

TNO innovation
for life

HIGH TEMPERATURE HEAT PUMP DEVELOPMENTS
EHPA – WEBINAR (30-9-2020)

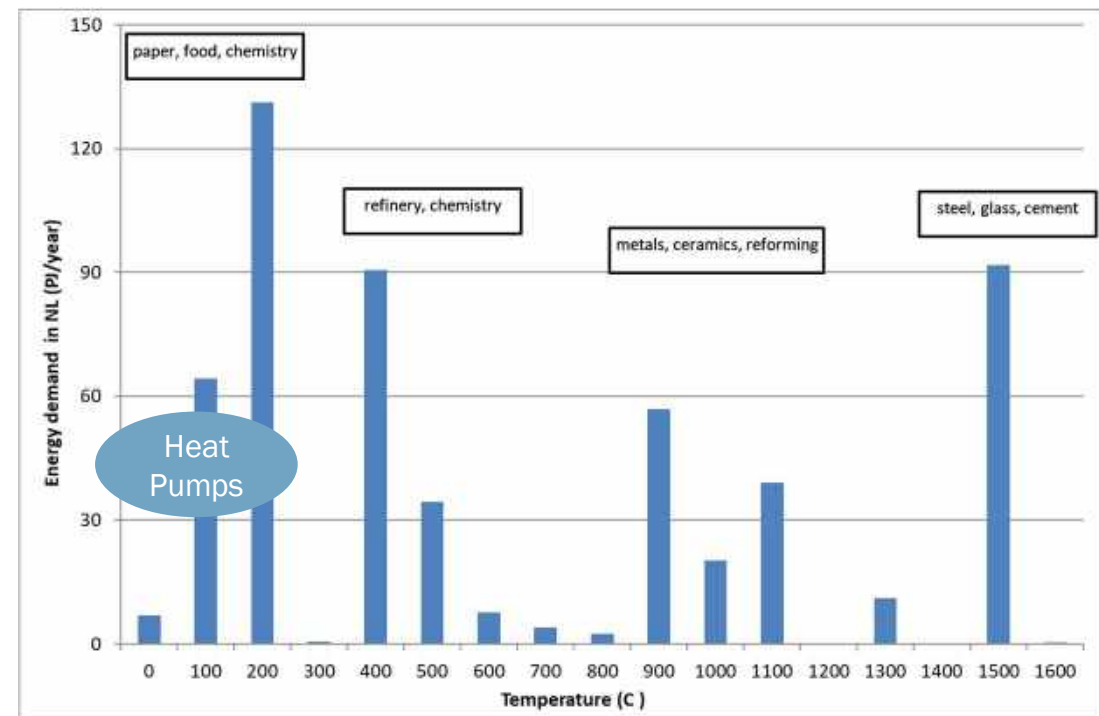
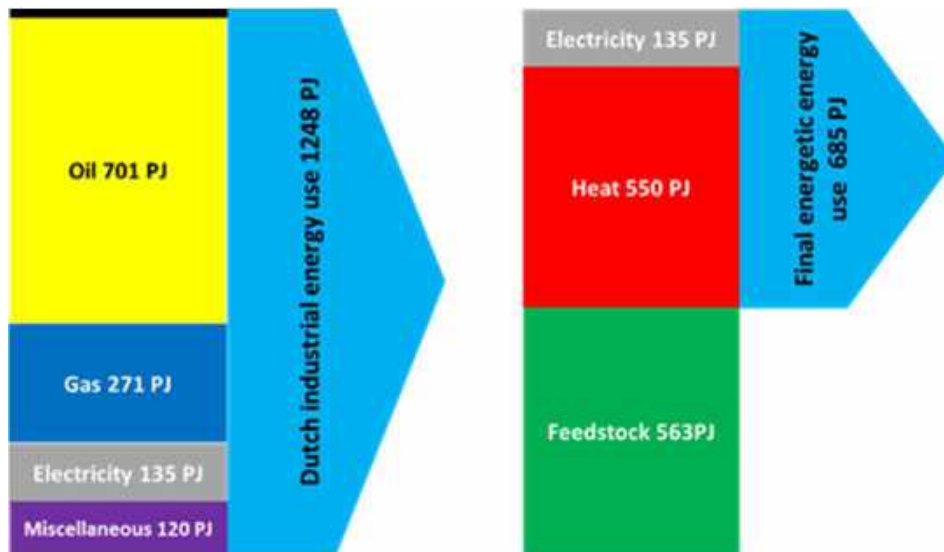
SOLEDAD VAN EIJK

'INNOVATION FOR LIFE'

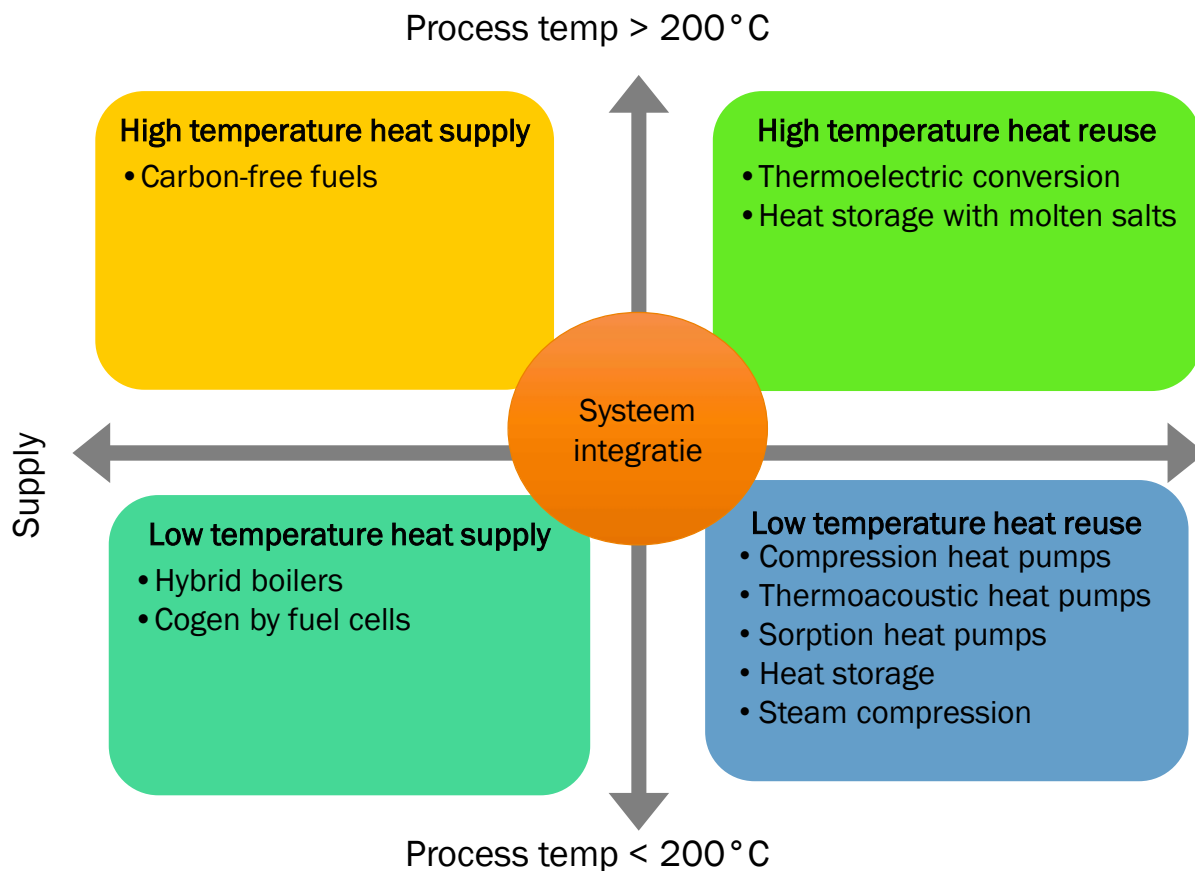
TNO CONNECTS PEOPLE AND KNOWLEDGE TO CREATE INNOVATIONS THAT BOOST THE COMPETITIVE STRENGTH OF INDUSTRY AND THE WELL-BEING OF SOCIETY IN A SUSTAINABLE WAY.

THIS IS OUR MISSION AND IT IS WHAT DRIVES US, THE OVER 3,400 PROFESSIONALS AT TNO, IN OUR WORK EVERY DAY!

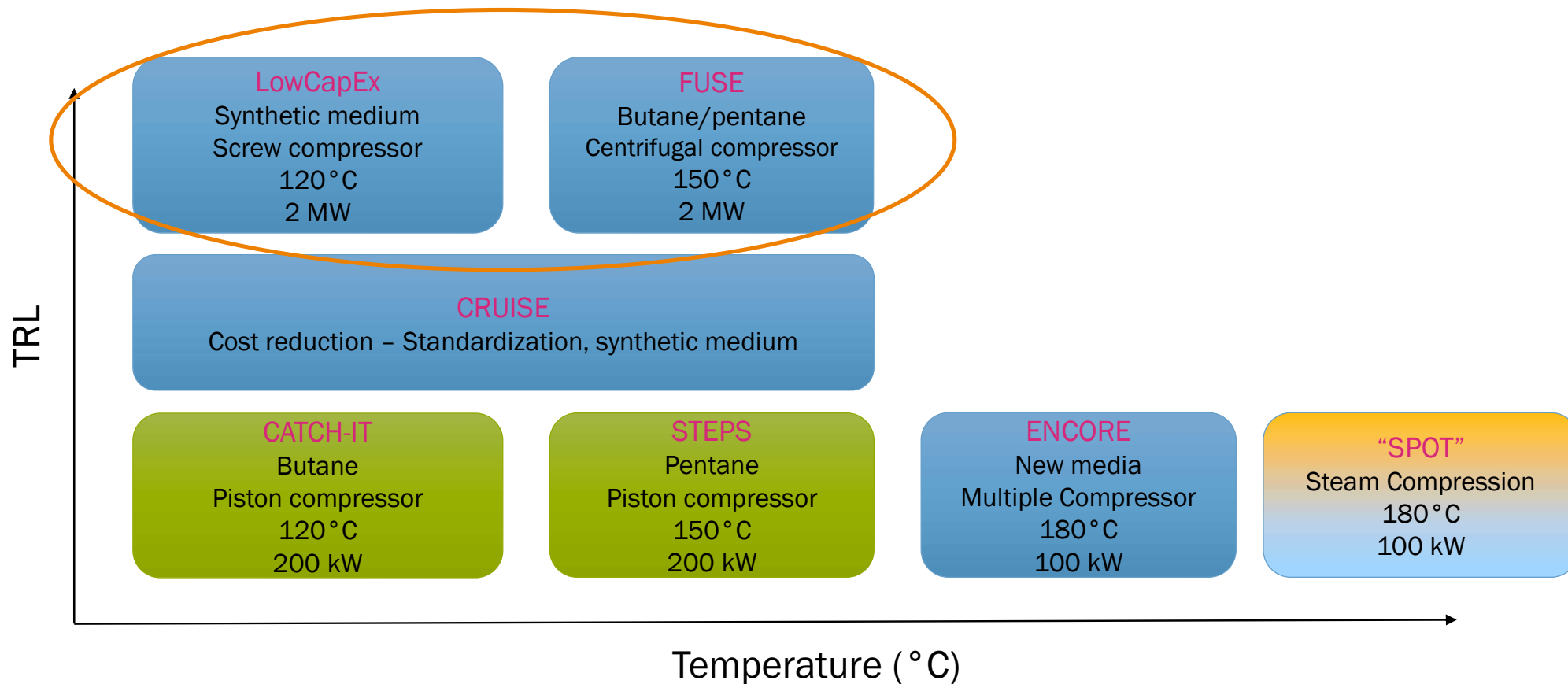
BACKGROUND ON INDUSTRIAL HEAT ENERGY USE IN THE NETHERLANDS



DEVELOPMENT PORTFOLIO TNO



COMPRESSION HEAT PUMP DEVELOPMENT @ TNO



› COMPRESSION HEAT PUMPS LOW CAPEX PROJECT

TECHNICAL

- › Steam production @120°C at 2MW scale
- › Synthetic working fluid - HFO
- › Two compressors
 - › Parallel construction of the high pressure side
 - › Shared evaporator
- › Potential for further lowering capex
- › Step towards industrial demonstrations

FOLLOW-UP

- › Demonstration in Paper mille (Smurfit Kappa)



› COMPRESSION HEAT PUMPS FUSE PROJECT

TECHNICAL

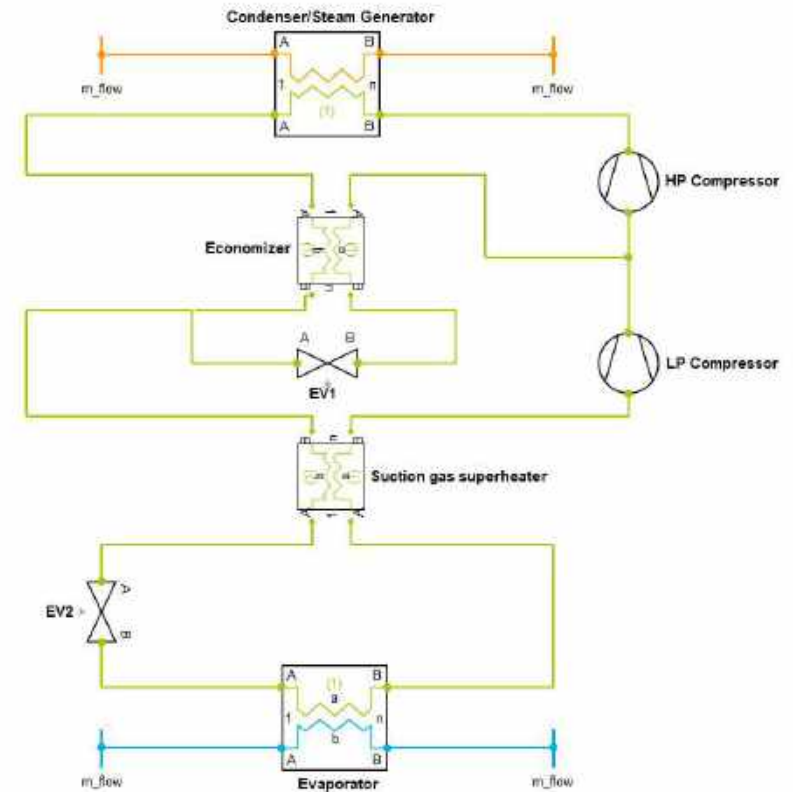
- › Steam production @150°C at 2MW scale
 - › Natural working fluid – Pentane
- › Using waste heat 60°C-90°C
- › Aim for investment cost < 200 €/kWth (excluding integration)

CHALLENGE

- › Finding a suitable compressor

FOLLOW-UP

- › Demonstration at DOW chemical

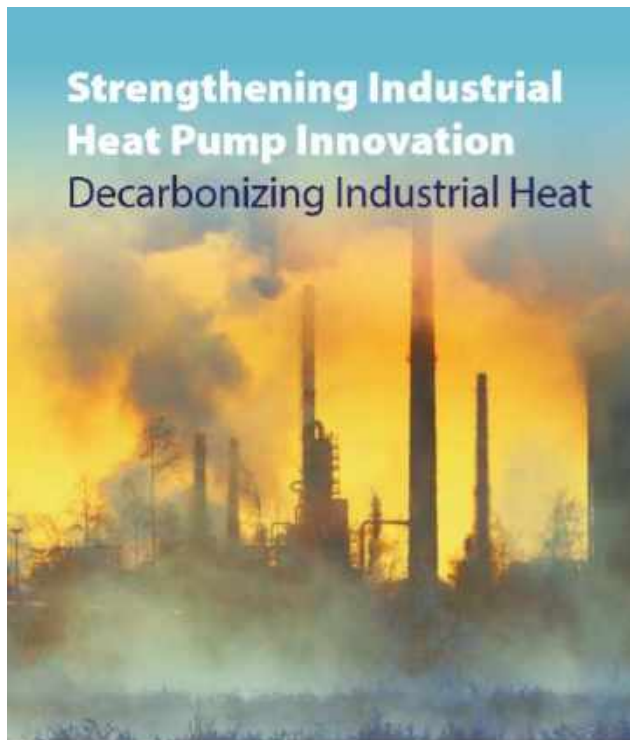


› CARNOT LAB TECHNOLOGY DEVELOPMENT

- › New lab facilities in the Netherlands; Petten
- › Contains general infrastructure for testing small scale to large scale heating equipment; 1 kW to 2 MW
 - › HP testing 200 kW, 10 bar steam
 - › Full scale HP 2 MW, 10 bar steam)
 - › Use of flammable working media
 - › 1 MW Electrical connection
 - › Humid air (100°C)
 - › Hot air loop (1000°C)
 - › General heating and cooling



WHAT IS NEEDED FOR FURTHER INNOVATION? WHITE PAPER



Strengthening Industrial Heat Pump Innovation Decarbonizing Industrial Heat



5. AMBITIONS FOR INDUSTRIAL HEAT PUMP IMPLEMENTATION AND DEVELOPMENT

The research institutes involved in the preparation of this whitepaper have set out the following ambitions and objectives for the period 2020 to 2025, which will lay the foundation for a developed industrial heat pump market and establish industrial heat pumps as a mature technology for increased application areas.

The key ambitions are as follows:

Heat pump technology is established as the reference (low carbon) technology for heat supply <100°C, with at least 500 large scale (1 MW to 10 MW) units installed in industry and other relevant application areas. (TRL 9)

Demonstration of 25 full-scale (1 MW to 10 MW) industrial heat pumps to supply heat in the range of 100°C to 150°C, installed at end-user locations in various sectors and countries. (TRL 8)

Up to 5 pilot scale (with ± 100 kW heating capacity) demonstration projects to validate the technical feasibility of industrial heat pumps to supply heat beyond 150°C. (TRL 6-7)

Development of 3 technologies at a laboratory scale (1 kW to 10 kW), demonstrating the technical feasibility of heat pump concepts to supply heat at temperatures above 200°C. (TRL 3-5)

Establishment of 3 new refrigerants, which are suitable for use in heat pumps supplying heat in the range of 150°C to 250°C, which have been demonstrated in parallel with natural working media alternatives.

Establishment of multiple knowledge, component and system suppliers for industrial heat pumps, which are able to supply the market with technical solutions that can deliver heat up to 150°C.

Industrial heat pumps which are an integral part of standard process equipment (feyes, distillation units, other processes) have become commercially available.

Realization of 5 projects in the framework of Horizon Europe, which have resolved the key market barriers that have so far prevented industrial heat pumps from achieving wide-scale implementation.

Industrial heat pumps are high on the European R&D agenda and are recognized as key technology for the EU decarbonization strategy of industrial heat demand below 200°C.

Establishment of uniform testing standards for determining the performance of industrial heat pump units.

Webinar
29th of October
At 15:00

<https://www.tno.nl/en/about-tno/events/2020/webinar-heat-pumps-for-decarbonising-the-industry/>



› **THANK YOU FOR
YOUR TIME**

Soledad van Eijk
Business Developer

soledad.vaneijk@tno.nl
+31 6 300 63 226

TNO innovation
for life