

Recent developments at ECN on Thermoacoustic heat pump technology - TASTE project

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ABSTRACT

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Objective TASTE project

The overall objective of TASTE is to develop and implement an electrically driven thermoacoustic heat pump (TAHP) technology that is able to generate steam in the temperature interval 150-200°C using waste heat of 80-120°C. A TAHP uses helium as working fluid. Soundwaves with high pressure amplitude are utilized to pump heat from low to high temperature by means of the thermodynamic Stirling cycle. The sound wave is driven by an electrically powered piston compressor. This technology can be applied in (petro) chemical industry, refining, paper & food industry. The production costs of this steam compete favourably with conventional steam production. Energy is saved by the reuse of waste heat.

Motivation

About 2/3 of the industrial energy use is related to the production of heat. Within the Netherlands, this accounts for 600 PJ per year, representing yearly costs for Dutch industry of 4.8 billion Euro. While industry uses large amounts of energy to produce heat, at the same time, waste heat is released by the processing industry to the ambient atmosphere. The processing industry needs technology for high-temperature heat pumps that can upgrade waste heat to process heat (up to and above 200°C) in an economically feasible way.

Activities

The project consortium consists of end-users (DOW, SmurfitKappa), equipment manufacturer (Bronswerk Heat Transfer, Howden Thomassen), and a knowledge institute (ECN). The approach is combination of experimental work and desk studies. First, the boundary conditions will be based on industrial cases from end-users involved. The experimental work at ECN will be based on this. The experimental results and the modelling verification will be used to establish a full scale design of 1 MW by close cooperation between ECN, Bronswerk, and Howden. Both the experimental results and the full-scale design are used to establish the economic feasibility and market potential.



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