Master thesis

TECHNISCHE UNIVERSITÄT DARMSTADT

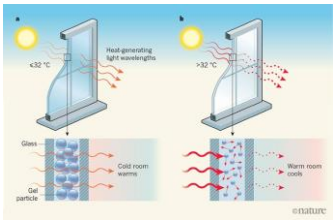
Institute for Constructive Design and Building Construction
Prof. Stefan Schäfer

Smart Repair - Cost-Effective Window Retrofit Strategies.

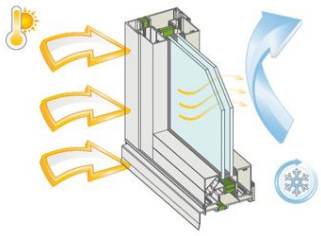
This master thesis evaluates the thermal performance and economic viability of implementing a low-cost adhesive window film retrofit as an interim energy-saving measure on single-glazed windows at a university building, comparing simulated energy savings against conventional full retrofitting approaches. The subtasks are given as follows.

1. Conduct a literature review on window film technologies, thermal properties of adhesive retrofit layers, and comparative studies of interim versus comprehensive building retrofit strategies in Central European climates.
2. Establish baseline energy use by analyzing utility records, conducting thermal imaging, and identifying single-glazing as the main thermal deficiency.
3. Model the current building performance using simulation software such as Hottgenroth or comparable tools.
4. Simulate the effects of window film retrofit on thermal and energy performance, estimating annual heating demand reductions and cost savings.
5. Perform a cost-benefit analysis comparing window film retrofit with full window replacement and complete renovation, considering materials, labor, implementation time, and payback period.
6. Evaluate how climate variability, film degradation, and heating pattern changes impact the long-term performance and economic returns of the interim retrofit.
7. Presentation of the thesis content on a poster DIN A1 and an oral presentation.

Application of smart film
(Source: https://www.smartfilmsinternational.com/post/need-to-start-your-own-smart-film-business)



windows that incorporate temperature-sensitive polymeric gel microparticles
(Source: https://www.nature.com/articles/d41586-019-00084-2)



Keep Energy Costs Low With Window Insulation
(Source: https://lifestylewindows.com.au/keep-energy-costs-low-with-window-insulation/)

Start: Possible from now

Supervisor: M.Arch. Rutuja Rasal,
Email: rasal@kgbauko.tu-darmstadt.de
Phone: 06151 16-21382