

Façade integrated HVAC systems for the renovation of residential buildings

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Content

- Project goals and method
- Development of energy supply systems
- Reference building
- Selected simulation results
- Outlook



Research project

HVACviaFACADE...

...prefabricated façade elements with maximum integrated HVAC components and systems for the renovation of existing buildings



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Project goals

- Increased integration of active and passive HVAC components in prefabricated facade modules for high quality retrofitting
- Develop energy supply systems which allow direct interaction between the active energy elements in the facade and the room (flat) behind
- High level of prefabrication and easy accessibility for maintenance purposes
- Make the advantages of multifunctional facades rateable and compareable



Development of energy supply concepts

Approach:

1. Development and pre-examination of individual concepts
 - Heating
 - Domestic hot water
 - Ventilation



Development of energy supply concepts

Approach:

1. Development and pre-examination of individual concepts



2. Pre-evaluation based on different aspects (matrix)



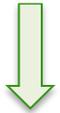
Development of energy supply concepts

Approach:

1. Development and pre-examination of individual concepts



2. Pre-evaluation based on different aspects (matrix)



3. Selection and merging to “overall supply concepts”



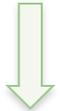
Development of energy supply concepts

Approach:

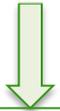
1. Development and pre-examination of individual concepts



2. Pre-evaluation based on different aspects (matrix)



3. Selection and merging to “overall supply concepts”



4. Simulation and detailed assessment



Concepts to be simulated

Scenario	heating demand [kWh/m ² a]	
	30	15
Reference case*	X	X

* central gas fired condensing boiler for heating,
decentralised electric heaters for DHW preparation



Concepts to be simulated

Scenario	heating demand [kWh/m ² a]	
	30	15
Reference case*	X	X
C Air-to-Water Heat Pump with PV	X	X
- Increase source temperature by using mechanical exhaust air		X
- Partially increase of outside temperature by using façade integrated air-heater solar collector or PVT collector	X	



Concepts to be simulated

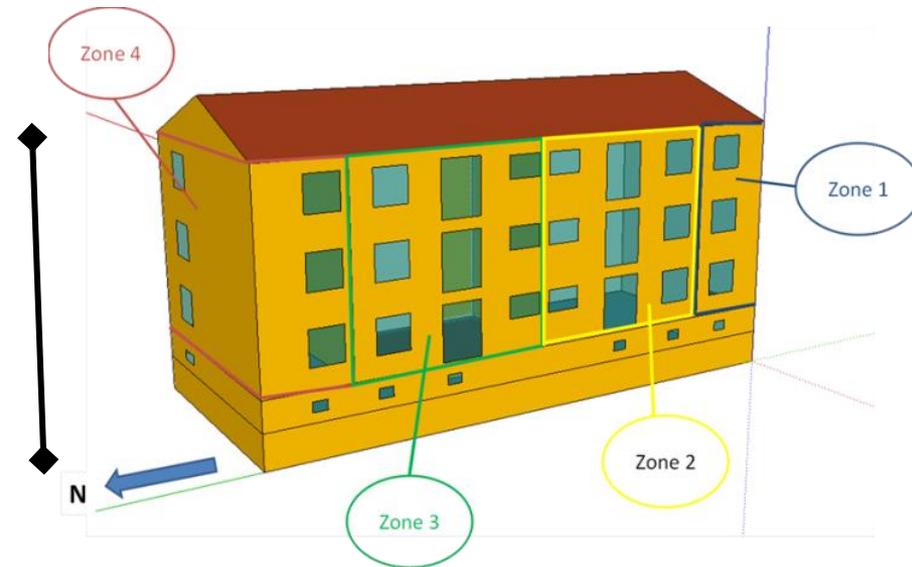
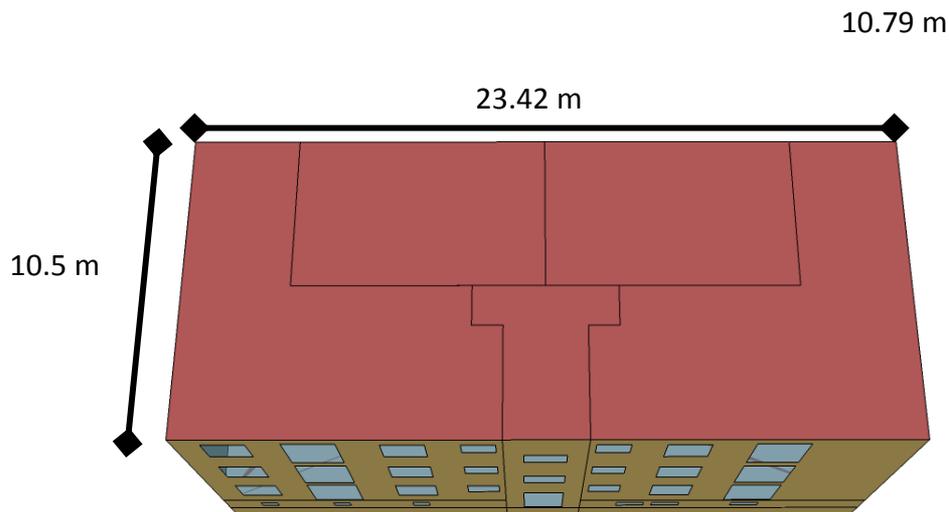
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D Air-to-Water Heat Pump with PV	X	X
- Partially increase of outside temperature by using façade integrated PVT collector	X	
Direct electric heating using PV and infrared heating	X	X
Activating the outside wall by using solar heat	X	X



Reference building

Simulation of the entire building

- 4 heated thermal zones (each including 3 apartments – 1 on each floor)
- 1 unheated staircase
- Unheated basement
- Unheated attic



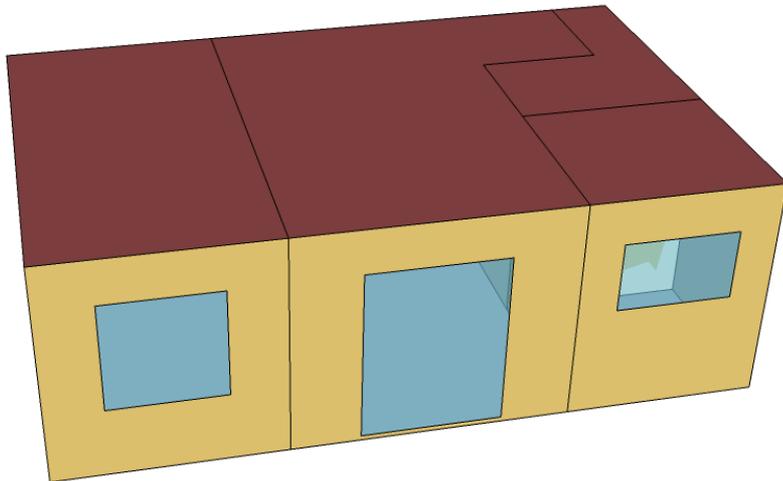
in total: 687 m² heated floor area



Reference building

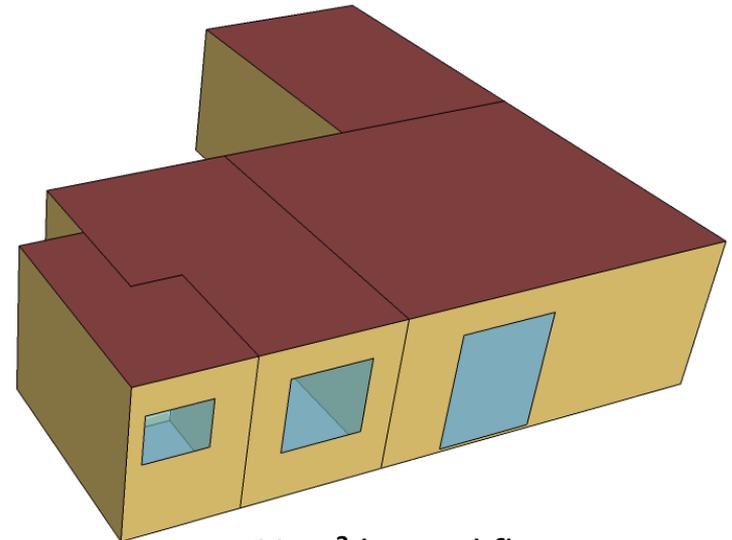
Simulation of a single apartment

apartment „small“



38 m² heated floor area

apartment „large“



63 m² heated floor area



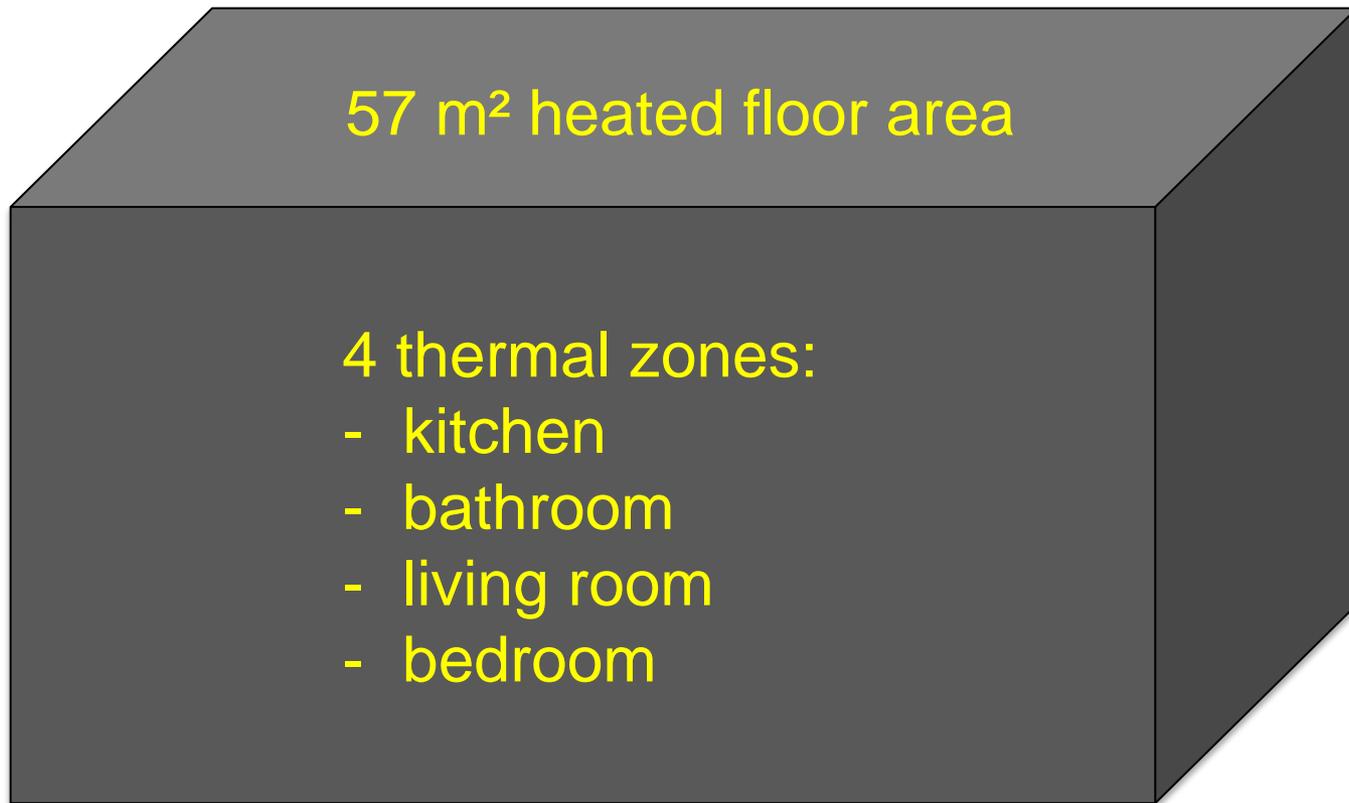
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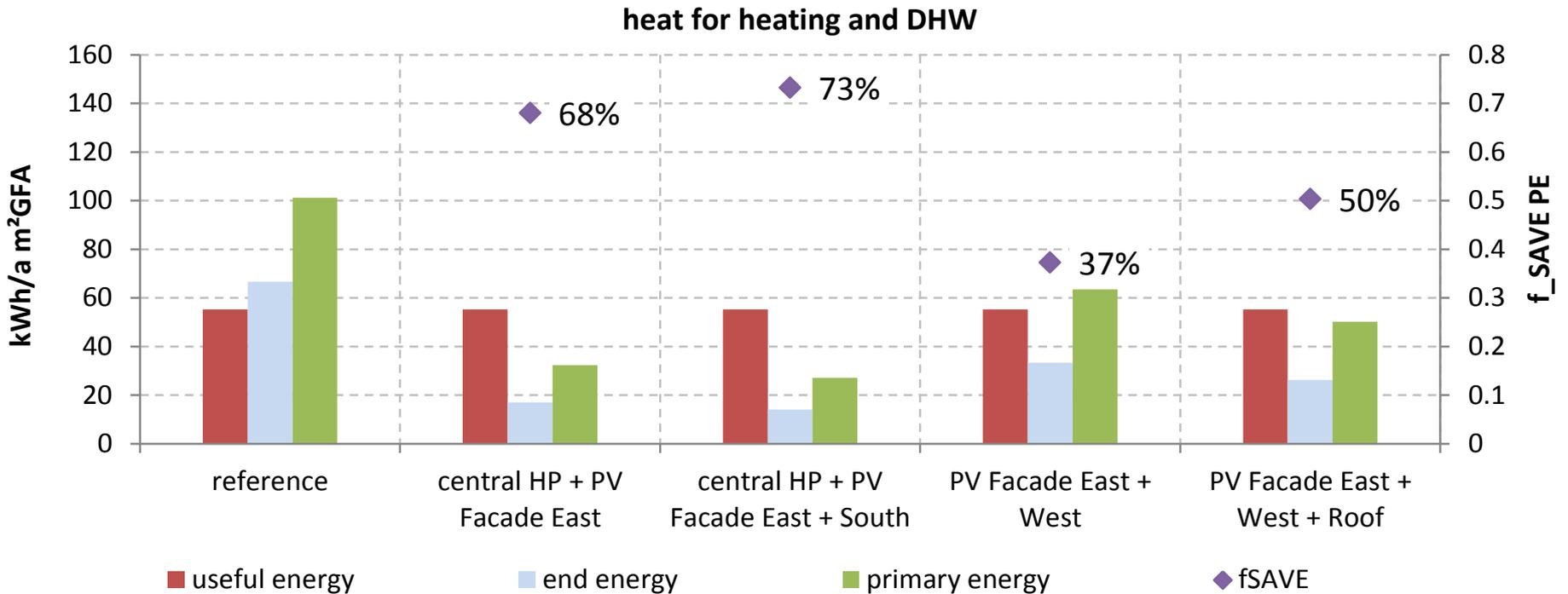
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Reference building

Simulation of a single apartment

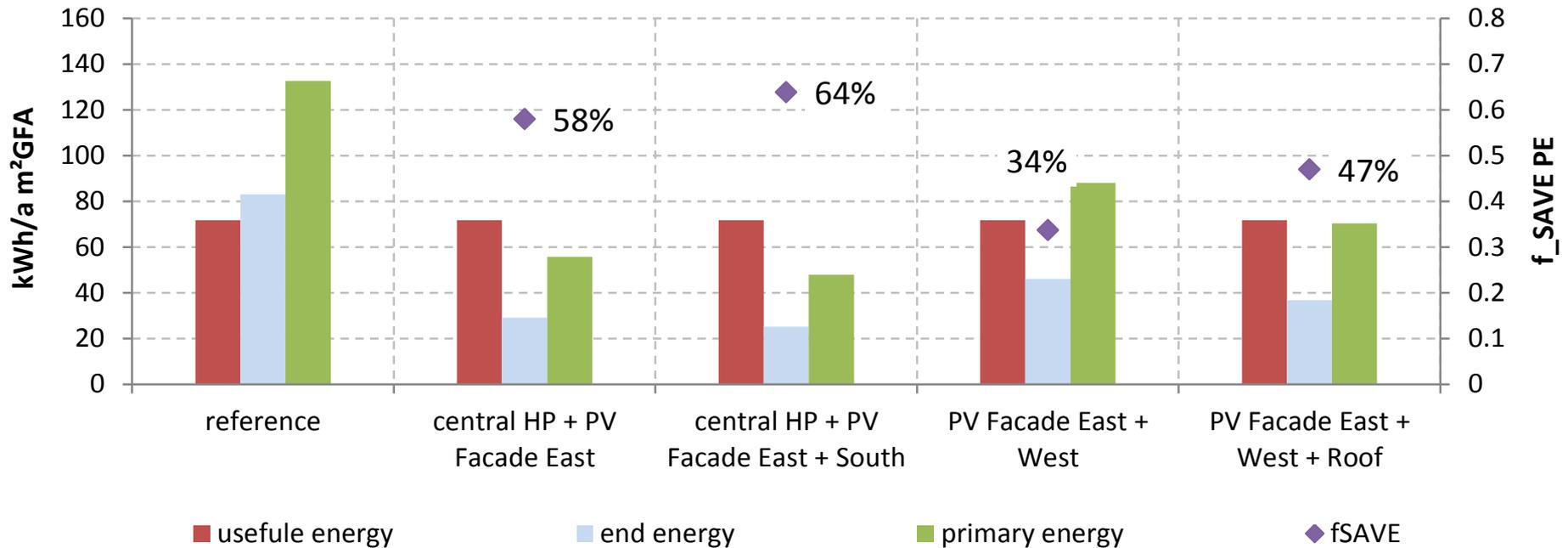


Simulation results



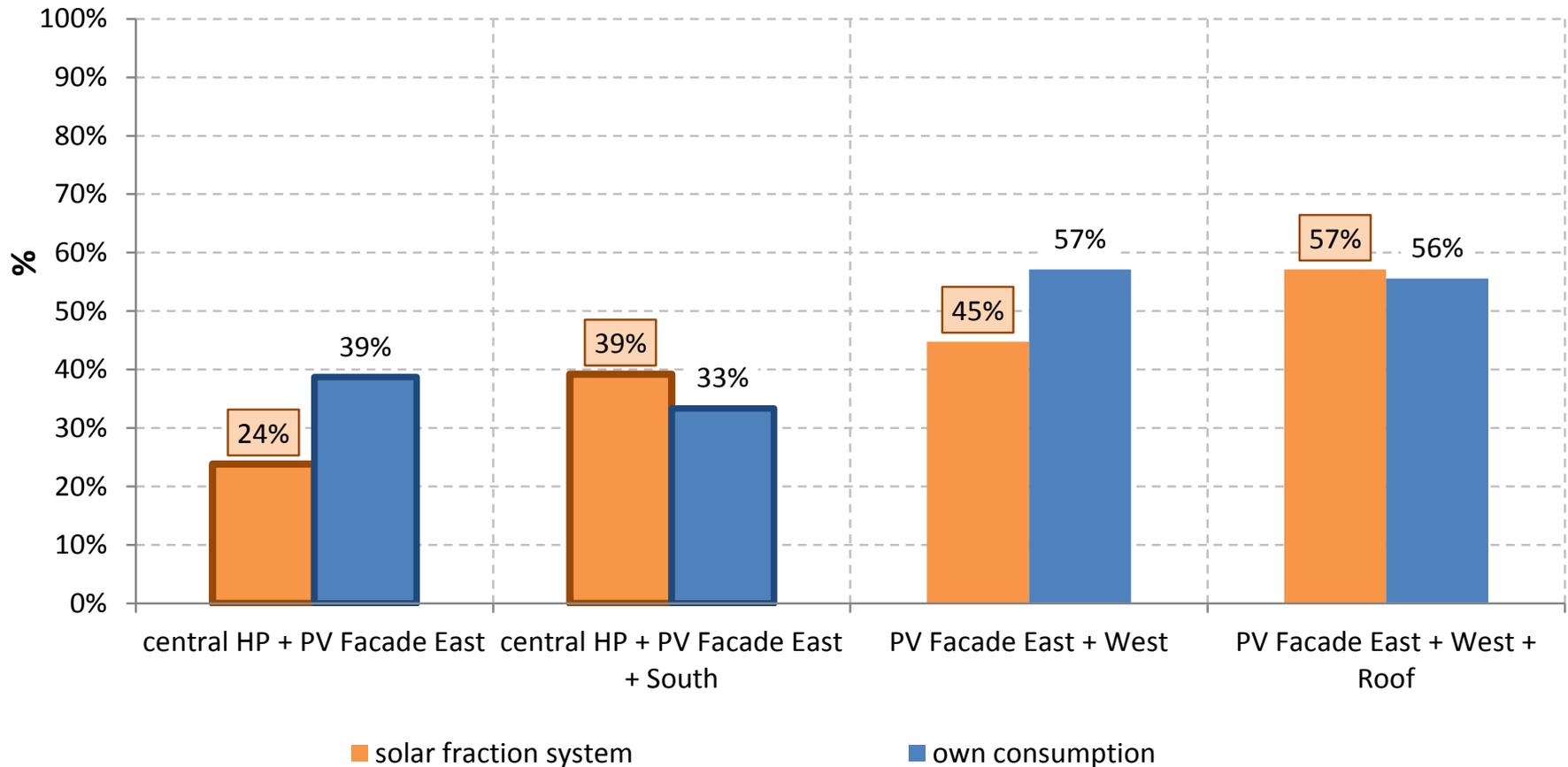
Simulation results

heat for heating and DHW + household electricity



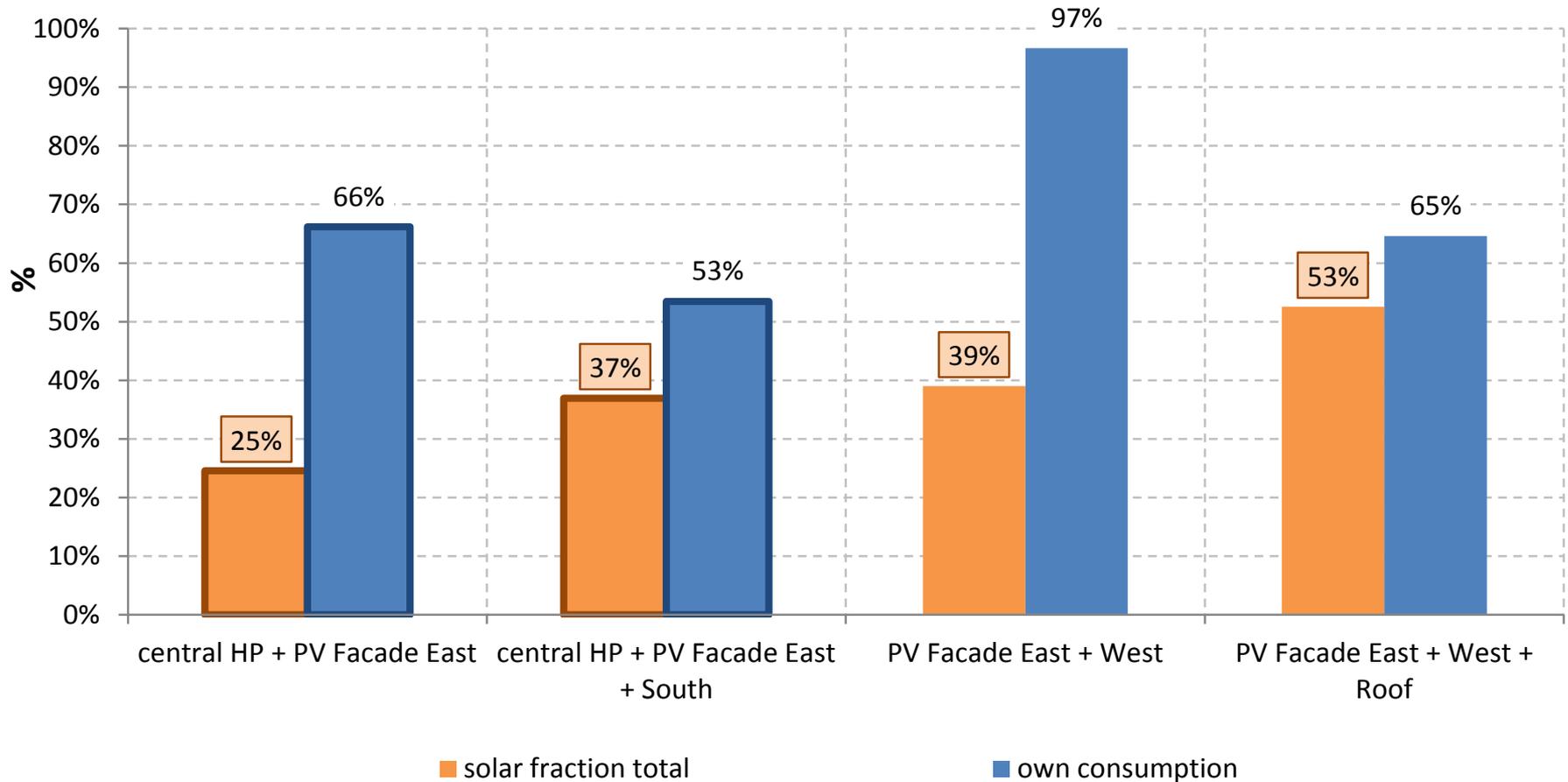
Simulation results

characteristic values of the PV system - only heat for heating and DHW



Simulation results

characteristic values of the PV system - heat for heating and DHW + household electricity



Outlook

- First simulations show good results
- Simulations will be finished within the next weeks
- Life Cycle Costs will be calculated for selected concepts
- Two façade modules with integrated HVAC will be constructed and tested at the façade test facilities of the Graz University of Technology



Thank you for your attention!



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