

COMpact modular Therm Akoestische warmtepomp

Publieke samenvatting / Public summary

Aanleiding

Heat is the predominant final energy carrier in industry, representing about 2/3 of final energy. Process heat is mainly produced by burning (natural) gas and therefore low carbon heating systems are required to meet the industrial contribution to the climate objectives. This can be realized by high temperature heat pumps. However, these heat pumps are commercial not available. The electrically driven thermoacoustic heat pump can fill this gap since it can deliver heat up to a very high temperature ($>200^{\circ}\text{C}$) and over a very wide range of temperatures with a fixed standardized design. Carbon free industrial heating will be realized when the future electricity supply is fully renewable. This development results in net primary energy saving potential of 97 PJ per year and a CO₂ emission reduction of 4.5 million tons/year within the sectors food, paper & board bulk chemical and refineries in the Netherlands. Major fuel cost savings for Dutch industry amounting to 4.8 billion Euro can be realized. In the future renewable electricity system carbon free electricity would result in even higher CO₂ emission of 9.4 million tons/year.

Doelstelling

The overall objective is to further develop the compact electrically driven thermoacoustic heat pump technology that is able to generate steam in the temperature interval $100\text{--}250^{\circ}\text{C}$ using waste heat of $50\text{--}150^{\circ}\text{C}$. The objective of the proposed project is to validate the technical and economic feasibility of the compact electrically driven

Projectinformatie / Project information

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TEEI118003

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Algemene informatie / General information

Penvoerder / Secretariat
Nederlandse Organisatie voor toegepast-natuurwetenschappelijk onderzoek TNO

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thermoacoustic heat pump by measurements, full scale heat pump design and onsite testing.

Korte omschrijving

The project consortium consists of end-user DOW for onsite testing, an end user group with 6 industrial partners, equipment manufacturers Bronswerk Heat Transfer and Howden Thomassen, networkorganisation ISPT, and knowledge institute TNO. The compact thermoacoustic heat pump (COMTA) will be used to experimentally demonstrate the very wide operational temperature window of the heat pump under simulated experimental conditions. The COP will be increased by optimization of components (heat exchanger, membrane). Onsite measurements with the optimized COMTA set-up takes place at DOW in order to obtain practical operational experience with the thermoacoustic technology. The experimental results will be used to establish a full scale modular design by close cooperation between TNO, Bronswerk, and Howden. End users will contribute in the evaluation of the techno-economic feasibility and market potential of the thermoacoustic heat pump. The experimental results, full-scale design and cost calculations are used to establish the economic feasibility and market potential. Dissemination of the project results is organized by ISPT.

Resultaat

The COMTA proposal serves as last stop before full scale demonstration projects. The remaining R&D work to improve efficiency concerns optimizing membrane and heat exchangers. This is addressed by means of experimental component testing within the existing COMTA test set-up. Integration at the DOW steam utility and the onsite testing will verify the technical feasibility under operational conditions. Realization of the full scale design will be used for the verification of the techno-economic feasibility and to prepare for the full scale testing in demo projects.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.

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