

**Project**

KickStart market industrial heat pumps  
MOOI42002

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**Motivation**

Industry is facing huge challenges in order to make the transition to a nearly CO<sub>2</sub>-neutral industry in 2050. Use of industrial heat pumps that upgrade waste heat to process heat is one of possible solutions to enable this. Compression heat pump technology has been developed to such a level that market introduction is possible in the near future. However, two main challenges hamper the implementation at the moment. Firstly, industrial heat pump technology has not reached the status of proven technology for end-users. Knowledge is lacking with respect to the integration with the process, the performance under industrial conditions and the practical problems and risks that are associated with introducing heat pump technology. Secondly, current companies in the supply chain of industrial heat pumps are mainly active in the market for industrial refrigeration technology. The market for industrial heating technology is hardly visible from that perspective. This leads to unfamiliarity and uncertainty at potential heat pump suppliers with respect to which products to develop (temperature, power) and how to integrate these into industrial processes.

**Goal of the project**

- The objective of this project is accelerate the implementation of industrial heat pumps by Developing technological solutions that are a commercially viable alternative to fossil fuel fired heating systems for industrial heat demand < 200°C, both for brown field and green field applications;
- Identifying the main non-technical barriers that hamper market implementation and how to reduce them.

Commercially viable means:

- Technology available that meets the technical requirements of the application at sufficiently low cost and sufficiently high performance to achieve pay back times less than 5 years;
- Technology suppliers have organized their supply chain and are able to produce this technology at desired price levels still maintaining a profitable business.

Reaching this objective will enable the implementation of heat pump technology on significant scale before 2030 and on the long term to covering a large share of the industrial heat demand < 200°C. This will provide a significant contribution to a CO<sub>2</sub>-neutral industry in 2050.

**Results**

The project will generate the following results:

- Two repeatable heat pump concepts developed and tested for brown field applications;
- Industrial heat pump technology integrated in two processes and operating reliably;
- Five repeatable concepts developed for heat pump integrated processes;
- Recommendations for accelerating market implementation of the heat pump technology;

**Summary of activities**

Full-scale heat pumps are developed for a specific application for two different end-users. To facilitate future integration of heat pumps, a so-called Digital Twin is developed. The heat pumps are tested in the Carnot lab @ TNO Petten under controlled simulated end-user conditions. Interfaces between the heat pump and the actual industrial process are developed by the end-users. Then the heat pump is integrated into the plant operation and commissioned, followed by actual testing and

monitoring of the heat pump in field conditions during 2000 hours. For green field application of heat pump integrated processes, a detailed thermodynamic analysis of common unit operations in industry with a heat demand < 200°C will be made. This will be combined with an analysis of several heat pump concepts based on 'standard' compression heat pump and modifications thereof and alternative systems. This will result in the conceptual design of a new process/unit operation, including the heat pump. Finally, the non-technical barriers for market implementation of industrial heat pumps will be investigated and addressed through case studies with end-users, the supply chain and the innovation ecosystem.

## Participants

Name partners	Type of organization	Role in project
IBK	Large company	Coordinator, development of full scale heat pumps, contribute to lab & field testing
TNO	Research organization (non economic activities)	Contribute to development and testing of full-scale heat pumps, contribute to field testing, development of heat pump integrated process concepts, social scientific research on barriers for market implementation.
TUD	Research organization (non economic activities)	Research on advanced cycles, working media and components
UT	Research organization (non economic activities)	Research on expansion devices for compression heat pumps
TUE	Research organization (non economic activities)	Research on digital twin
Recoy	SME	Research on economic barriers
De Kleijn Energy Consultants & Engineers	SME	Development of heat pump integrated process concepts
KWA	SME	Development of heat pump integrated process concepts
Kiremko	SME	Development of heat pump integrated process concepts
Yeager Energy	SME	Development of heat pump integrated process concepts involving geothermal energy
SmurfitKappa	Large company	Development of interface to full scale heat pump, integration and field testing of heat pump.
Corbion	Large company	Development of interface to full scale heat pump, integration and field testing of heat pump
FarmFrites	Large company	Development of heat pump integrated process concepts
Shell	Large company	Development of heat pump integrated process concepts involving geothermal energy
Bunge Lodders Croklaan	Large company	Development of heat pump integrated process concepts

## More information

Bas van Noorden – IBK B.V.  
bnoorden@ibknl.com