



**TOWARDS A MMIP 7  
CO2 FREE INDUSTRIAL HEAT**

**MATCH MAKING EVENT  
APRIL 9, 2019**

# WHY DO WE NEED A PROGRAM ON INDUSTRIAL HEAT?

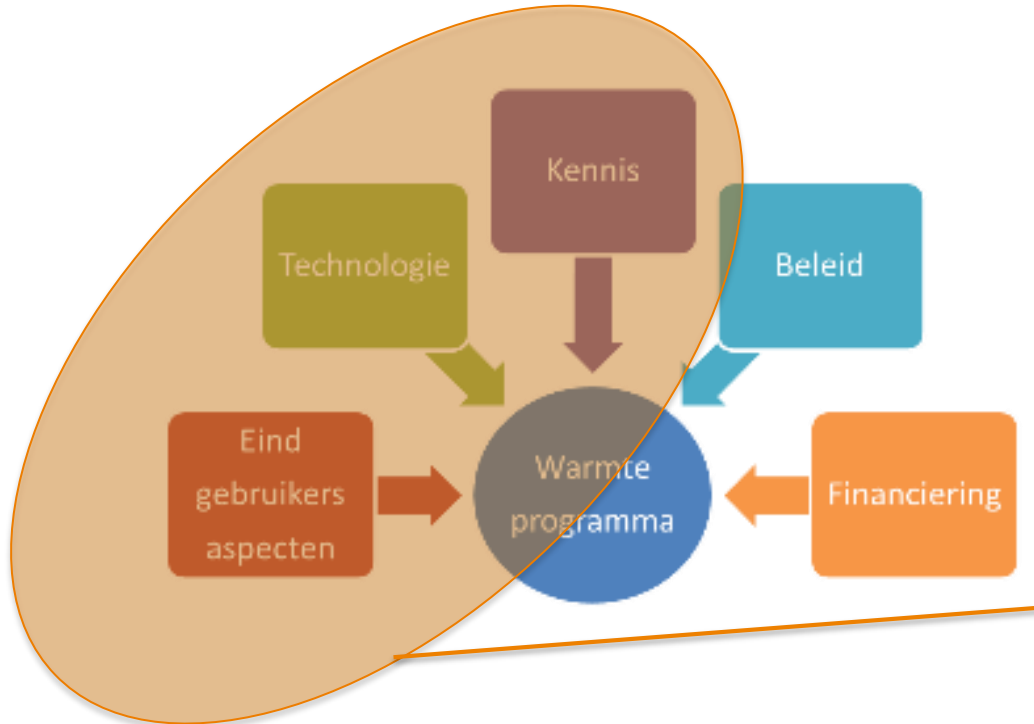
Characteristics of industrial heat:

- › Heat is with 80% the most important industrial energy carrier
- › For end users, heat is an important utility but not a core business
- › For technology suppliers, the market for IHT is insufficiently clear to invest in innovations
- › For governments industrial heat is a difficult to handle topic

Industrial heat has stakeholders with different interest, for none of them Industrial heat as such is core business. The topic industrial heat needs ownership, the ambition of the program 'CO2 free industrial heat system' is to take that ownership and reduce CO2 emissions through:

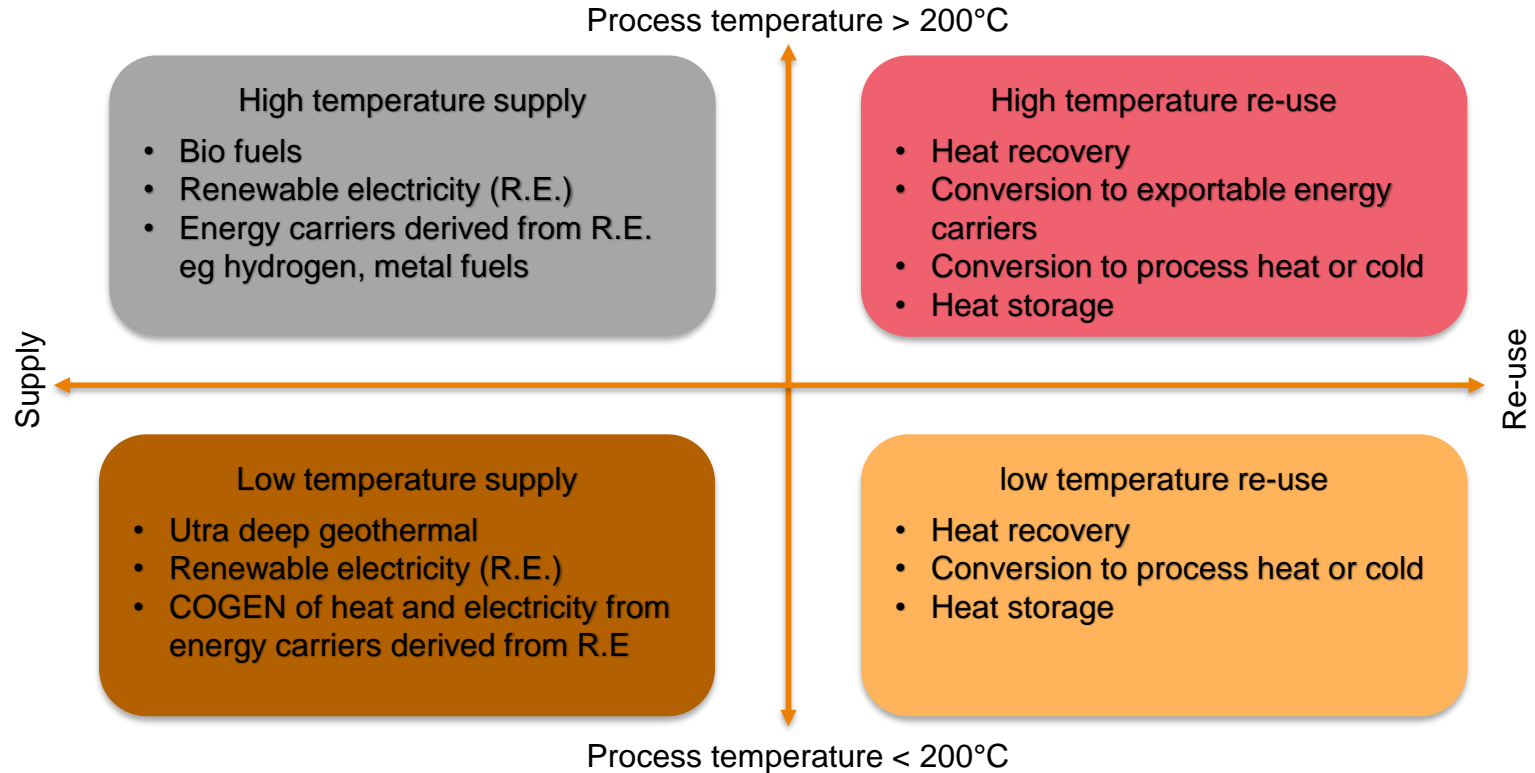
- Reduction of heat demand via improved process efficiency and heat use
- Development and demonstration of efficient heat and separation technologies.

## ECN>TNO IDEA FOR A MMIP 7



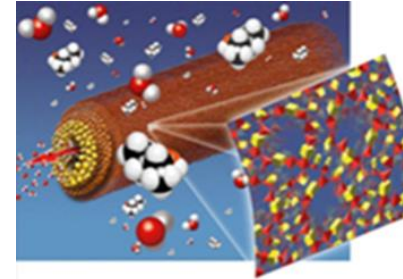
- › Contains all relevant stakeholders
  - › Develops and demonstrates industrial heat technologies
  - › Develops and implements transition policies
  - › Develops new business models
  - › Disseminates knowledge
- 
- › ECN>TNO focusses development and demonstration of industrial heat technologies based on the innovation model used to develop industrial heat pump technology

# AREAS OF INTEREST HEAT TECHNOLOGIES



# AREA OF INTEREST PROCESS EFFICIENCY

- › Increased energy efficiency & performance
- › Recovery & recycling of valuable components
  
- › Technologies:
  - › Membrane technology for pervaporation & vapour permeation
  - › Organic solvent nanofiltration
  - › Crystallisation
  - › Intensified reactors and separators (PI)



An aerial photograph of an industrial complex, likely a refinery or chemical plant, situated along a river. The facility features several large storage tanks on the left, a central processing area with various structures and pipes, and a tall smokestack on the right emitting a plume of white smoke. In the background, a line of wind turbines is visible against a cloudy sky. The surrounding landscape includes green fields and a road.

# PROJECT PITCHES



# STEAM PRODUCING TOP CYCLE

- › Titel: Steam producing top cycle for condensers
- › Objective: Develop and demonstrate a cost effective, efficient, packaged unit to produce hot water and steam from condenser heat
- › Activities: Develop modular heat pump package, build, test, validate and optimize at ECN>TNO, demonstrate at end user
- › Project partners: End users in food processing, technology suppliers
- › Project budget: ~ M€ 1,2, mixed funding 50% industrial contribution

# STEAM COMPRESSION

- › Titel: Steam compression in heat pump driven processes
- › Objective: Introduce steam compression in food, paper and chemicals production
- › Activities: Identify generic steam compression applications in (future processes), test and validate existing steam compressors at ECN>TNO, demonstrate at end user, where and when relevant define necessary innovations
- › Project partners: End users in food , paper and chemicals production, technology suppliers
- › Project budget: ~ M€ 3, mixed funding 50% industrial contribution

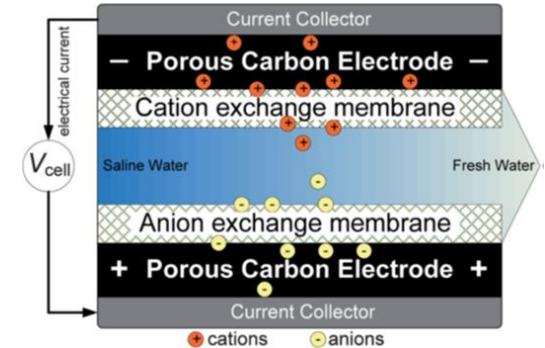


# GEOTHERMAL HEAT IN INDUSTRY

- › Titel: Steam from geothermal source
- › Objective: Develop and demonstrate a cost effective, efficient, packaged unit to produce hot steam from condenser heat
- › Activities: Develop modular heat pump package, build, test, validate and optimize at ECN>TNO, demonstrate at end user
- › Project partners: Steam consuming end users in industry or built environment e.g. a hospital
- › Project budget: ~ M€ 1,2, mixed funding 50% industrial contribution

# REMOVAL OF SALTS FROM PROCESS STREAMS

- › Titel: MCDI for Industry
- › Objective: Develop and lab scale demonstration of a new technology for the removal of salts from process streams
- › Activities: Identify and lab scale testing applications in the process industry, development of a continuous and more efficient process
- › Project partners: End users in food, pharma, chemicals production and biorefinery, technology suppliers
- › Project budget: ~ M€ 0,6 , mixed funding 50% industrial contribution



# ORGANIC SOLVENT NANO FILTRATION

- › Titel: Multi-application pilot testing of organic solvent nanofiltration
- › Objective: Boosting OSNF membrane implementation by demonstration on pilot scale
- › Activities: Pilot testing, set-up operational and membrane cleaning strategies, process evaluation
- › Project partners: End users in food, pharma and chemicals production, technology suppliers
- › Project budget: ~ M€ 1,2, mixed funding 50% industrial contribution

