

# Energy recycling with heat pump based technologies

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## **Abstract:**

A heat pump technology is designated as one of the most important 21 technologies in Japan. Heat pumps are mainly classified into an absorption and compression type heat pumps. Therefore, energy recycling technologies using the absorption and compression type heat pump technologies are introduced respectively.

First, an absorption heat transformer is focused on. The absorption heat transformer is a kind of the absorption heat pump that can be driven by waste heat sources. This system can produce the steam whose temperature is higher than heat sources. From this feature, this system is a promising energy recycling candidate.

We developed the actual system whose steam generation rate was 140 kg/h. This system was actually applied to the gas engine cogeneration system. As a result of the experiment, it was clarified that 120 °C steam can be produced by 88 °C waste heat. And as a result of the simulation, it was found that this system can produce 145 °C steam with 88 °C waste heat and the lowest waste heat to produce 120 °C steam is 75 °C.

Then, a hybrid liquid desiccant air-conditioning system is introduced. This system is a combination of the liquid desiccant dehumidification cycle and compression type heat pump cycle. In this system, the waste heat from the compression type heat pump is used for the liquid desiccant dehumidification cycle. From this, the efficiency of this system is extremely high.

Such a system is composed of numerous elements owing to the fact that it is a combination of the liquid-desiccant dehumidification cycle and the heat pump one, and hence, its working is extremely complex. Therefore, we evaluated the performance and characteristics of the hybrid liquid desiccant air-conditioning system with experiments and simulations. As a result, it was determined that COP of approximately 5.8 of this system was certainly achievable, though the coefficient of performance (COP) of the current system was 2.8.

## **Keywords:**

Heat pump, Waste Heat, Absorption, compression, desiccant