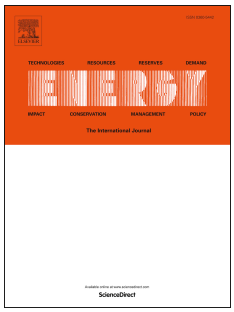
Accepted Manuscript



High temperature heat pumps: Market overview, state of the art, research status, refrigerants, and application potentials

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PII: S0360-5442(18)30575-9

DOI: 10.1016/j.energy.2018.03.166

Reference: EGY 12624

To appear in: *Energy*

Received Date: 16 December 2017

Revised Date: 23 March 2018

Accepted Date: 30 March 2018

Please cite this article as: Arpagaus C, Bless Fréé, Uhlmann M, Schiffmann Jü, Bertsch SS, High temperature heat pumps: Market overview, state of the art, research status, refrigerants, and application potentials, *Energy* (2018), doi: 10.1016/j.energy.2018.03.166.

High temperature heat pumps: market overview, state of the art, research status, refrigerants, and application potentials

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Abstract

This study reviews the current state of the art and the current research activities of high temperature heat pumps (HTHPs) with heat sink temperatures in the range of 90 to 160 °C. The focus is on the analysis of the heat pump cycles and the suitable refrigerants. More than 20 HTHPs from 13 manufacturers have been identified on the market that are able to provide heat sink temperatures of at least 90 °C. Large application potentials have been recognised particularly in the food, paper, metal and chemical industries. The heating capacities range from about 20 kW to 20 MW. Most cycles are single-stage and differ primarily in the refrigerant (e.g. R245fa, R717, R744, R134a or R1234ze(E)) and compressor type used. The COPs range from 2.4 to 5.8 at a temperature lift of 95 to 40K. Several research projects push the limits of the achievable COPs and heat sink temperatures to higher levels. COPs of about 5.7 to 6.5 (at 30 K lift) and 2.2 and 2.8 (70 K) are achieved at a sink temperature of 120 °C. The refrigerants investigated are mainly R1 336mzz(Z), R718, R245fa, R1234ze(Z), R600, and R601. R1336mzz(Z) enables to achieve exceptionally high sink temperatures of up to 160 °C.

Keywords

high temperature heat pump, market overview, state of the art, research status, COP, refrigerant