

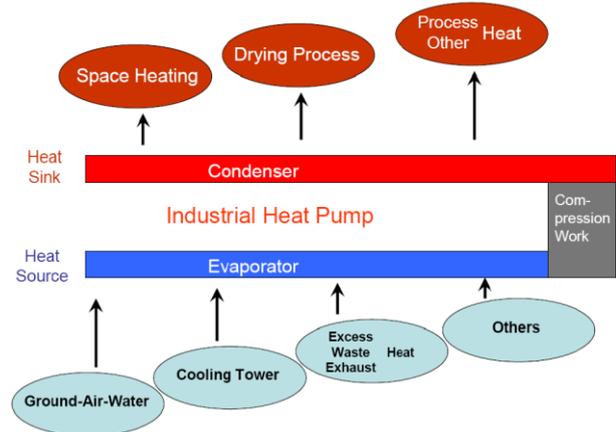
IEA Heat Pumping Programme

Annex 35-13: Application of Industrial Heat Pumps

Securing a reliable, economic and sustainable energy supply as well as environmental and climate protection are important global challenges of the 21st century. Renewable energy and improving energy efficiency are the most important steps to achieve these goals of energy policy. While impressive efficiency gains have already been achieved in the past two decades, energy use and CO₂ emissions in manufacturing industries could be reduced further, if best available technologies were to be applied worldwide.

Industrial heat pumps (IHP) are active heat-recovery devices that increase the temperature of waste heat in an industrial process to a higher temperature to be used in the same process or another adjacent process or heat demand

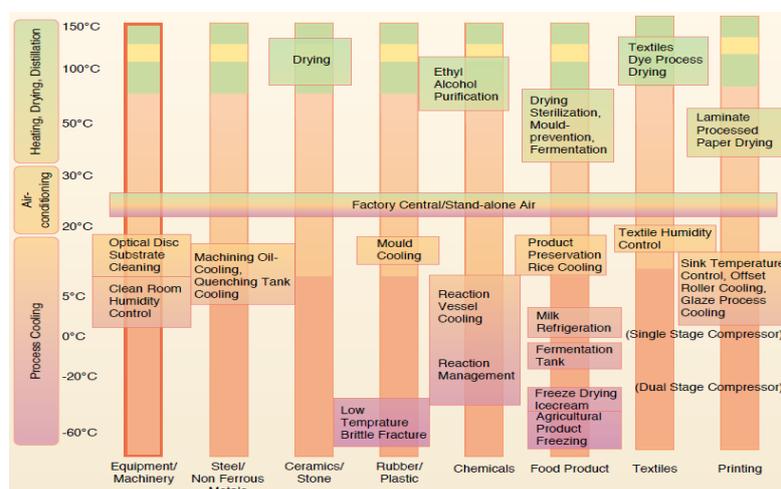
The IEA HPP-IETS Annex 35/13 "Application of industrial Heat Pumps", a joint venture of the International Energy Agency (IEA) Implementing Agreements "Industrial Energy-Related Technologies and Systems" (IETS) and "Heat Pump Programme" (HPP) has been initiated in order to actively contribute to the reduction of energy consumption and emissions of greenhouse gases by the increased implementation of heat pumps in industry.



The main objectives of the project include market overviews in the participating countries (country reports), systems aspects and opportunities, apparatus technologies (R&D projects) and system technologies (case studies).

The country reports shows that the industrial energy consumption in the participating countries varies between 17 to 58 % with great differences of the manufacturing sectors: for pulp and paper in Austria 20 % in Canada 28 % and Sweden 52 %; wood needs in Austria, Canada, Denmark and Sweden between 3 and 8 % of the energy, metal production needs between 10 and 36 % (Germany) and chemical and petrol industry between 8 and 59 % (Netherlands). The energy demand of the food industry varies between 1 and 26 % (Denmark).

Industrial heat pumps can be find in several applications, as shown in the figure:



The project collects totally 39 examples of R&D-projects and 115 case studies. These examples show successful integration of heat pumps. Payback periods, which are lower than 1.5 years are possible in some examples. CO₂-emissions and energy costs can be reduced by more than 80 % in some cases.

Good example

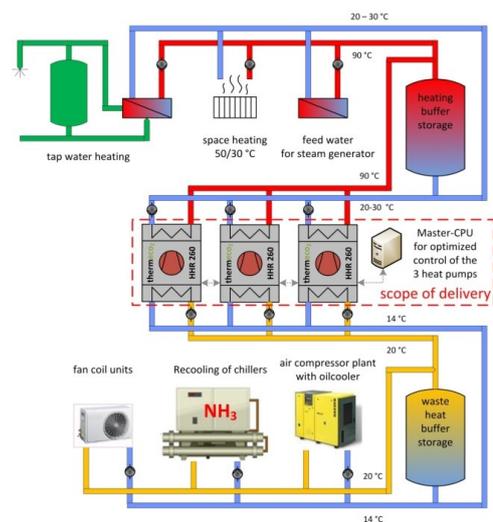
Slaughter House in Zurich (Switzerland)

In 2011, a new CO₂ heat pump system for hot water generation and heating was put into operation in the slaughterhouse Zurich. The three CO₂-machines with a total capacity of 800 kW deliver the required 90 °C with better COPs compared to other refrigerants.



The heat pumps use waste heat as source among others from an existing Ammonia refrigeration plant and from an oil cooled air compressor unit. The heat is collected in waste heat buffer storage (56 m³) with a design temperature of 20/ 14°C. The warm side of the parallel working heat pumps are connected with hot water buffer storage. The hot water is used for the warm water production for cleaning purposes in the slaughterhouse, for the feed water for a steam generator and for the heating system of the building.

Previously the thermal energy for the slaughterhouse Zurich was provided by a steam boiler system. The decision for a high temperature heat pump system with CO₂ as a refrigerant had several reasons. The efficiency advantages of the high temperature heat pump system had high priority. In the calculated overall energy balance of the slaughterhouse, the CO₂ emissions could be reduced by approx. 30 %, this means using the heat pump system, could save 2,590 MWh fossil fuels per year, representing an annual reduction in CO₂ emissions of 510 tonnes



There is a great potential for industrial heat pumps to reduce the energy consumption and related greenhouse gas emissions of the industry. However, further investigations are necessary to reduce the present barriers of the application of heat pumps in industry.

Further information

The project started on 01. April 2010 and expired on 30. April 2014, with 15 participating organisations from Austria, Canada, Denmark, France, Germany (Operating Agent) Japan, The Netherlands, South Korea and Sweden.

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