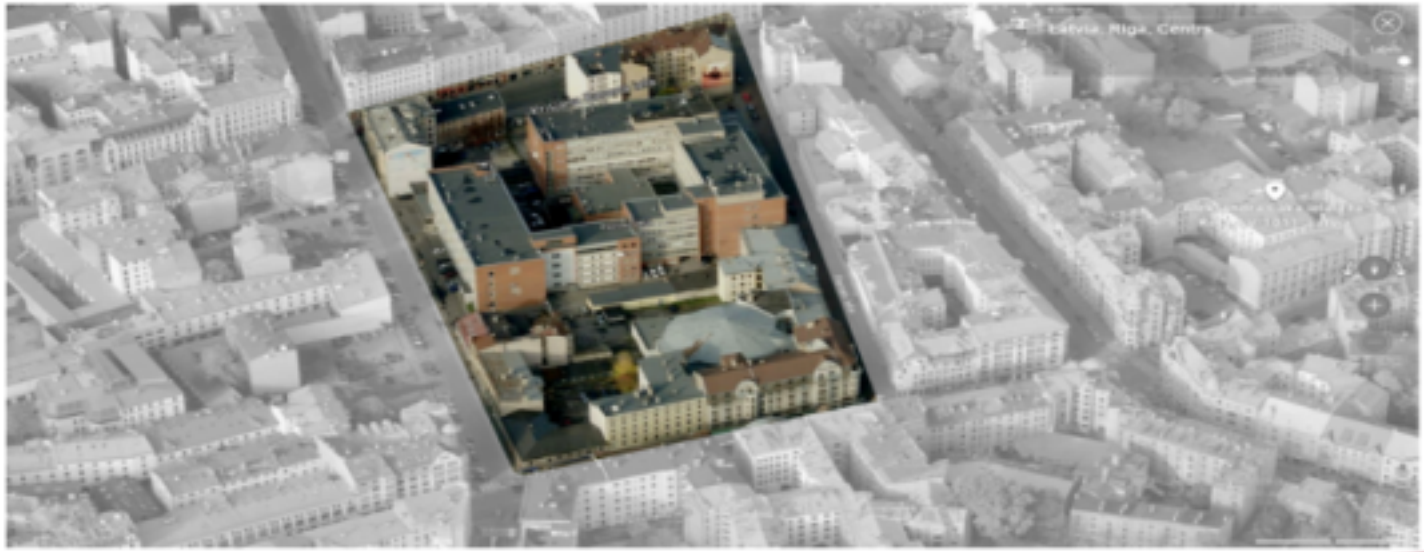
They make optimal use of elements:

advanced materials, local RES, local storage, smart energy grids, demand-response, energy management (electricity, heating and cooling), user interaction/involvement and information and communications technologies

The goal of the study

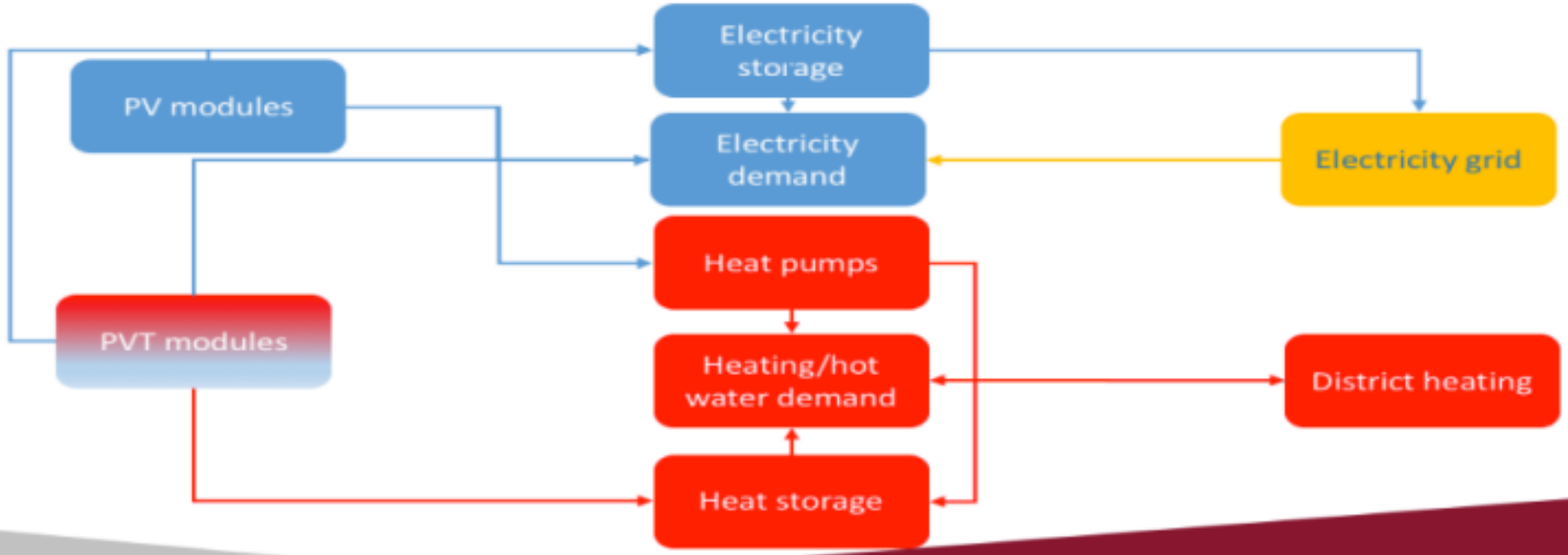
To assess different scenarios to reach Positive Energy Block in densely populated urban environment by:

- reducing impact on climate change
- regenerating urban environment.



Modelled system

- A system dynamics model was created based on hourly energy balance.
- Scenarios:
  - energy efficiency and RES first
  - architectural values first
  - compromise between energy efficiency, RES and architectural values.

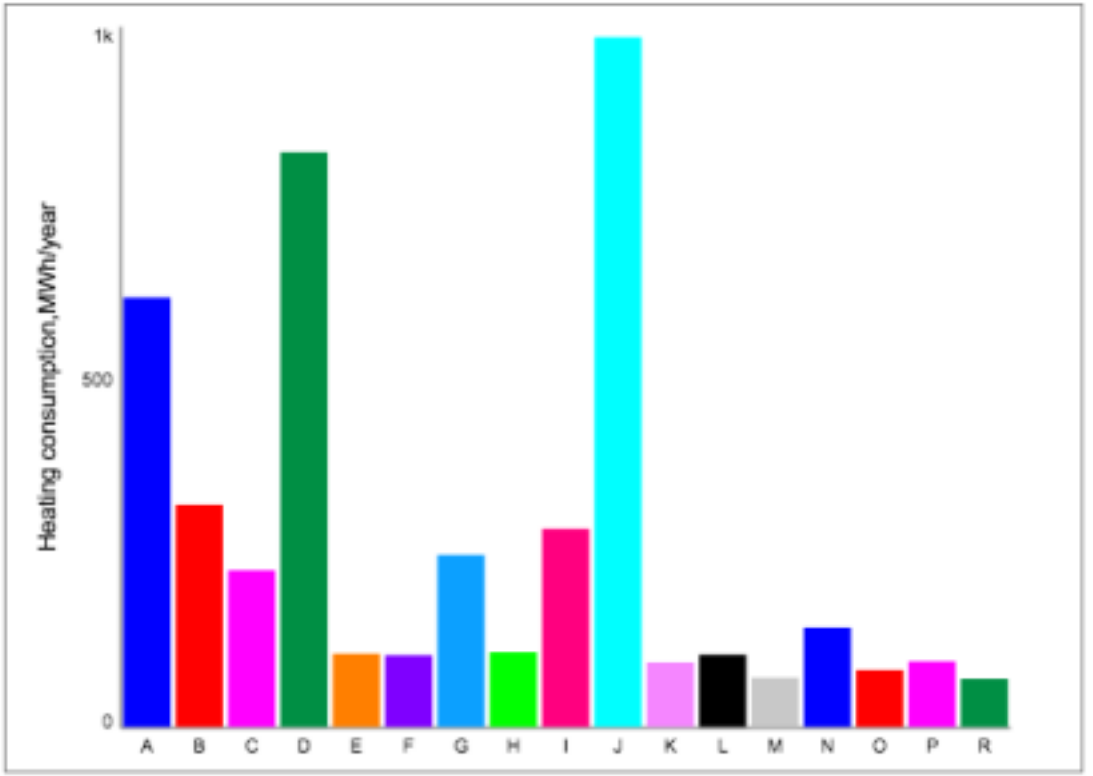


HEAT CONSUMPTION IN THE BLOCK

ARCHITECTURAL VALUES FIRST

ENERGY EFFICIENCY AND RES FIRST

Total heating and HW consumption, GWh/year	2,75

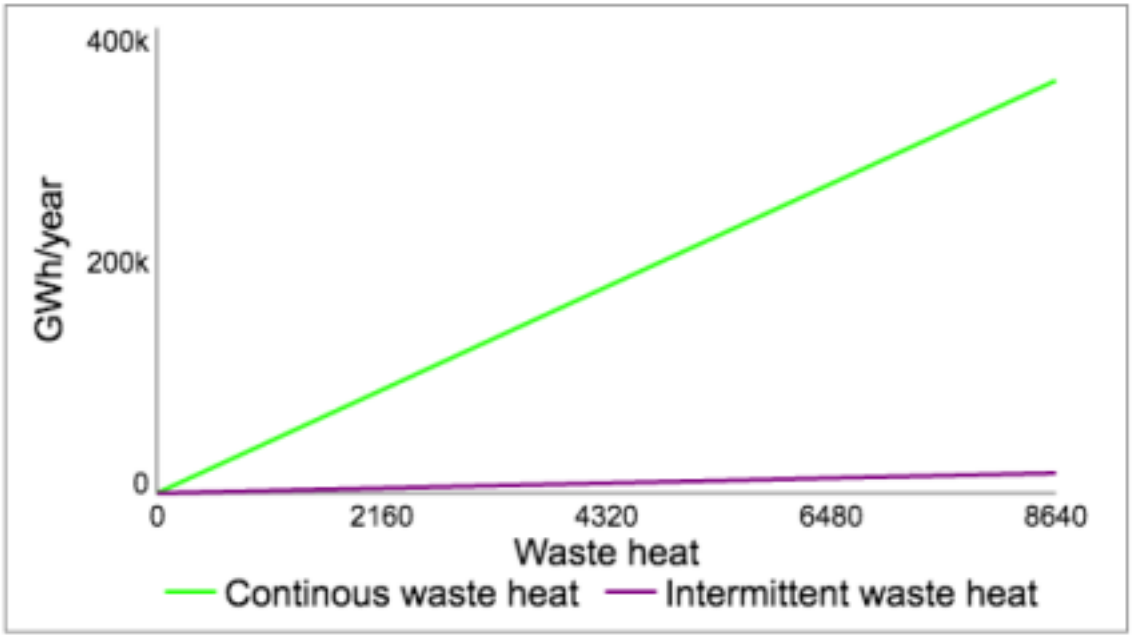


SIMULATE

START NEW RUN

VPP-EM-EE-2018/1-0003

WASTE HEAT



SIMULATE

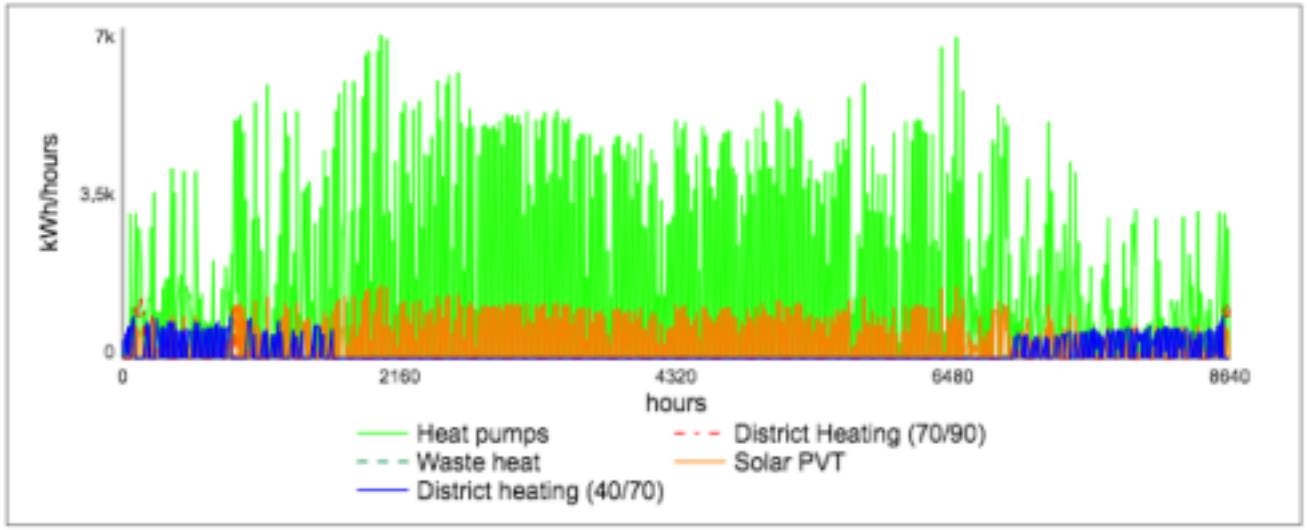
START NEW RUN

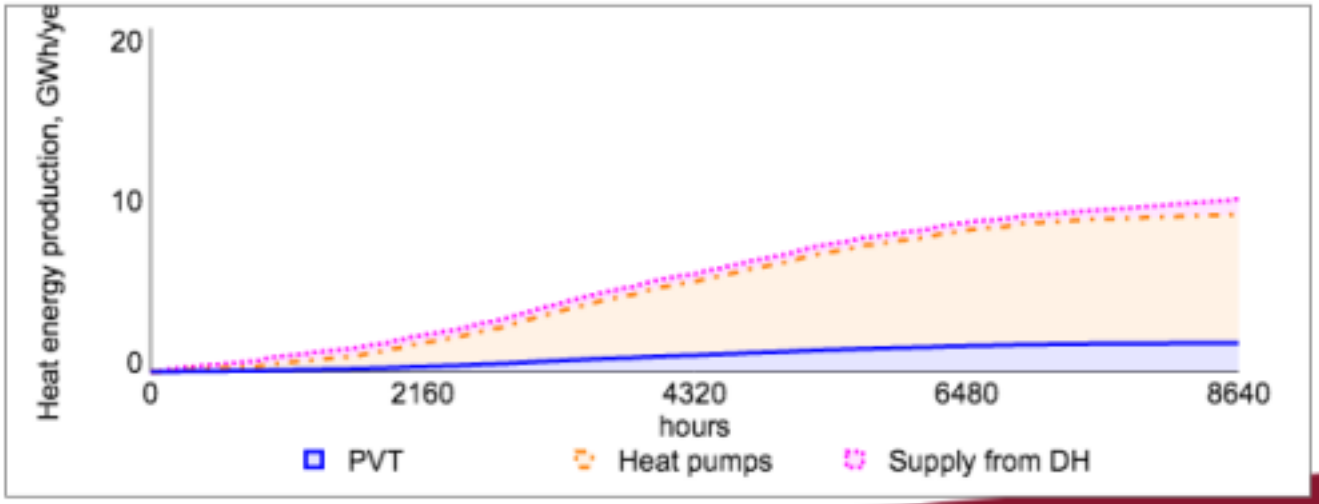
ELECTRICITY SAVINGS SCENARIO

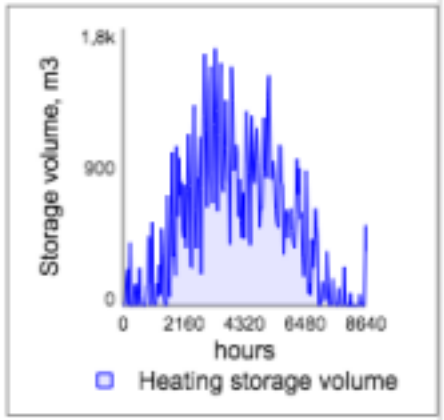
USE OF RES

ARCHITECTURAL VALUE FIRST

ENERGY EFFICIENCY FIRST







RES subsidies

0 0,5 1

SIMULATE

START NEW RUN

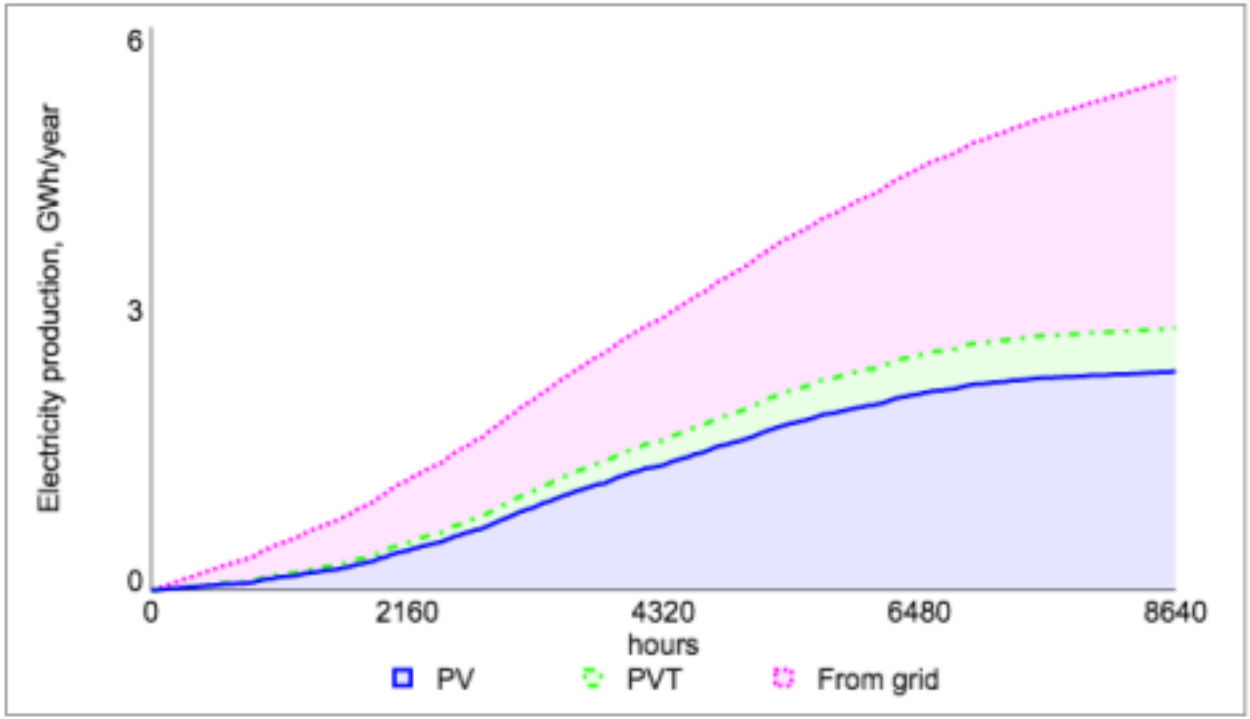
VPP-EM-EE-2018/1-0003

ELECTRICITY SAVINGS SCENARIO

USE OF RES

ARCHITECTURAL VALUE FIRST

ENERGY EFFICIENCY FIRST



SIMULATE

START NEW RUN

Conclusions

- It is technically feasible to reduce energy consumption in:
  - Energy Efficiency FIrst scenario by 42%
  - Architectural Values First scenario by 30%
- Subsidies are needed for both energy saving scenarios
- It is technically feasible reach Positive Energy Block for heating and electricity production by using seasonal thermal energy storage
- Subsidies for heat pumps, heat storage and PVT are needed to be economically feasible
- Further research:
  - will focus on social acceptance of Positive Energy Block, incl. autarky, autonomy issues
  - developed model will be further used as single player game and multi player game to create hypothetical Positive Energy Block to study behavior and decision making by inhabitants

This research is funded by the Ministry of Economics of the Republic of Latvia, project “Improvement of building energy efficiency technologies (I-BEET)”, project No. VPP-EM-EE-2018/1-0003