Experimental Study of a Low-Temperature Power Generation System in an Organic Rankine Cycle - DTU Orbit (08/11/2017)

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This paper presents a new power generation system under the principle of organic Rankine cycle which can generate power with a low-temperature heat source. A prototype was built to investigate the proposed system. In the prototype, an air screw compressor was converted into an expander and used as the engine of the power generator. The style of the preheater was a shell and tube heat exchanger, which could provide a long path for the working fluid. A flooded heat exchanger with a high heat transfer coefficient was taken as the evaporator. R134a was used as working fluid for the Rankine cycle in the system. This study compared and analyzed the experimental performance of the prototype at different heat source temperatures. The results show that the preheater and flooded evaporator was used for sensible heating and latent heating of the working fluid, respectively, as expected. When the temperature of the heat source increased, the pressure at the inlet of the screw expander increased, and the mass flow rate of the working fluid increased as well. The fluid at the outlet of the expander is superheated with an average superheating of 2.6 degrees C. In the range of 55-65 degrees C of the heat source, the average isentropic efficiency of the screw expander was 68%, and the efficiency of power generation varies from 1.2 to 4.56%. The highest value of thermodynamical perfectness was 29.06%. It can be concluded that organic Rankine cycle could be competitive for recovering low-temperature heat source to electrical power. (C) 2014 American Society of Civil Engineers.

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