Prototype of a high-temperature heat pump for recovering industrial waste heat

September 12 2019

Credit: Universitat Jaume I

Scientists from the Thermal and Energy Systems Engineering research group (Istener) at the Universitat Jaume I, in collaboration with the company Rank, have developed the first functional prototype of a high-

temperature heat pump for the recovery of industrial waste heat in Spain. The first experimental results of this prototype have been published in the journal *Applied Energy*. Results were also presented last week at the 25th IIR International Refrigeration Congress held in Montreal (Canada).

This new prototype designed at the UJI uses HFC-245fa as refrigerant, which is well known in organic Rankine cycles, but not as common in conventional refrigeration or heat pumps. "Its main advantage is the high critical temperature of this fluid (153.86 degrees C), which makes it possible to produce steam or pressurized water up to 140 degrees C," explains Istener group researcher Carlos Mateu. However, this refrigerant has a high global warming power (GWP) of 858, "so it is necessary to search for more sustainable refrigerants that provide similar energy performance. Consequently, this prototype also establishes a reference to investigate new refrigerants with low GWP that are sustainable regarding the environment," adds Mateu. In fact, in coming months, potential low-GWP refrigerants that will replace HFC-245fa in high-temperature heat pumps will be experimentally researched.

The conclusions of this research show that this technology, according to Mateu, "has a promising future in the decarbonization of the planet, since useful heat has been generated at 140 degrees C from a waste heat source of low temperature at 80 degrees C, obtaining a COP of 2.23," because it will reduce the greenhouse effect emissions responsible for global warming. At the same time, it has been demonstrated that the integration of this technology in cogeneration systems to recover heat from the engine cooling oil manages to reduce CO_2 emissions equivalent up to 57 percent compared to conventional heat generation systems, such as natural gas boilers.

More information: Carlos Mateu-Royo et al. Experimental exergy and energy analysis of a novel high-temperature heat pump with scroll

compressor for waste heat recovery, *Applied Energy* (2019). DOI: 10.1016/j.apenergy.2019.113504

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