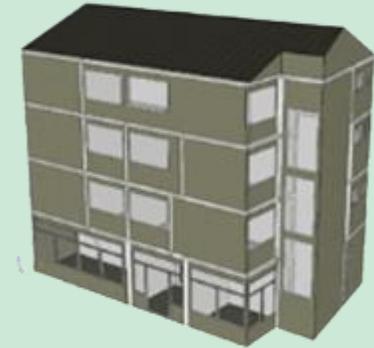
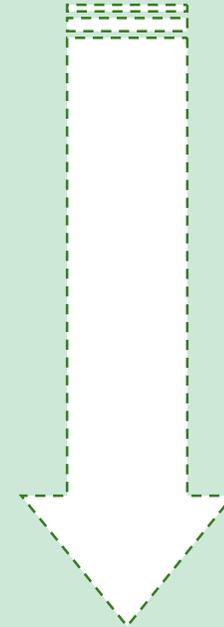
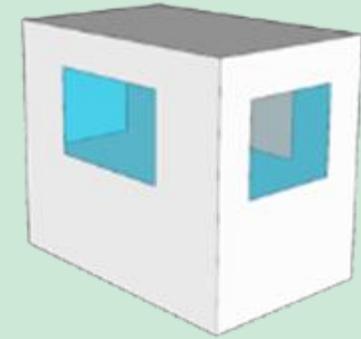


Advanced models and approaches for making heating and cooling more efficient, economically resilient, clean and climate-friendly

Dr Gašper Stegnar

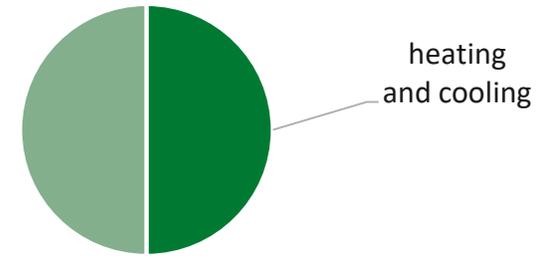
Jožef Stefan Institute, Slovenia





Situation on the European space heating market

European final energy consumption

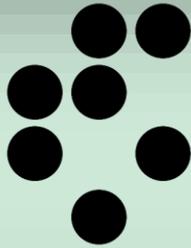


Facts and challenges

- The building stock accounts for a significant portion of worldwide energy consumption and greenhouse gas emissions.
- 80 million out of 120 million installed space heating systems in Europe currently only achieve an energy label class C or D → big potential for savings
- While the majority of the existing building stock has poor energy performance, deep renovation efforts are obstructed by a wide range of human, technological, organisational and external environment factors across the value chain.
- A key challenge is integrating appropriate human resources, materials, fabrication, information and automation systems, knowledge management in a proper manner to achieve the required outcomes and meet the relevant regulatory standards, while satisfying a wide range of stakeholders



- National campaigns
- Webinars and trainings
- Heating system calculator



- Level of accuracy when using different calculation methods
- Demonstation cases

H2020 REPLACE approach

REPLACE aims to motivate and support people in nine different countries to replace their old heating systems with more environmentally friendly alternatives. To reach that goal, REPLACE project brings together installers, chimney sweeps, politicians and other key players at one table.

Advanced models

Use of advanced calculation methods and design approach results in more accurate results for decision-making process.

But such approach requires more data, effort, time and knowledge.



REPLACE challenges

- As a rule, outdated heating systems normally are replaced when they permanently fail during use or are about to fail.
- There is then often no time for informed decisions towards the change to an alternative heating system (like-for-like changes).
- In addition, the amount of information required for a change-over is high, many questions have to be clarified and different bodies consulted.
- Often there is not enough money available to be able to afford low-CO₂ systems with higher up-front investment, even though life cycle costs are lower and immanently much less risky.





REPLACE project objectives

All activities aim at informing and motivating end-users to

- **replace inefficient heating and cooling systems**
- with **efficient, economic and climate-friendly alternatives**



Leading to the following effects

- end-users save money
- improved air quality and environment
- improved resilience through utilization of price-stable and regionally available renewable energy
- increased property value through sustainable and climate-friendly energy supply



How we are going to achieve that?

By creating regional, bottom-up replacement campaigns.

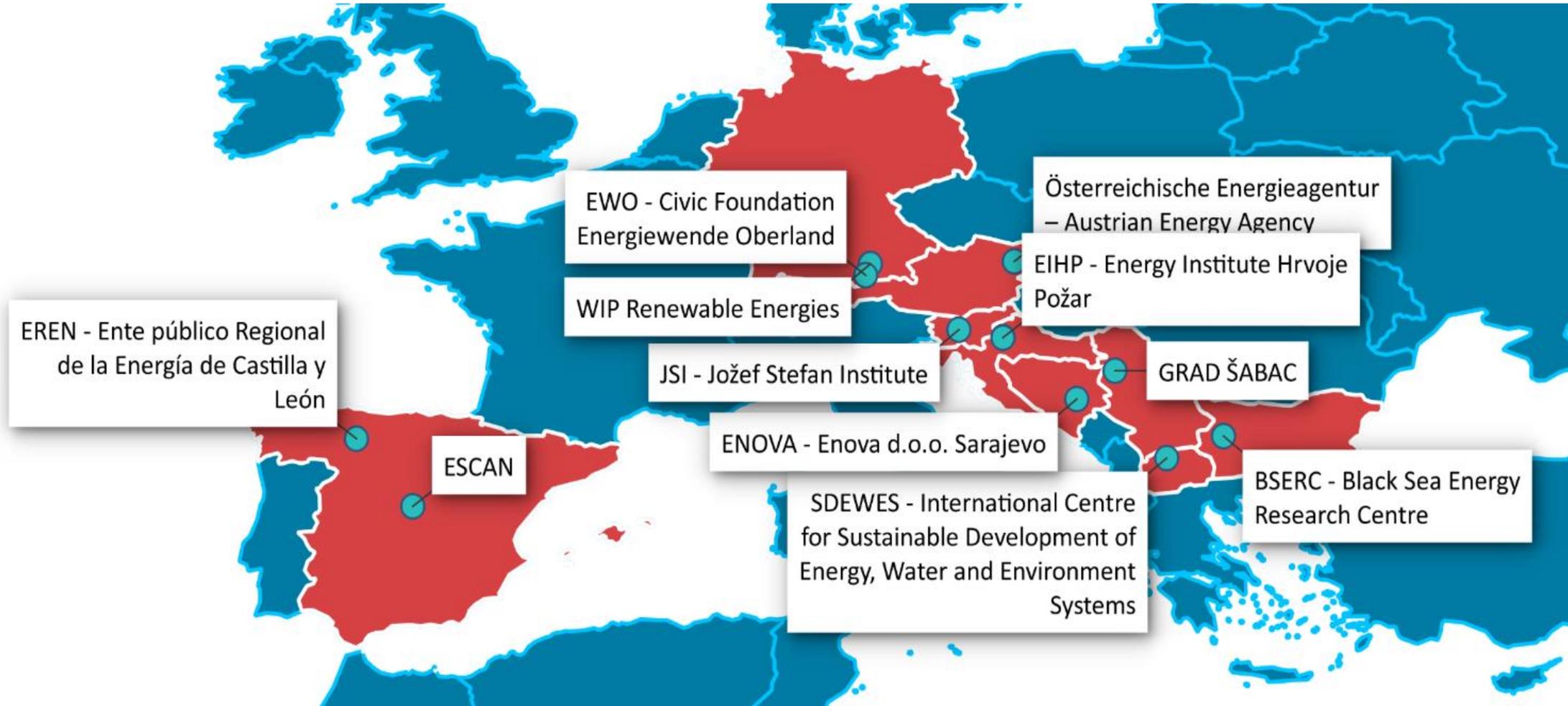
- Regional campaigns focus on end-consumers through local working groups.
- Local working groups (LWGs) consist of (1) end-consumers (e.g. associations), (2) public sector (mayors, council members, administration) and (3) private sector (manufacturers, installers, chimney-sweepers, consultants, contractors).

By organizing trainings for intermediaries (energy advisors, installers, etc.)

By creating web-platforms that offer end users key information for more informed decisions.



12 Project Partners, 9 countries





Planned activities throughout the project in Slovenia (1)

1. **A1:** Annual labelling for boilers
2. **A2:** Techno-economic feasibility studies
3. **A3:** Establishment of REPLACE information hubs
4. **A4:** Information points on consumer's fairs
5. **A6:** Labelling campaign for 100 % renewable HC
6. **A7:** Organization of house events
7. **A9:** Organization of webinars on the usage of REPLACE tools

8. **Collective action 1:** Joint purchase of RHC equipment in the scope of „fuel oil phase out“ campaign
9. **Collective action 2:** Development and establishment of „fuel oil phase out“ offensive through web-based platform with Eco fund & Borzen



Planned activities throughout the project in Slovenia (2)

- Started a campaign „**Replace fuel oil for the environment**“, which is designed as „education process“ for raising awareness among households.
- The households gains a holistic overview of replacement options and can calculate investment and savings.
- Based on the successfully completed questionnaire, households can gain a voucher for investment in heat pump.
- The campaign stimulated over 50 fuel oil boiler replacement in 6 months.

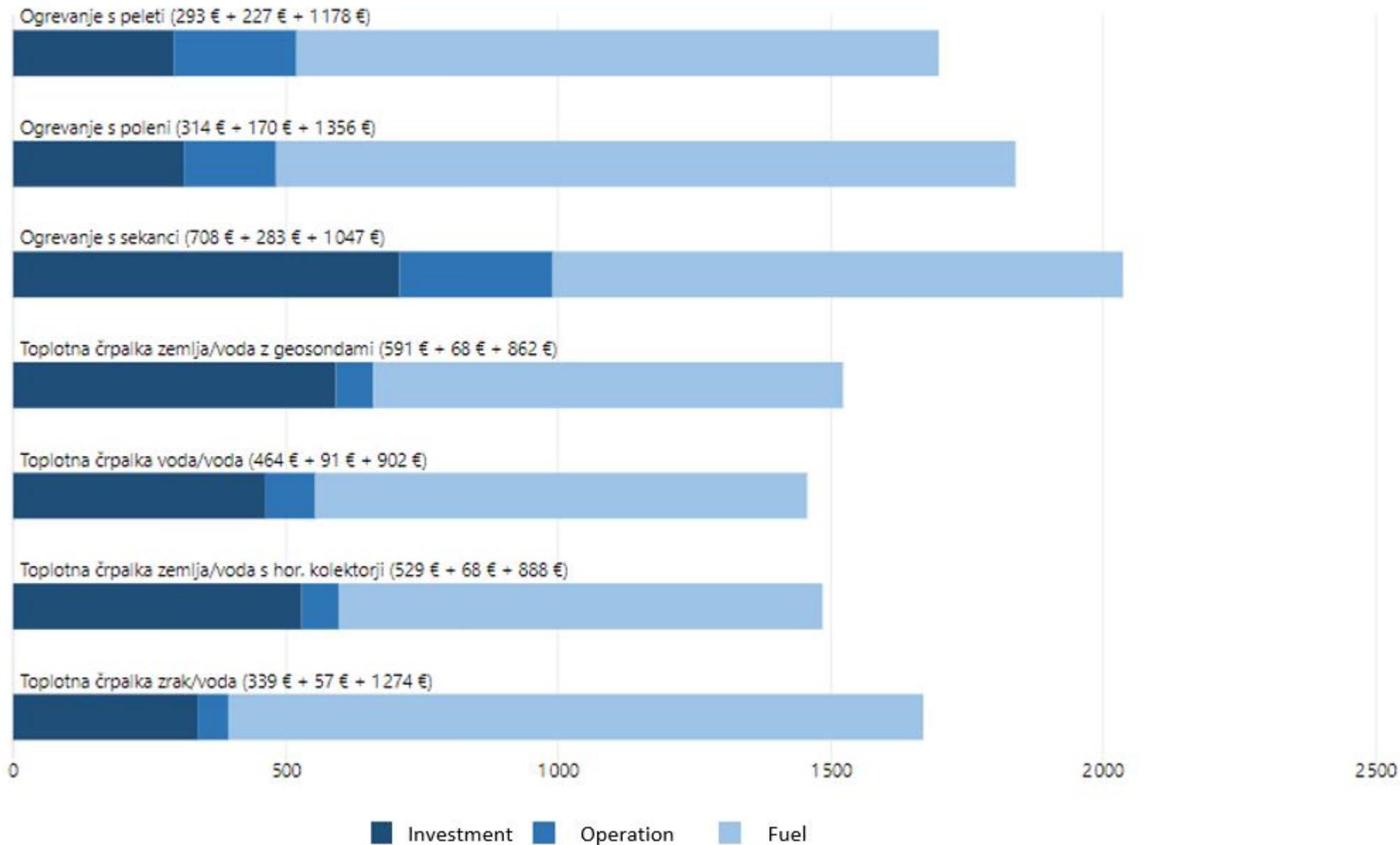
More info: www.zamenjajolje.si



**ZAMENJAJ OLJE
ZA OKOLJE**



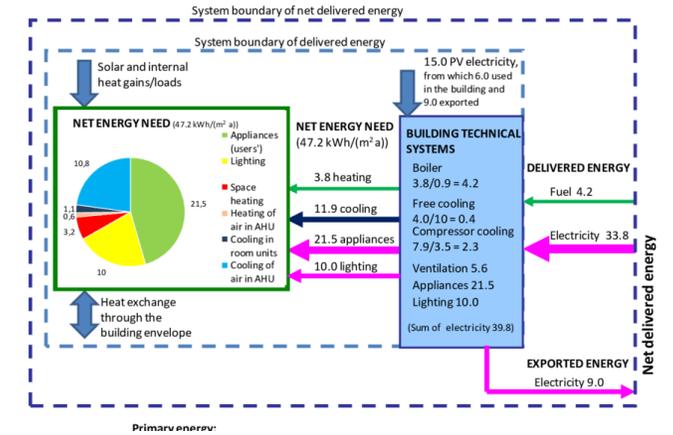
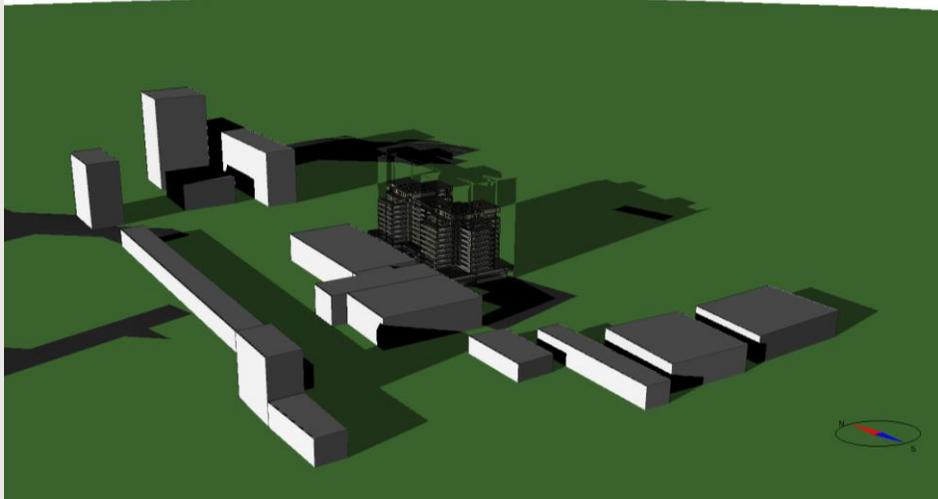
Annual costs [EUR]



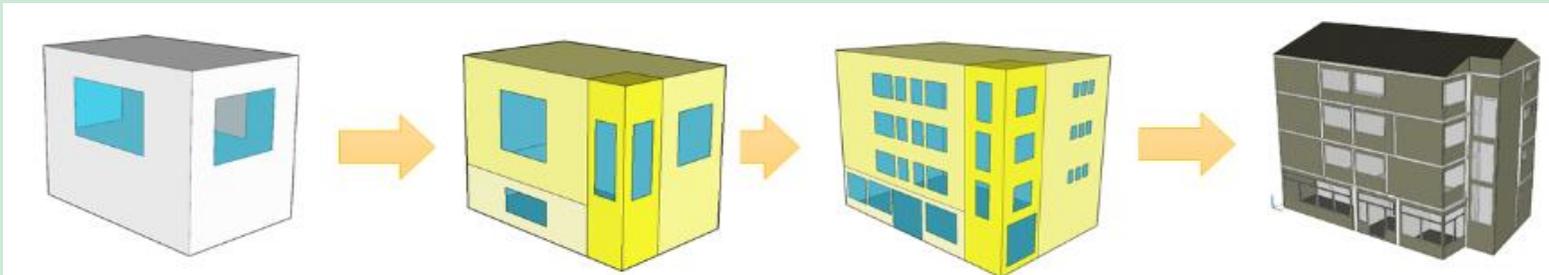


Energy simulations

TIMEPAC



A way to aid and upgrade EPC?





To understand energy simulation, lets understand building simulation

- Building simulation is the process of using computer to build a virtual replica of a building.
- The building is built from its components part on a computer and a simulation is performed by taking that building through the weather conditions of the entire year.
- In a way, building simulation is a way to quantitatively predict the future and thus has a considerable value.
- Building simulation as commonly divided into two categories:
 1. Load design
 2. Energy analysis
- The common phrase for building simulation when energy is involved is energy-simulation.



When thinking about energy renovation...

- Is a holistic energy renovation interesting from a financial point of view?
- What's the effort in order to achieve low energy consumption in real life?
- What is the environmental impact generated (or avoided) by renovation?
- Is it possible to reach good compromise between economic and environmental aspects?



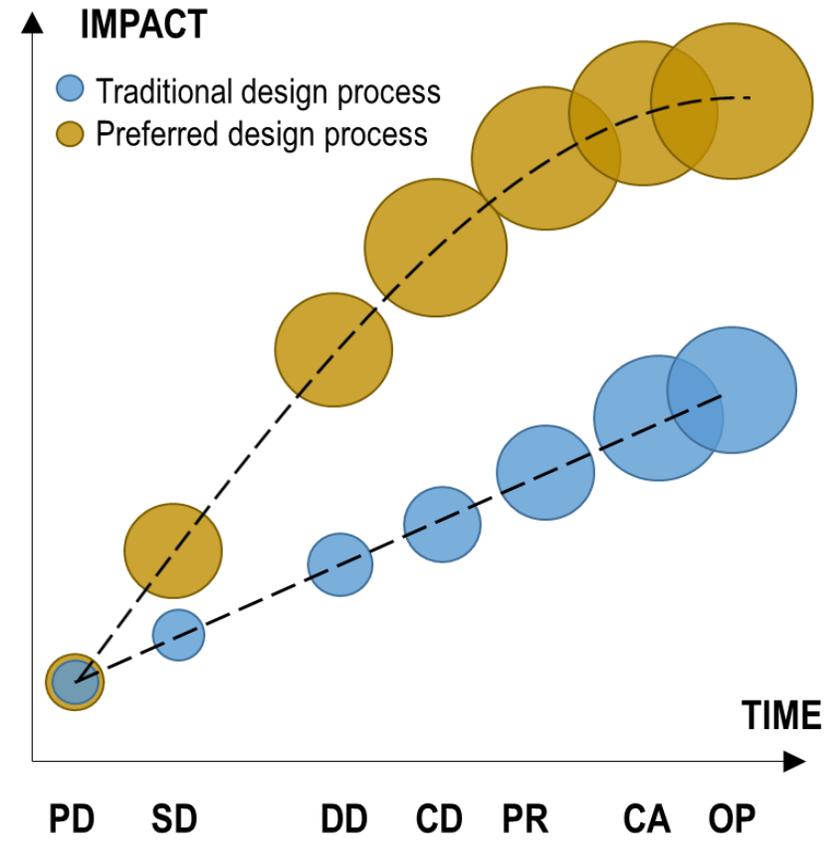
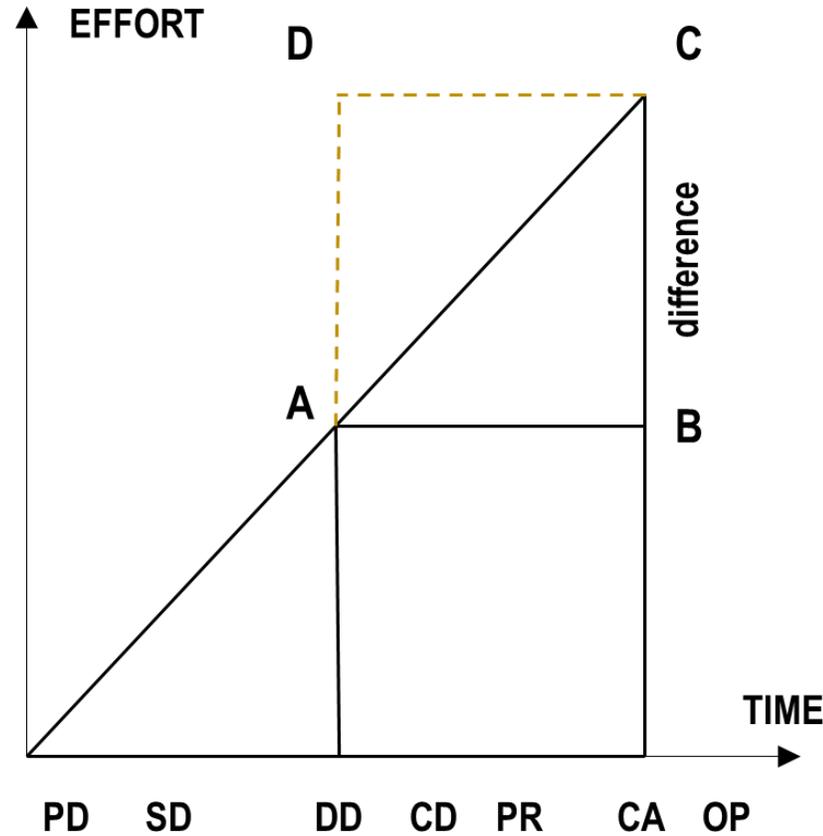
Main advantages

- An important support used for building designers to reduce the energy related costs.
- The energy simulation software allows to determine with high accuracy variable that can support designers to take decisions about the best measures to apply for any building.
- Softwares have also available tools to improve constructive solutions through simulating the incorporation of a passive solar systems in buildings (e.g. horizontally or vertically shading systems) and more accurate analysis of HVAC system loads.



Effort vs impact

TIMEPAC

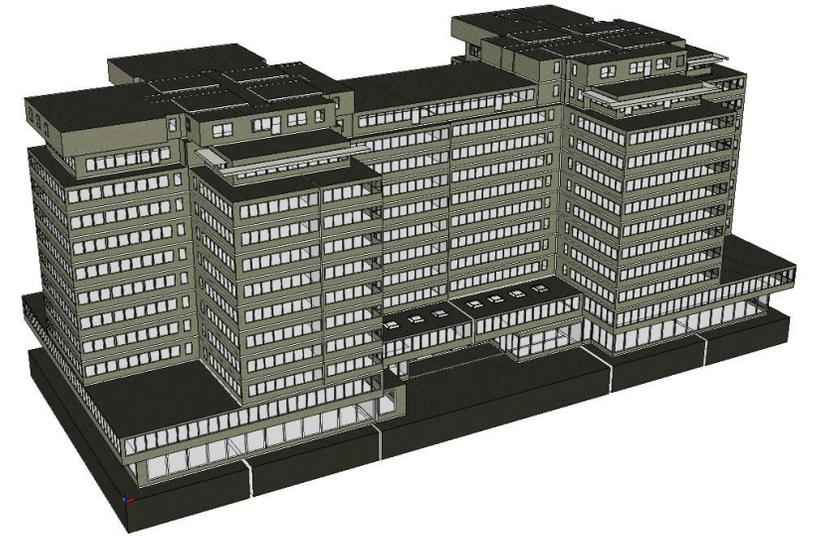


Project design phases



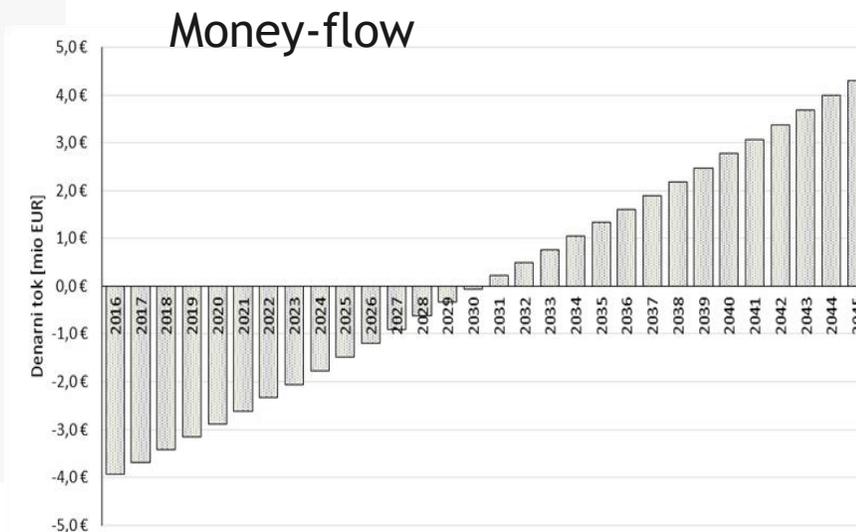
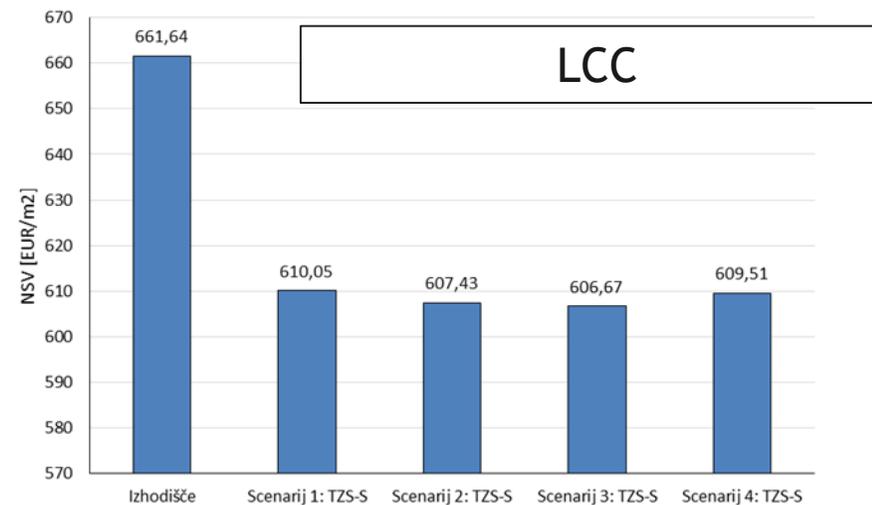
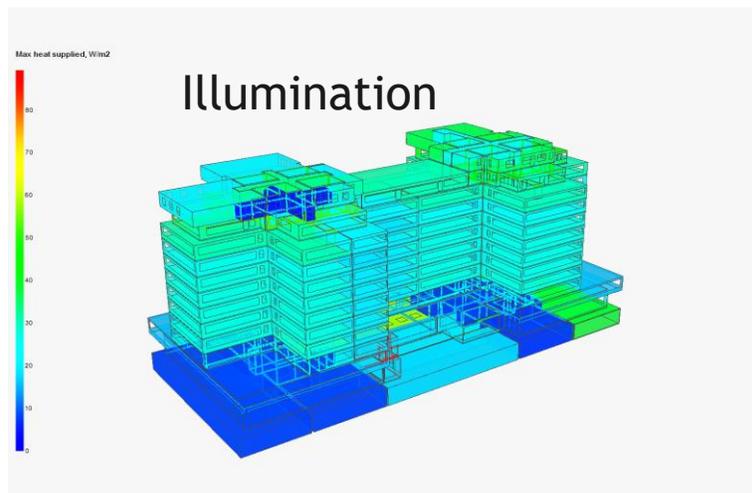
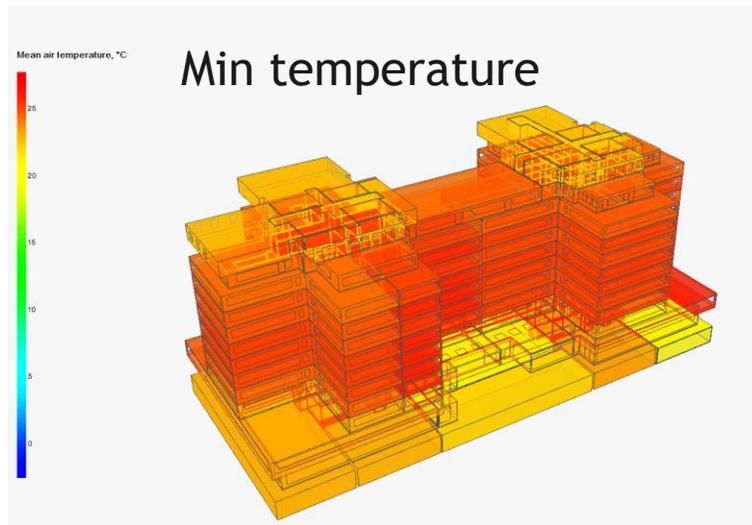
Example 1 – office building

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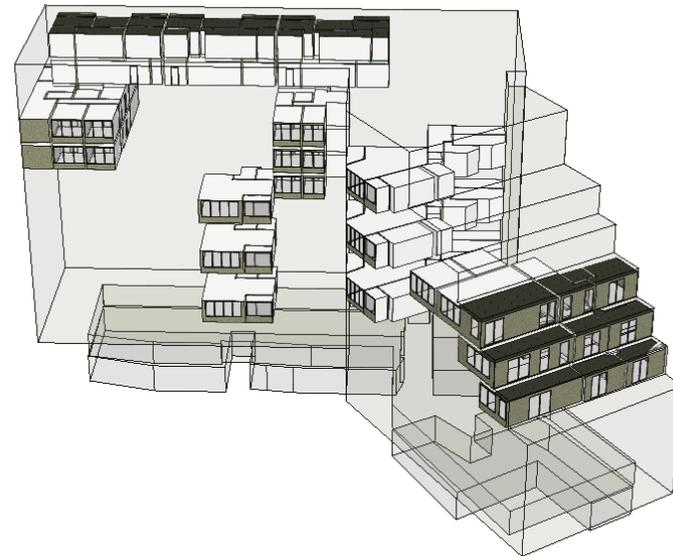
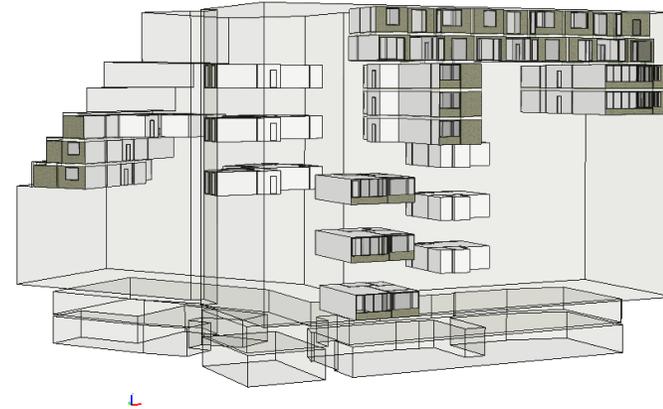
Example 1 – office building





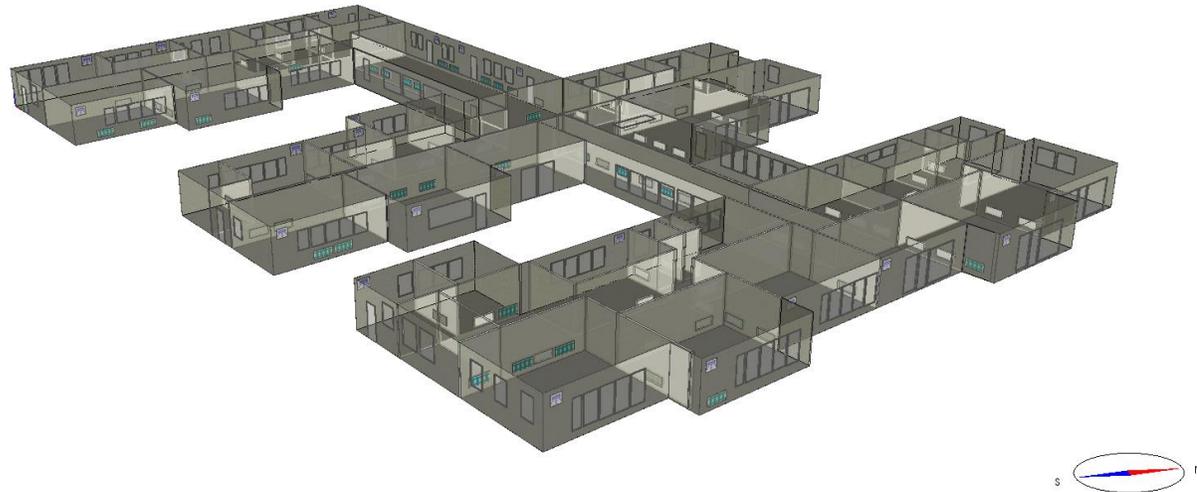
Example 2 – nZEB multi-family building

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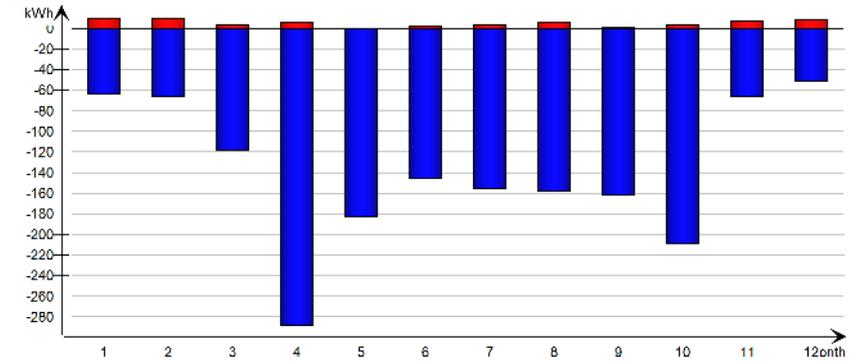




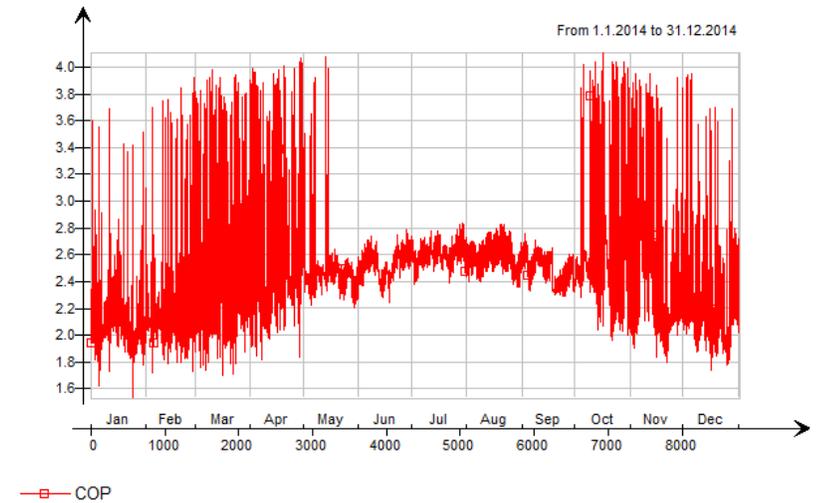
Example 3 – kindergarten



Final energy use



COP





To conclude

- Always consider that buildings are a complex integration of energy flows and systems comprising not only the whole of building form and fabric but also plant and various other environmental control systems.
 - Main advantage of using dynamic simulations: more accurate results compared to analytical model
 - Main disadvantages: it's expensive to build a simulation model and to conduct a simulation, requires special training
- Is the effort worth the trouble? Is it realistic to expect all EPC should be based on dynamic simulations?

Thanks for your attention!

**If you would like to have more
information, please contact us:**

gasper.stegnar@ijs.si

