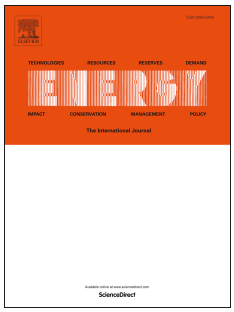
Accepted Manuscript



Optimal combined heat-and-power plant for a low-temperature geothermal source

Sarah Van Erdeweghe, Johan Van Bael, Ben Laenen, William D'haeseleer

PII: S0360-5442(18)30164-6

DOI: 10.1016/j.energy.2018.01.136

Reference: EGY 12248

To appear in: *Energy*

Received Date: 20 September 2017

Revised Date: 15 December 2017

Accepted Date: 27 January 2018

Please cite this article as: Van Erdeweghe S, Van Bael J, Laenen B, D'haeseleer W, Optimal combined heat-and-power plant for a low-temperature geothermal source, *Energy* (2018), doi: 10.1016/j.energy.2018.01.136.

Optimal Combined Heat-and-Power Plant for a Low-Temperature Geothermal Source

Sarah Van Erdeweghe[a,c], Johan Van Bael[b,c], Ben Laenen[b], William D'haeseleer[a,c,*]

[a] *University of Leuven (KU Leuven), Applied Mechanics and Energy Conversion Section, Celestijnenlaan 300 - box 2421, B-3001 Leuven, Belgium*

[b] *Flemish Institute for Technological Research (VITO), Boeretang 200, B-2400 Mol, Belgium*

[c] *EnergyVille, Thor Park, Poort Genk 8310, B-3600 Genk, Belgium*

Abstract

This work compares the performance of four combined heat-and-power (CHP) configurations for application in a binary geothermal plant connected to a low-temperature 65/40 and a high-temperature 90/60 district heating system. The investigated configurations are the series, the parallel, the preheat-parallel and the HB4 configurations. The geothermal source conditions have been defined based on existing geothermal plants in the northwest of Europe. Production temperatures in the range of 110-150°C and mass flow rates in the range of 100-200kg/s are considered. The goal is to identify the best-performing CHP configuration for every set of geothermal source conditions (temperature and flow rate) and for multiple values of the heat demand. The electrical power output is used as the optimization objective and the different CHP plants are compared based on the exergetic plant efficiency. The optimal CHP plant has always a higher exergetic plant efficiency than the pure electrical power plant; up to 22.8%-pts higher for the connection to a 65/40 DH system and up to 20.9%-pts higher for the connection to a 90/60 DH system. The highest increase of the exergetic plant efficiency over the pure electrical power plant is obtained for low values of the geothermal source temperature and flow rate.

Keywords: CHP, district heating, geothermal, ORC, thermodynamic optimization

*Corresponding author
Email address: william.dhaeseleer@kuleuven.be (William D'haeseleer)