Basic Knowledge
Thermal Insulation and Heat Recovery

Improving the thermal insulation of walls and roofs is only one possible measure towards energy savings in buildings. An economic assessment requires an analysis of the savings to be expected through reduced heat losses in each individual case.

A lack of insulation in old buildings can lead to heat leakages. These problem areas can be detected by means of sensitive infrared cameras based on the emitted heat radiation. It is not just the heat conduction of materials, but also how they are fabricated that determine the effectiveness of insulation in walls and heat transfer conduits.

Heat transport

Temperature differences result in the transport of thermal energy. Transport takes place in the direction of the lower temperature. There are three different heat transport processes:

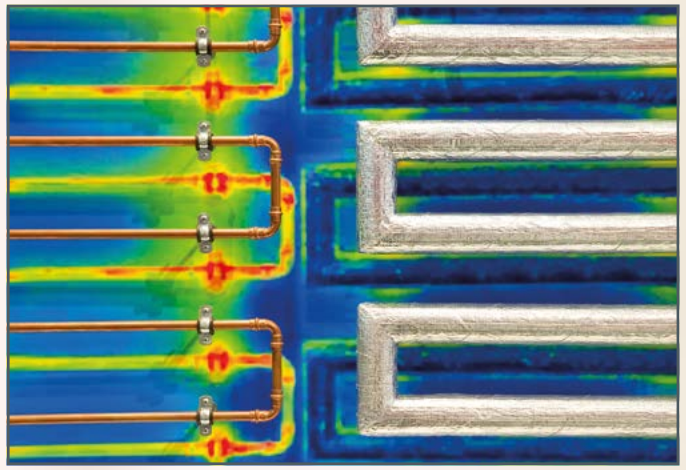
- heat conduction
- convection
- heat radiation

Enabling heat transport with as little obstruction as possible, or suppressing heat transport, are crucial in providing an efficient heat supply for buildings.

If a heat transfer medium is used for transporting heat (forced convection), then an unimpeded intake at the heat source and an unimpeded heat dissipation at the place of use are the ideal. However, heat dissipation should be suppressed as much possible during the actual transport.

In the case of heating for rooms, heat dissipation out of the room being used and into adjacent areas should be prevented. Besides the heat transfer surface, the heat conduction properties of the heat transfer material are a key factor for heat transfer which is as unobstructed as possible. Heat conduction is typically expressed as a coefficient of thermal conductivity.

In contrast, construction materials for suppressing heat dissipation are usually described by the overall heat transfer coefficient. This also includes the thermal resistance of the adjacent air layers.



The insulation of heat transfer conduits also provides a significant contribution to energy efficiency.

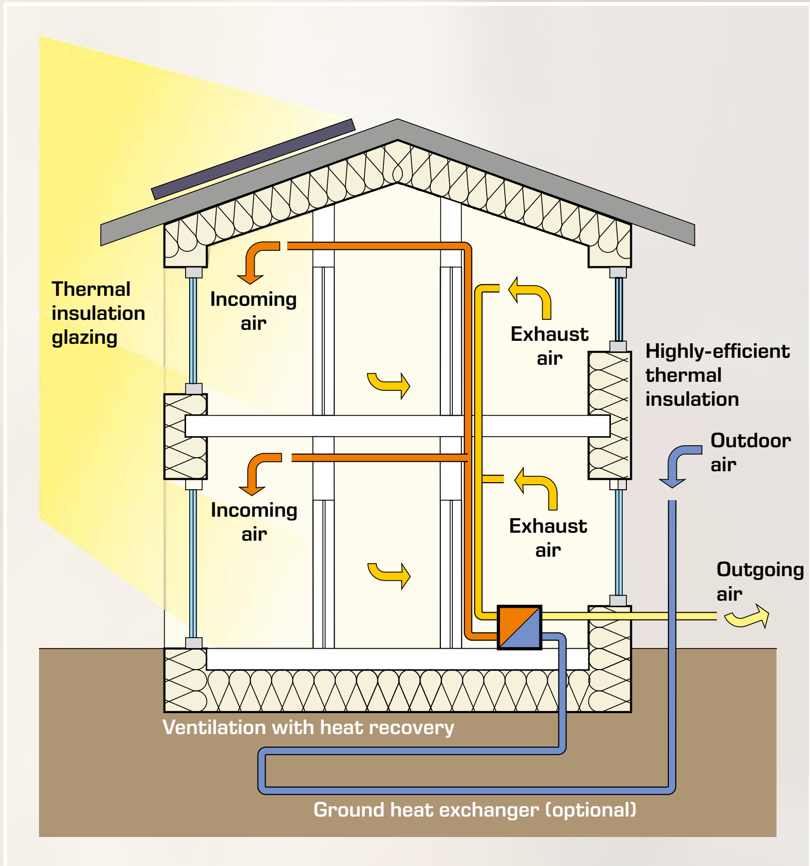
Heat recovery

Processes in which the residual heat of a mass flow is used after its primary use are referred to as heat recovery. The heat gained in this way would otherwise be wasted without heat recovery.

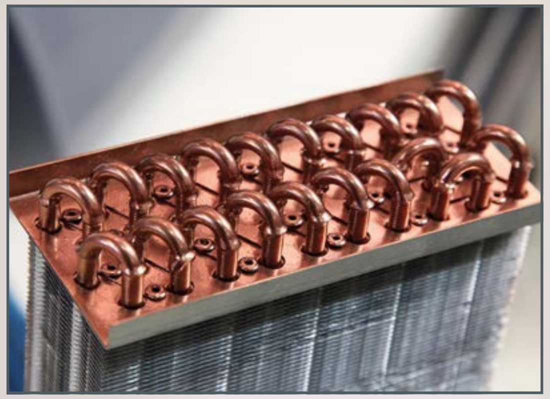
The greatest energy savings potential from heat recovery comes from heating and ventilation systems. In addition, heat recovery systems are conceivable in principle in many other supply and disposal processes in building services engineering.

Heat demand of a passive house

In buildings known as passive houses, the heat demand is reduced by up to 90 % by thermal insulation and heat recovery compared to typical houses in existing building stock. Highly effective insulating materials and triple glazing are used in passive houses. One particularly efficient measure is heat recovery from the ventilation system's exhaust air.



In larger buildings in particular, the optimisation of ventilation technology often results in huge savings opportunities in the year-round energy demand for heating and air conditioning.



In so-called circuit compound systems, two separate air-to-water heat exchangers are employed in order to use the heat contained in the exhaust air to heat the incoming air.

Subject Areas

Heat Supply and Air Conditioning

Significant savings can often be achieved just through simple measures and the more conscious use of energy. In the field of building heating, the necessary energy can be reduced by more than 80 % through a combination of measures in some cases. These include improved insulation materials, optimised hydronic balancing of radiators and the use of more modern, controlled circulation pumps.

Since the energy consumption required to cool buildings is becoming an increasingly important factor in warmer regions of the world, and due to generally rising average temperatures, our building services engineering teaching equipment also covers this area. Further efficiency improvements in air conditioning are possible, for example, with new materials and the intelligent control of combined systems for heating and cooling.

Subject Areas	2E Products
Thermal insulation and heat recovery	**WL 376** Thermal Conductivity of Building Materials **WL 110** Heat Exchanger Supply Unit
Efficient heating technology	**HL 305** Hydronic Balancing of Radiators **HM 283** Experiments with a Centrifugal Pump **HL 630** Efficiency in Heating Technology
Air conditioning	**ET 340** Building Automation in Heating and Air Conditioning Systems **ET 630** Split System Air Conditioner