Mapping of low temperature heat sources in Denmark

Low temperature heat sources are available in many applications, ranging from waste heat from industrial processes and buildings to geothermal and solar heat sources. Technical advancements, such as heat pumps with novel cycle design and multi-component working fluids, make the utilisation of many of those heat sources feasible. In this work a mapping of those heat sources is performed to gain an overview of the potential amount of waste heat and natural heat sources in Denmark. The energy potentials are mapped together with the temperature ranges at which the heat is available and the exergy content of the heat. The mapping is based on data and literature primarily published by Statistics Denmark and the Danish Energy Agency, as well as interviews with specialists and engineering estimates. The results indicate that up to 13% of the energy input to the analysed sectors is available as waste heat. The total accessible waste heat potential is found to be approximately 266 PJ per year with 58% of it below 100 °C. In the natural heat category, temperatures below 20 °C originate from ambient air, sea water and shallow geothermal energy, and temperatures up to 100 °C are found for solar and deep geothermal energy. The theoretical solar thermal potential alone would be above 500 PJ per year. For the development of advanced thermodynamic cycles for the integration of heat sources in the Danish energy system, several areas of interest are determined. In the maritime transport sector a high potential is found in exhaust gases, where also high temperatures are present. Also the industry sector has a large waste heat recovery potential from refrigeration and cooling processes, however at much lower temperatures.

General information
Publication status: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Viegand Maagøe A/S
Contributors: Bühler, F., Holm, F. M., Huang, B., Andreasen, J. G., Elmegaard, B.
Number of pages: 12
Publication date: 2015

Host publication information
Title of host publication: Proceedings of ECOS 2015: 28th International Conference on Efficiency, Cost, Optimization, Simulation and Environmental Impact of Energy Systems
Keywords: Waste heat potential, Low temperature heat, Waste heat recovery, Energy mapping, Exergy mapping
Electronic versions:
ECOS_2015_Waste_Heat_DK_05.pdf
Source: PublicationPreSubmission
Source ID: 110843037
Research output: Chapter in Book/Report/Conference proceeding › Article in proceedings – Annual report year: 2015 › Research › peer-review