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Presentation Type

Oral presentation

Poster presentation

My preferred session indicated by 1, 2, 3:

2 Renewable energy technologies (solar, wind, biomass, hydrogen, geothermal, wave and tidal energy, etc;)

1 CO2 reduction and low carbon technologies

3 Sustainable energy technologies in the built environment

Renewable energy managements, and environmental impact

Technology transfer, international cooperation and innovation

Title of Paper

Evaluation of Rankine cycles for power production from surplus heat at off-design conditions

Abstract (no more than 250 words and five keywords)

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Both organic rankine cycle (ORC) and transcritical CO₂ Rankine cycle have been proposed as alternatives to the standard steam Rankine cycle for power production from low temperature waste heat. Several studies compare the performance of these cycles at given operation points. This work aims to study the sensitivity of the cycles, when exposed to small variations to the conditions of the heat source.

An UA-based excel model linked with a thermodynamic property library developed at SINTEF Energy Research has been built to study the effect of off-design operation of power production cycles with CO₂ and organic fluids. R-123 was chosen as a sample fluid for the ORC.

The ORC cycle was found very sensitive to reduction in the available heat, as the optimum design point will be with an expander inlet condition at the saturation line. Small changes in operating conditions results in liquid droplets at the expander inlet.

Both with variations in the heat source temperature and mass flow rate, the CO₂ cycle has a better response than the ORC. A 5 % increase in air mass flow yields a 4 and 3 % increase in work output for the CO₂ and ORC respectively, while a 5 % increase in air temperature yields an 11 and 10 % increase respectively.

Keywords: Power production, waste heat, ORC, CO₂, Off-design

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