

Basic Knowledge Energy Efficiency in Refrigeration Technology



Typical application for refrigeration systems:
sales counters in supermarkets operating in the standard cooling range.

Refrigerating plants in building services engineering

Refrigerating plants consist of various components, in which energy is transferred. All of these components are associated with different efficiencies, and can therefore be regarded as potential adjusting points for optimisation. Building services engineering in particular provides the option of significantly increasing the efficiency and cost-effectiveness of the overall system by, for example, utilising the waste heat from a refrigerating plant to heat the building. Another interesting concept for interlinked operation of heat sources and heat sinks consists of the use of waste heat for cold production in absorption refrigeration systems, for example.

Measures to improve energy efficiency

In refrigeration technology the implementation of energy-efficient concepts for refrigerating plants is often associated with increased investment costs. In contrast, achievable savings and economic benefits for some solutions are only significant when viewed over the entire life of the system. Therefore, it may be useful to create economic incentives for specific applications or technologies to reduce the risks for new systems, especially in the initial phase.

In Germany, refrigeration plants and air conditioning units consume about 15% of electrical energy. Under EU rules, the German government has set up special support programmes to increase efficiency in this area in order to achieve the planned savings targets by 2020.



Individual production steps in food production often require very precise preset temperatures. One particular challenge when planning production facilities is the energy efficient integration of the required refrigerating plants into the rest of the building supply.



Condenser in a refrigerant network

Refrigerant networks for building supply

In larger refrigerating plants, cold generators and refrigeration points are often physically separated from each other. Sometimes several refrigeration points at different locations are supplied by a central plant. There is often not enough space at the refrigeration points (e.g. the sales counter) to install a cooling unit. It is also crucial for the system design whether the waste heat is to be released to the outside air or into the building supply. In principle, it is the task of refrigerant networks to transport refrigerant from the cooling unit to the refrigeration point and back.

Energy efficiency under varying cooling demand

Naturally, the performance of a refrigerating plant should cover the maximum demand of all refrigeration consumers at peak times. Adaptive refrigeration systems can be used to keep the energy demand as low as possible when cooling demand varies widely. These systems include, for example, variable speed or multi-stage compressors and electronic expansion valves. Efficient plant control avoids frequent switching on and off. However, it also requires sufficient cold storage. Integration into the energy management system of the entire building should also be considered alongside an intelligent control system.



Goods often have to be stored in refrigeration for a long time, and not only in the food sector. Substantial savings in energy consumption are also possible even with low efficiency gains, due to the required continuous operation of refrigerating plants.

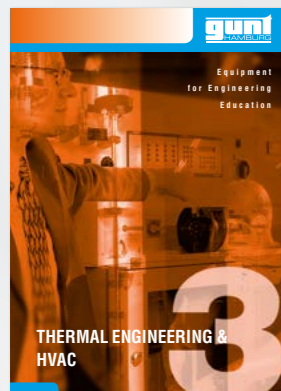
Temperature ranges in refrigeration technology

The integration of refrigeration technology into building services engineering first requires consideration of the temperature range of the application. Typically, the following ranges are identified:

- air conditioning +25°C ... +15°C
- standard cooling +10°C ... -5°C
- deep freeze -15°C ... -30°C
- shock freezing -35°C ... -50°C

System monitoring by energy management systems

In addition to the implementation of efficient system concepts and the use of optimised components, regular monitoring of all operating parameters is crucial for the long-term reduction of energy demand. Interlinkable refrigeration controllers, whose data is collected by a modern energy management system for the entire building, are becoming increasingly important for system monitoring.



Many of the fundamental themes of refrigeration technology are also covered by a wide selection of educational systems from our catalogue 3.

Catalogue 3
Thermal Engineering and HVAC