Assessment of a combination of three heat sources for heat pumps to supply district heating - DTU Orbit (05/05/2019)

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This paper reports a study on how hourly temperature variations of different heat sources influence the seasonal coefficient of performance (SCOP) of heat pumps (HPs) when supplying district heating. The considered heat sources were: groundwater, seawater, air and a combination of the three. The system included HPs, an electric peak load boiler and short-term storage. Linear programming was used to minimize annual electricity consumption of the system. This process also determined the optimum capacities of the HPs using different heat sources. The study was based on data for the area of Copenhagen, Denmark. The results showed that the SCOP of seawater and air HPs, considering heat demand variations, was 11 % and 15 % lower, respectively, than their arithmetic mean performances. For a combination of heat sources, the optimum proportions of HP capacities were: 63 %, 14 % and 23 % for the groundwater, seawater and air HP, respectively. The SCOP of such system was found to be 3 %, 6 % and 11 % greater than the SCOP of a system using the heat sources individually. The results indicate that a maximum system performance may be achieved for HPs based on a combination of different heat sources.

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