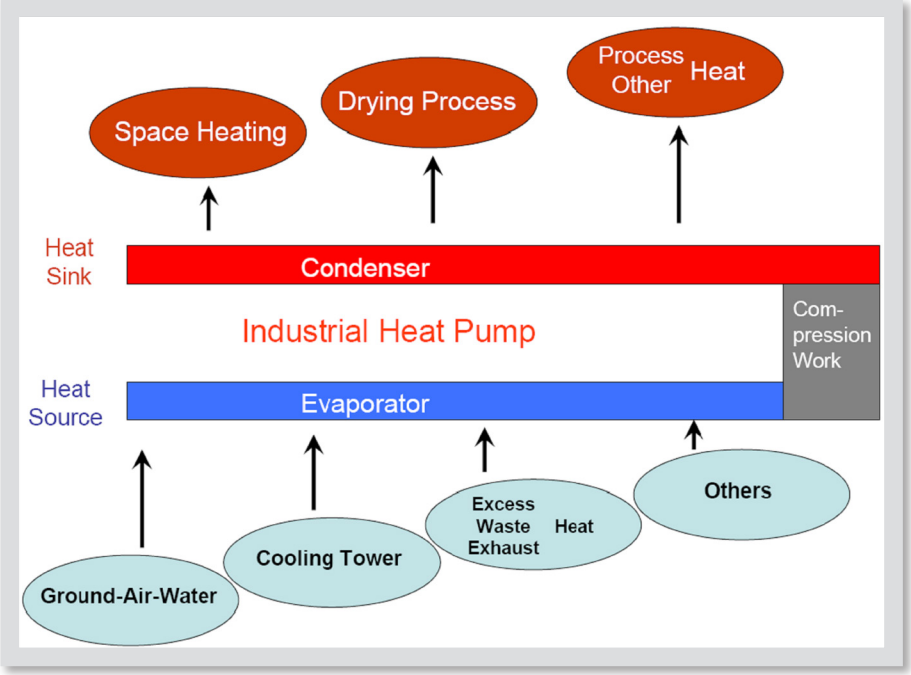
Annex 35

IEA Heat Pump Programme

# Application of Industrial Heat Pumps




*Possible Heat Sources and Heat Sinks for Industrial Heat Pumps.*

There is a great potential for industrial heat pumps to reduce the energy consumption and related greenhouse gas emissions in the industry.

The project collected totally 39 examples of R&D-projects and 115 case studies worldwide, showing the successful integration of heat pumps in the industry and how to overcome barriers: Short payback periods are possible (less than 2 years), high reduction of $CO_2$-emissionen (in some cases more than 50 %), temperatures higher than 100 °C are possible, supply temperatures below 100 °C are standard.

## Background

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 $CO_2$ 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) was 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.

## Objectives

The main objectives of the project included 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 27.6 % and Sweden 52.1 %
- 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 8.3 and 58.8 % (Netherlands)
- the energy demand of the food industry varies between 1.4 and 25.7 % (Denmark).

### Good example

*Slaughterhouse in Zurich, Switzerland*

In 2011, a new $CO_2$ heat pump system for hot water production and heating was put into operation in the slaughterhouse Zurich. The three $CO_2$-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 $CO_2$ 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 $CO_2$ 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 $CO_2$ emissions of 510 tonnes.


*New $CO_2$ heat pump system for hot water generation and heating slaughterhouse in Zurich, Switzerland*

## Further information

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**Participating countries:** Austria, Canada, Denmark, France, Germany (Operating Agent), Japan, The Netherlands, South Korea, and Sweden

**Publications:** Final report of HPP Annex 35 (Part 1 & Part 2) and an Executive Summary, see internet.

**Internet:** www.izw-online.de/annex35/index.php? and www.heatpumpcentre.org

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