SMART BUILDING
ENVELOPE WITH SOLAR
ENERGY STORAGE

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Introduction

Energy efficiency and energy demand reduction are highlighted as key mitigation choices by many IPCC Assessment Reports and UNFCCC documents, protocols and international agreements. Accounting for concerning 40% of EU’s final energy and 36% of CO₂ emissions, buildings are related to a major untapped energy saving potential.

A lot of the energy presently used in buildings is wasted because of out-of-date construction practices.

There is a high demand of innovative technological solutions for the significant reduction of heating and cooling in buildings.
Aim of the work

The main goal of the study is to develop an innovative dynamic facade system with solar energy storage.

The main task is to evaluate the energy efficiency of the technology based on experimentally obtained results.
The concept of proposed technology

Facade module with solar radiation tracking and heat storage

Main components:
- Frame
- Fresnel lens
- Hinge
- Blade
- Rotational axis
Prototype

Facade module with solar radiation tracking and heat storage

- Phase change material (PCM)
- Aerogel filling
- Blade with reflector (filled with aerogel)
Solar radiation is measured by pyranometer

Blade angles are calculated by program using information about solar position in time

Blades are moved by stepper motors
Expected results

Improvements compared to regular facade with thermal insulation:

• Use of phase change material (PCM) for efficient energy conservation
• Heat accumulation while the room temperature is in the comfort range (around 19-21°C)
• Improved thermal insulation to avoid heat loss
• Increased energy efficiency of the building due to the charge and discharge cycles – energy is absorbed in the daytime and released at night
• The proposed technology is a climate adaptive building shell which plays a very significant role in overall energy balance of the building
Conclusions

The technology proposed has a great potential to reduce heating energy demand of a building especially in northern climate.

It would have positive impact on climate change by avoiding CO$_2$ emissions in unnecessary heating reducing the length of the heating season.