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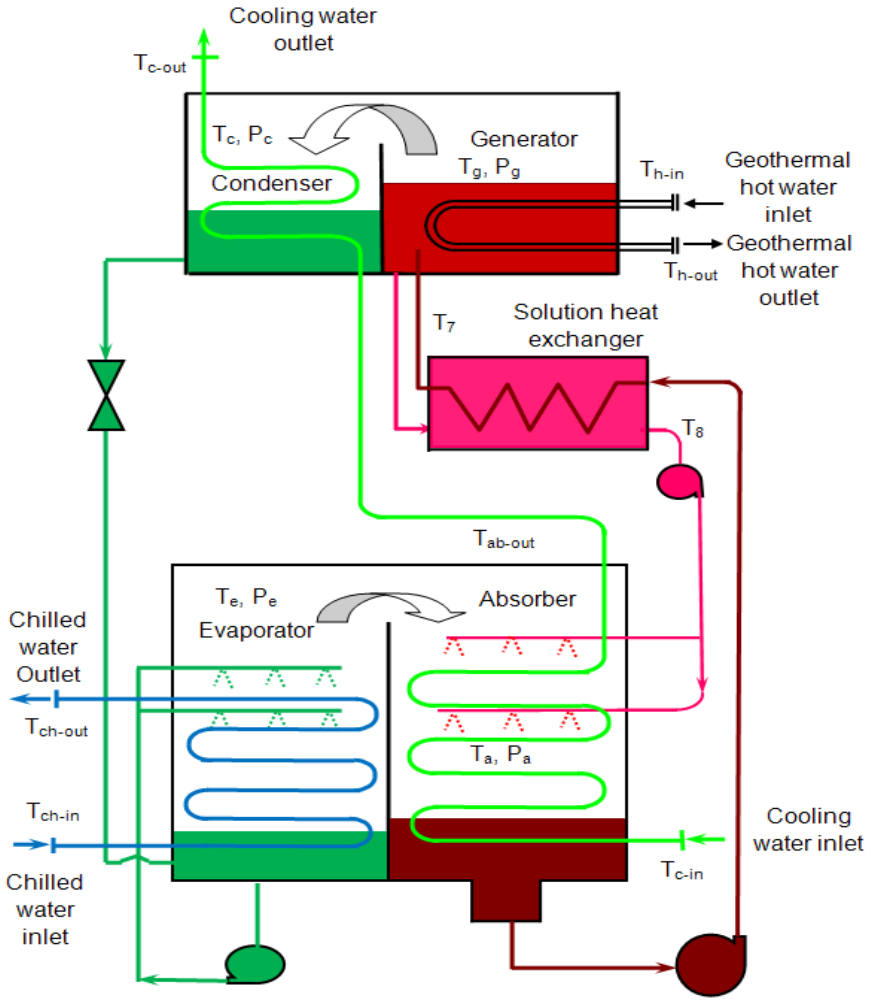
Technology Opportunity

Absorption Chiller:

6-12% Efficiency Improvement for Geothermal and Waste Heat (medium temperature) applications



Schematic of a single effect absorption chiller

Background

While absorption chilling technology is well developed and widely used, thermodynamic efficiencies when applied to low temperature heat sources (such as geothermal heat sources of 75-100 °C) are less than satisfactory.

Researchers at the School of Mechanical Engineering and the Western Australian Geothermal Centre of Excellence (WAGCoE) - both at The University of Western Australia (UWA) – have focussed their energy on improving absorption chiller efficiency, and have come up with novel systems designs that increase the thermodynamic efficiency by 6 to 12% compared to commercially available systems.

Performance of the Improved System

Single effect absorption chiller system:

- 6% increased cooling capacity
- 2°C increase in ΔT temperature drop

Two-stage cascading chiller system:

- 12% increased cooling capacity
- 3°C increase in ΔT temperature drop

Benefits of the Technology

- Improved cooling capacity for a given heat source
- Alternatively, reduced hot water supply flow rate to provide a given level of cooling
- Reduced plant cost per KW capacity

For geothermal applications:

- Reduced pumping costs for production and injection wells (for a given cooling capacity)
- Increased peak cooling capacity
- Reduced depth of the injection well (i.e. reduction in drilling costs)
- Reduced risk of thermal breakthrough due to increased vertical separation between production and injection well

State of Development

Currently, the system exists as a design supported by extensive performance modelling. The researchers have extensive experience in the field and the accuracy of the model has been verified using published data of commercial systems.

Commercial Opportunities

Perth, Western Australia is situated on a sedimentary aquifer well suited for geothermal exploitation with an estimated source water temperature of 90 °C, and two application projects with chilling requirements of several MW are in advanced stages of planning.

Perth is also a major centre for mining companies with the technical as well as financial background to successfully execute major drilling projects.

Apart from the two specific projects presented below, commercial opportunities exist for geothermally powered absorption chilling (and heating) e.g. in major shopping centres, hospitals and new suburb developments in Perth, but also in many other Australian capital cities, as many of them are situated on sedimentary aquifers with significant geothermal potential.

Worldwide this technology is applicable wherever a medium temperature waste heat or geothermal resource can be accessed.

UWA Geothermal Energy Project

Together with Green Rock Energy (ASX = GRK), UWA has been granted a geothermal exploration permit (GEP1) covering the North Perth Metropolitan area, including UWA's Crawley campus. UWA is partnering with Green Rock Energy to demonstrate the commercial use of medium temperature geothermal resources, in particular the replacement of electricity powered compression chillers (that produce cold water for air-conditioning) with geothermal powered absorption chillers. The chilling requirement for this project is 1MW.

PAWSEY High Performance Computing Centre

To boost the chances of Australia's bid to host the $2.5 billion international Square Kilometre Array (SKA) radio telescope, the federal government is funding:

- $56m for the Australian SKA Pathfinder radio telescope located in the Murchison region, 400km north of Perth
- $80m for the Pawsey SKA Science and High Performance Computing Centre in Perth

The chilling requirement for the high performance computing centre is will be several MW. The project is managed by CISRO, and the WA Geothermal Centre of Excellence and Green Rock Energy are proposing a geothermal solution for the chilling infrastructure.

Should Australia win the bid for the international SKA (a final decision is expected late in 2012), chilling requirements for the computing infrastructure will be many times more than for the Pawsey High Performance Computing Centre.

The Research Team

Prof Chua and A/Prof Wang at UWA's Centre for Energy focus their research on maximizing efficiencies of above ground plant for cooling and desalination, driven by low/medium temperature geothermal or industrial waste heat sources in collaboration with the Western Australian Geothermal Centre of Excellence.

Prof. Chua and A/Prof. Wang have extensive experience in development of both absorption and adsorption chiller systems. They have successfully developed a four-bed adsorption chiller system and an electro-adsorption chiller system. The four-bed adsorption chiller system has been licensed to industry.

Intellectual Property protection

Details of the technology are currently being kept secret. Any interested party will be required to sign a non disclosure agreement with UWA prior to release of any technical detail of the technology.

References:

UWA Centre for Energy: www.cfe.uwa.edu.au/research/geothermal

WA Geothermal Centre of Excellence: www.geothermal.uwa.edu.au

The Australian Government commits $47.3 million to develop sustainable energy solutions for the Square Kilometer Array:
http://www.ska.gov.au/news/Pages/100609-SustainableenergyprojectforSKA.aspx

Green Rock Energy offered $5.4 million funding from the Western Australian Government:
www.greenrock.com.au/media/2010_09_29__ASX__LEED_Grant_approved_FINAL.pdf

Chua, H.T. & Wang, X. 2009, 'Absorption Cooling: A Review of Lithium Bromide-Water Chiller Technologies', *Recent Patents on Mechanical Engineering,* Vol. 2, No. 3

Wang, X. Chua, H.T. & Ng, K.C. 2005, 'Experimental investigation of a multi-bed adsorption chiller with a passive heat recovery system', *International Journal of Refrigeration*, Vol. 28 No. 5

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