Exergy performance of different space heating systems: A theoretical study - DTU Orbit (08/11/2017)

Exergy performance of different space heating systems: A theoretical study

Three space heating systems (floor heating with different floor covering resistances, radiator heating with different working temperatures, warm-air heating with and without heat recovery) were compared using a natural gas fired condensing boiler as the heat source. For the floor heating systems, the effects of
floor covering resistance on the whole system performance were studied using two heat sources; a natural gas fired condensing boiler and an air-source heat pump. The heating systems were also compared in terms of auxiliary exergy use for pumps and fans.
The low temperature floor heating system performed better than other systems in terms of exergy demand. The use of boiler as a heat source for a low-exergy floor heating system creates a mismatch in the exergy supply and demand. Although an air-source heat pump could be a better heat source, this depends on the origin of the electricity supplied to the heat pump. The coefficient of performance (COP) of the heat pump has a critical value (2.57 in this study); it is beneficial to use a heat pump instead of a boiler only when the COP is above this critical value.
The floor covering resistance should be kept to a minimum, in order not to hinder the performance of the floor heating and the whole system. The exergy input to auxiliary components plays a significant role in the overall exergy performance of systems, and its effects become even more significant for low temperature heating systems.

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