The safe insulation from the inside as a solution to the energy and climate crisis

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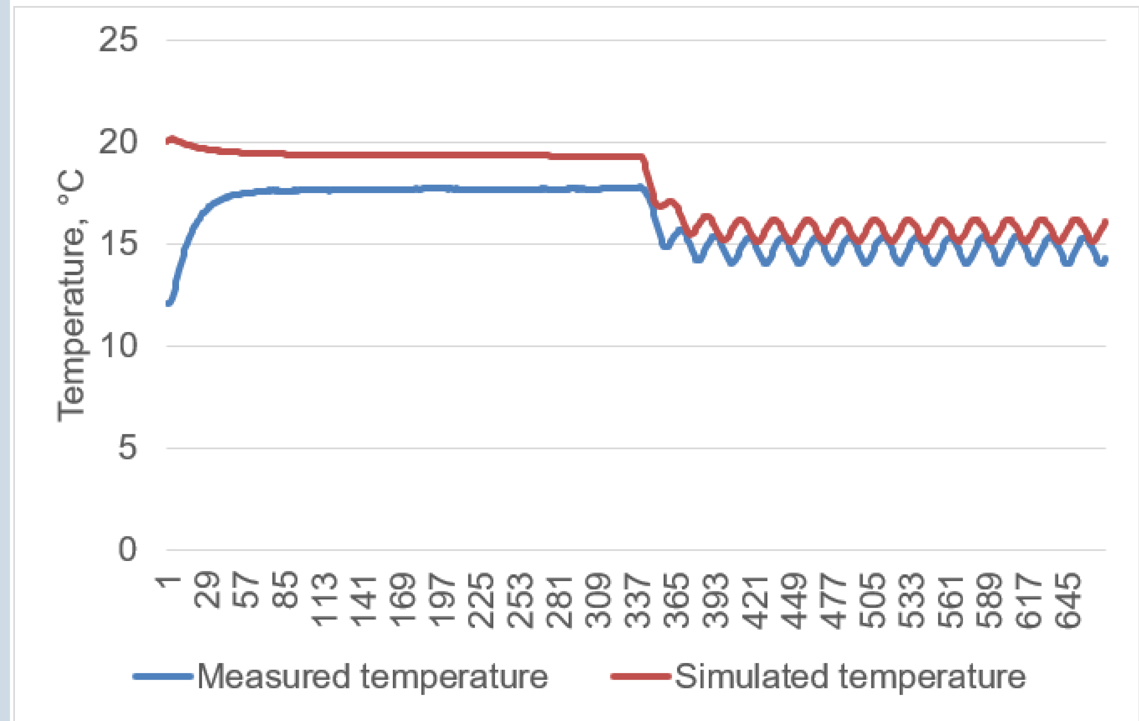
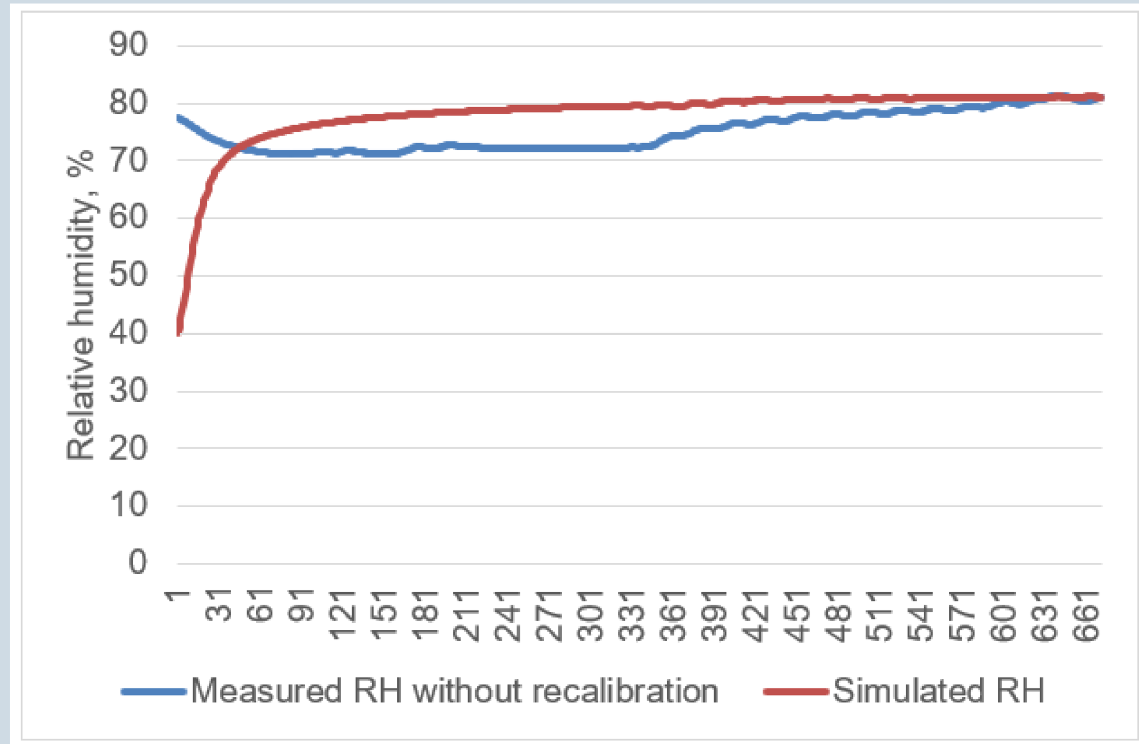
Buildings are responsible for approximately 32% of the world's final energy consumption, 17% of direct carbon dioxide (CO2) emissions and one third of indirect emissions. Speaking directly within the EU, buildings consume approximately 40% of all energy.

- The current energy crisis has acutely raised the issue of energy poverty. Therefore, one of the ways to fight with energy poverty and high energy consumption in buildings is insulation from the inside.

- When considering the option of insulating from the inside, moisture problems and the risks of mold formation always must be taken into account.

- Data obtained from the first two cycles for an insulation system with mineral wool and a vapor barrier and a simulation of the same system show similar data and patterns.





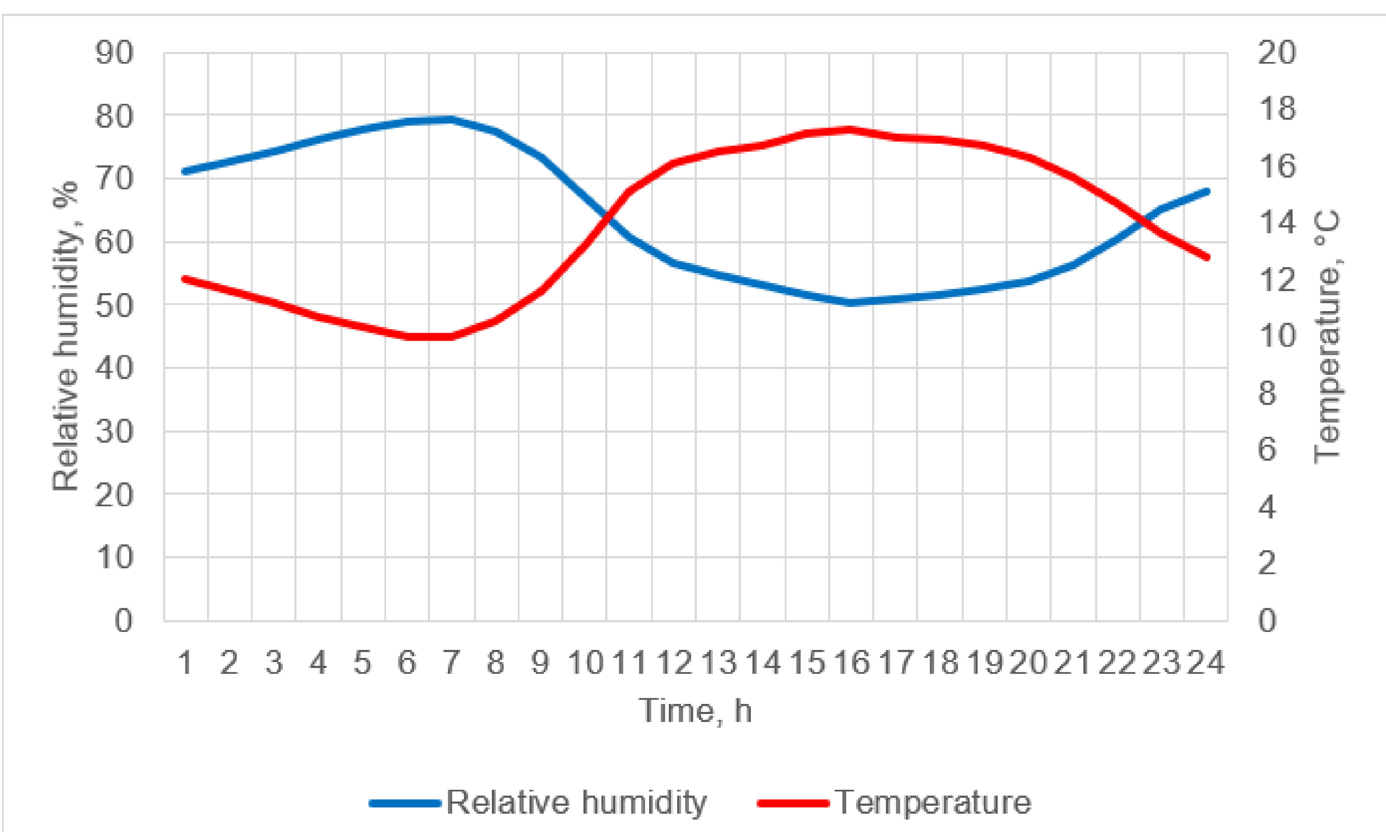
Introduction

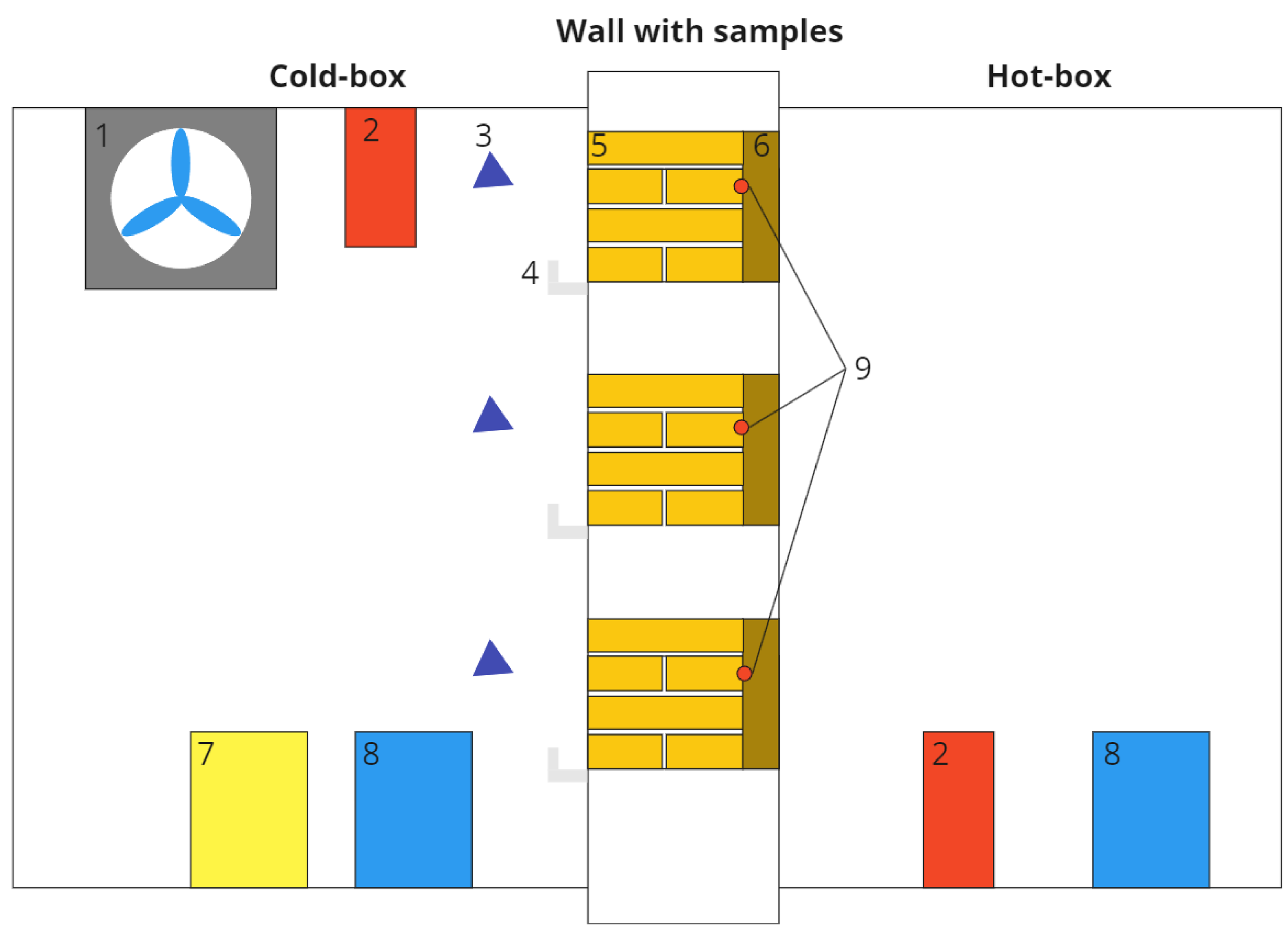
The set European long-term climate policy goal for 2050 is to gradually reduce domestic carbon dioxide (CO_2) emissions by 40%, 60% and 80% by 2030, 2040 and 2050. The EU is actively trying to reduce CO_2 emissions, which also results in a reduction in energy consumption to achieve that. The building sector is currently facing major challenges related to energy consumption, decarbonization and access to modern renewable technologies along with the global depletion of fossil fuels.

Methodology

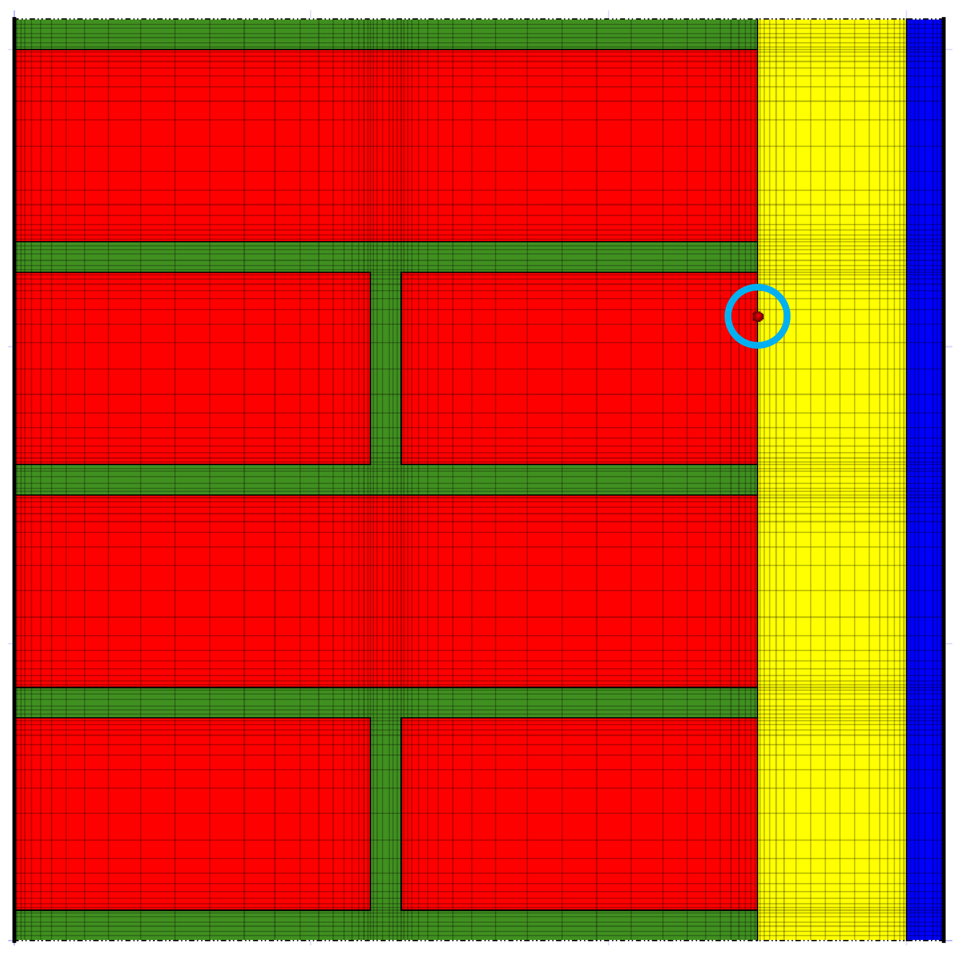
The research is based on conducting laboratory tests in climate chambers with certain conditions and comparing the obtained results with the data obtained by the computer program DELPHIN. 9 samples are placed in a 3*3 grid between two climate chambers with outdoor conditions (cold-box) and indoor conditions (hot-box). The laboratory test lasted 8 weeks and consisted of four cycles, each cycle consists of 2 weeks. In the hot-box, the parameters were constant for all four cycles, with a temperature setting of 20 °C and 40% relative humidity (RH). On the other hand, the following cycles were set in the cold-box:

1. Stable cycle: temperature – 18 °C, RH – 40%;
2. Dynamic cycle: climatic conditions change depending on time;
3. Stable cycle: temperature – 18 °C, RH – 40%;
4. Dynamic cycle with rain simulation: climatic conditions after dynamic cycle, amount of rain – 0.22 l/(m²s).





1 – air cooling device, 2 – air heater, 3 – water nozzles, 4 – water drain; 5 – brick wall, 6 – insulation material, 7 – air dryer, 8 – air humidifier, 9 – temperature and relative humidity measurement point



Red – brick, green – mortar, yellow – insulation, blue – gypsum board, between insulation and gypsum board are vapor barrier, red dot in the blue circle – data point

Acknowledgement

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