TECHNISCHE UNIVERSITÄT DARMSTADT

Energy efficiency measures for the industrial building stock

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

Research project “ETA im Bestand”

A comprehensive exhaustion of the complex, systemic energy efficiency potential in the German industrial stock is absolutely necessary in order to be able to achieve the ambitious climate targets of the federal government. Against this background, technical and methodical solutions which enable an increase in energy efficiency in existing industrial buildings are being developed in cooperation with partners from science and industry, in the project “ETA im Bestand”. A holistic approach is pursued in which all subsystems of a production system (machines and equipment, building services and supply engineering, production environment) are considered under the aspect of broad applicability.

Initial situation

As part of the joint project “ETA im Bestand” (FKZ: 03EN2048A-I), the Institute of Structural Mechanics and Design is investigating energy efficiency measures in relation to the building as a production environment.
The potential for increasing energy efficiency through energy refurbishment and the use of waste heat is very high in the industrial sector. For the Greenfield sector the project “ETA-Fabrik” demonstrated successfully that direct use, i.e. the coupling of waste heat from machines and building air conditioning through intelligent heat networks and supply technology, can generate high energy savings. Rising electricity prices and the high savings potential in the building sector connecting to the energy transition will also demand solutions for energy efficiency measures for the brownfield sector in the future. Nevertheless, the energy refurbishment of the production environment is often avoided in order not to cause long and cost-intensive production stops.
There is often a lack of economical and energy-efficient retrofit solutions. One of the problems is that the number of industrial buildings in Germany is very high and diverse. Thus, industrial buildings are always considered as individual cases, which is why the measures turn out to be cost-intensive. Currently, there are no databases for the energy analysis of industrial buildings whose information content provides a fundamental basis for the derivation of efficiency measures for building envelopes and the building services equipment.

Approach

A structural database will be created from the survey of industrial building operators, which will give an indication of the current industrial building stock. This will not only include building-specific parameters such as construction type, insulation properties and airtightness, but also process-related parameters such as waste heat quantities of the machines to air and network, in order to consider the entire potential in the holistic view. Based on this database, energy efficiency measures can be derived and summarized in a catalog of measures for industrial buildings.
One solution approach is the retrofitting of a second “envelope” around machines or production processes with particularly high requirements for room air temperature or room air quality (room-in-room solution). For this purpose, a modular retrofit solution in the form of thermally activated wall and ceiling elements made of micro-reinforced, ultra-high-strength concrete is being developed. Up to now, industrial buildings have been air-conditioned mainly using conventional ventilation technology, which is very energy-intensive in large factory buildings. The modular retrofit solution should make it possible that specifical industrial processes, which release high amounts of waste heat into the air, can be conditioned individually and consequently thermally isolated from the rest of the factory building. Optionally, depending on the temperature level, the machine waste heat from production can either be used directly within the factory building for further production or building processes, be regeneratively and efficiently recooled, or be used indirectly in existing local heating networks.

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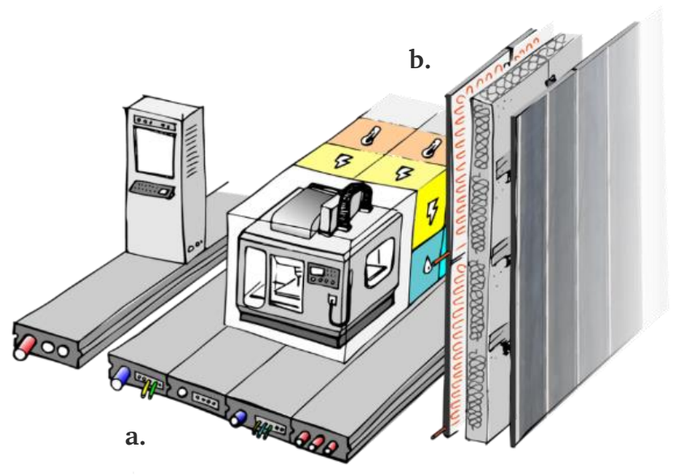
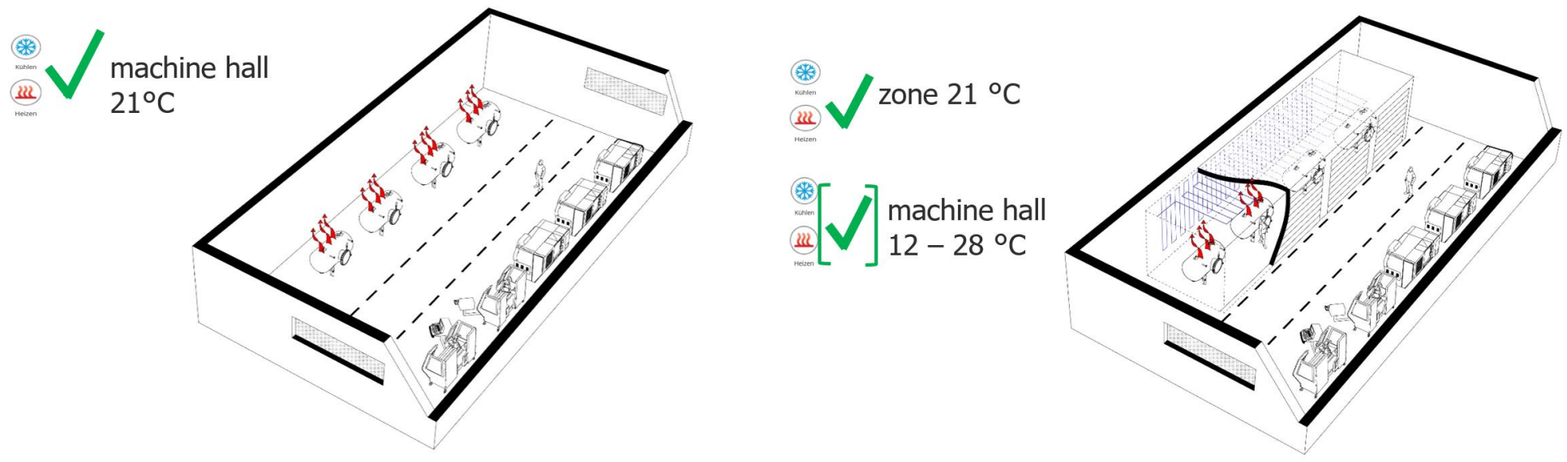
Website:
www.eta-fabrik.de/forschung/projekt/eta-im-bestand/



Example drawing: a) floor or ceiling module for energy-efficient design of energy networks, b) thermally activated wall module



Comparison of a reference factory building and a refurbished factory building with thermal zoning of the machines

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