Analysis of the part load behaviour of sorption chillers with thermally driven solution pumps

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Abstract

It is well known that the possible cooling capacity of sorption chillers is controlled by the hot water temperature. However, when solar energy is used to drive a sorption chiller the driving heat is not necessarily available at the required temperature level and it is normally not constant. Consequently, the cooling capacity will vary. So, the performance in part load is significant for the overall system efficiency.

It is also known that thermally driven solution pumps (thermosyphon) are being used in solar-driven chillers. This kind of solution pump has some advantages over mechanical pumps: the processes of refrigerant generation and solution pumping is combined in one hermetical unit, the costs for maintaining the vacuum is decreased, and a moving part is eliminated from the system.

When analysing the part load characteristics of commercial H_2O/LiBr-absorption chillers with thermally driven solution pumps a considerable (and negative) deviation is found as compared to systems using mechanical pumps. This deviation is characterised by a rapidly decreasing COP at low chilled water temperature and high driving temperature. On the other hand, at high chilled water temperatures the cooling capacity does not increase as expected. This specific part load behaviour is due to the kind of evaporator used, and to the performance of the thermally driven solution pump.

The full paper will include measurements recorded at a commercial H_2O/LiBr-absorption chiller with thermally driven solution pump in a solar cooling application. These results are compared to theoretically expected data using the method of the characteristic temperature differences. For the discussion of these differences, also results from an laboratory test for thermosyphon pumps will be included.