TECHNISCHE UNIVERSITÄT DARMSTADT

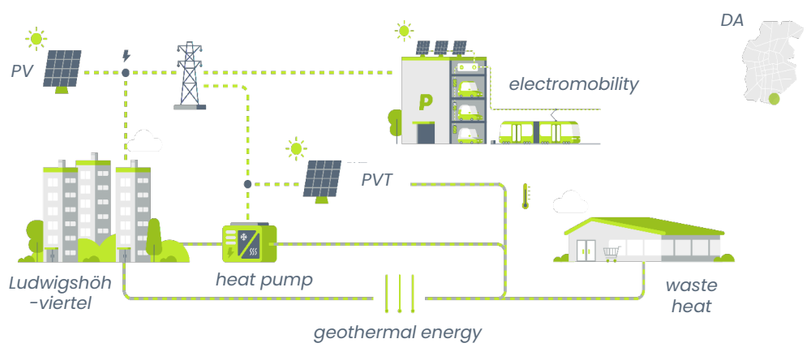
ISM+D
Institute of Structural Mechanics and Design
Institut für Statik und Konstruktion

Energy Efficient Construction

Energy Efficient Construction

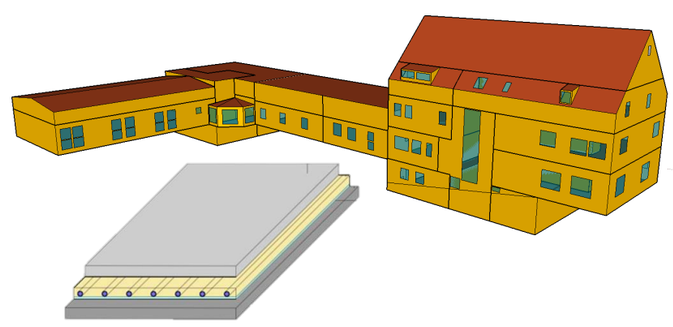
The research group Energy Efficient Construction develops methods to reduce the energy consumption of buildings and districts. The aim is energy efficient construction and energy system planning. Circularity is also taken into consideration. In addition, innovative thermally activated building components for thermal conditioning and energy flexibility are developed.

Research topics:
Energy Systems for buildings and quarters, regeneration of borehole heat exchanger fields, energy flexibility, circular construction with a focus on LCA, green facades, thermally activated building components, phase change materials, thermal crosslinking of machine and building as a production environment



DELTA

In DELTA, energy-optimized districts are explored to demonstrate that technical potentials for improving energy efficiency and flexibility are economically feasible and socially acceptable. Subproject 1 focuses on the ‘Ludwigshöhviertel’ district in Darmstadt. Achieving Germany's climate goals in the building sector requires sustainable materials, renewable energies, and innovative technologies. Key elements in ‘Ludwigshöhviertel’ include wood-hybrid construction, façade greening, borehole heat exchangers with decentralized heat pumps, photovoltaic thermal modules, and exhaust-air heat pumps integrated into an intelligent electrical and thermal network. The ISM+D conducts part of the accompanying research and co-manages subproject 1 with bauverein AG.



INNASOL

INNASOL is about integrating a newly developed asphalt solar collector into the building energy system. It is anticipated that this active asphalt temperature management will result in a longer lifespan and no need for winter maintenance. Through simulative investigation, an optimal combination of energy system components and operational strategy is chosen and implemented in real life. After the monitoring, the actual performance of this integrated asphalt collector building energy system will be evaluated. The measurement data is used to validate the simulation model and continuously optimize the system. The research results can serve as a reference for future use of roads as solar collectors, aiding the development of distributed renewable energy systems for the energy transition in the future.

B-SWIVT

The B-SWIVT project is a follow-up to SWIVT II, in which a sector-coupling energy system was implemented for existing and new buildings in the 'Postsiedlung’ district in Darmstadt. B-SWIVT focuses the operation of the energy system. The district can act as an active energy cell that utilizes flexibility and load shifting potential in the electricity market. Based on real measurement data, the energy operation of the district can be optimized with the help of the energy management system, taking into account the operator model. This is accompanied by scientific studies, including the optimization of the regeneration of borehole heat exchanger field and the cooling operation, the energy efficiency of the façade PV, possible renovation strategies for the existing buildings and an economic system analysis with changing energy prices.

Gebäude o.K.

This research project is dedicated to the development of a new type of heating method in which ultra-thin, plastic-free heating paper is integrated into prefabricated concrete components. The heating paper consists of conductive carbon fibres and generates heat through electrical currents. Future research will focus on the use of this technology in combination with photovoltaic systems in order to enable the efficient integration of renewable energies and enhance sustainability in the building sector. The research of ISM+D in this project includes the building physics analysis, including experimental and simulative tests on the prototype, the optimization of the innovative heating system, the energy design of a real demonstrator and the selection of operating strategies.

Prof. Dr.-Ing. Clemens Hübler
huebler@ismd.tu-darmstadt.de
+49 6151 16 - 23013

Technical University of Darmstadt
Department of Civil and Environmental Engineering
ISM+D - Institute of Structural Mechanics and Design
Franziska-Braun-Str. 3, 64287 Darmstadt, Germany
www.ismd.tu-darmstadt.de