The role of heat pumps for decarbonization of industrial processes

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Energy-efficient industry, buildings and transportation could reduce the world's projected energy needs in 2050 by one third.

Contribution of energy efficiency

Prospects of global energy use

Source: IEA Energy Technology Perspectives 2014
Long-term development of industrial processes for resource-efficient and carbon-lean production

- Increased use of excess process heat
- Energy efficient processes
- Renewable energy sources
- Renewable and/or recycled feedstock
- Integration with eco-industrial parks and/or regional energy systems
- Carbon capture and storage/re-use
- Electrification Power-2-XXX

Industrial HPs have an important role to play!
Energy Technology

IEA Joint HPT & IETS Workshop – Industrial Heat Pumps, the next phase
Industrial excess heat – definitions

Internally usable excess heat

Avoidable excess heat

Externally usable excess heat

Non-usuable excess heat – waste heat

Saved fuel

Saved steam

Boiler

Fuel

Steam

Industrial process

Industrial excess heat

Saved fuel

Saved steam

Boiler

Fuel

Steam

Industrial process

Industrial excess heat
Heat pumps should be integrated across the process pinch!

\[ Q_{H,\text{min}} - Q_{\text{HP}} - W \]
\[ Q_{C,\text{min}} - Q_{\text{HP}} \]

Heat pumping opportunities should be investigated at design stage.
Advanced curves can be used for identifying HP opportunities in retrofit situations
Haven’t industrial heat pumps been investigated many times in the past?

Yes, but …

Important to consider new advances regarding performance and CAPEX of HP technology (particularly high temperature heat pumps)

All sectors (in particular industry, power and heat) are subject to the same societal drivers. In other words, techno-economic as well as sustainability KPI:s for heat pumps can change rapidly.

Power generation sector is changing rapidly as intermittent power sources become increasingly main stream. HP projects must be evaluated for base-load and balancing market conditions

Energy efficiency is increasingly important. New business models and new stakeholders can provide new opportunities for heat pumps in connections with heat storage as well as industrial symbiosis in eco-industrial parks
Energy market scenarios can be used to identify robust opportunities for heat pumps in industry.
Roadmaps needed for a wide range of technologies and applications. Knowledge sharing is important!
Questions for the audience and panel

Do you agree that there is currently a lack of knowledge about the role of heat pumping and other process electrification measures for achieving long-term societal sustainability objectives for the process industry sector?

Do you agree that there is a need for comparative investigation of the climate consequences of substantially increased electrification in sectors such as industry and transportation?

Do you agree that it is important to understand how heat pumping and other process electrification measures will interact with future electricity markets with a high degree of intermittent power sources?