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Submission of Abstracts due:	**Monday, 16 July 2018**
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Papers due for peer review:	**Monday, 15 October 2018**
Feedback from reviewers to authors:	**Monday, 12 November 2018**
Final paper submission due from authors:	**Monday, 26 November 2018**

Your contribution will not be formally accepted and scheduled, until you have registered your attendance at the conference.

Please indicate by ticking which stream/s best fits your abstract

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Echuca solar cooling system assessment using IEA SHC Task 53 Framework

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Echuca Regional Health (ERH) is a public hospital in Echuca, Victoria. A solar thermal heat based solar cooling system was conceived to benefit the hospital i) avoid expensive electrical network upgrades, ii) reduce hospital's operating energy costs and reliance on fossil fuels. ERH has two solar cooling systems commissioned in 2011 and 2017 respectively [1]. As a result, the hospital has two thermal driven absorption chillers in addition to the electrical driven vapor compression chiller integrated with hot and cold water storage tanks. CSIRO has been associated with monitoring of Echuca hospital solar cooling installations from Oct 2016 onwards.

IN the course of International Energy Agency Solar Heating and Cooling (IEA – SHC) Task 53 a tool for assessment of technical and economic viability of solar heating and cooling systems has been developed [2]. This tool allows for evaluation of various solar heating and cooling technologies and system configurations including PV driven and thermal driven systems. Several existing solar heating and cooling system has been evaluated and provide a good overview and benchmarks of system performance and economics.

The authors have utilised the IEA task 53 framework to study the Echuca (phase I) solar cooling system. Phase I solar cooling system consists of 406 m^2 of evacuated tube collectors delivering heat to the facility. The design uses a variable speed control pump in the solar loop to deliver 95^{o}C hot water to the chiller. A 500 kW (rated cooling capacity) single stage H_2O/LiBr absorption chiller with natural gas backup is used to deliver chilled water to the building. While heat is not being used for cooling the solar heat can be stored in two 5000 litre storage tanks for domestic hot water or space heating purposes.

Echuca solar cooling system and subsystem level performance parameters have been calculated based on monthly energy data. These parameters are evaluated against pre-defined task 53 standard values. Non-renewable Primary Energy Ratio, primary energy savings, equivalent Seasonal Performance Factor (SPF_{equ}) are used to evaluate the system benefits.

Results clearly demonstrate the electrical energy saving benefit of the solar cooling system. Expressed as equivalent Seasonal Performance factor ($\frac{\sum Q_o}{\sum(Q_{el}+\frac{Q_{th}}{\varepsilon_{th}}\varepsilon_{el})}$), this parameter shows the system operates with SPF of 9.3 on system level including all auxiliaries whereas according to the standard T53 values conventional heat pump systems would reach a SPF of 3.35.

Results show that the primary energy saving benefits depend upon the solar fraction since the solar cooling system operates with natural gas as the backup. Monthly solar fraction ($\frac{Q_s}{Q_s+Q_f}$) of the system varies from 0.42 to 0.8 during the analysis period.

This analysis provides multiple benefits such as identification of opportunities for improvement of existing plant, its demonstration of economics and benchmarking of Echuca system with other operational solar cooling systems in the world.

References

[1] “Solar Flair “ AIRAH Ecolibrium magazine, July 2011 (https://www.airah.org.au/Content_Files/EcoLibrium/2011/July2011/2011-07-F01.pdf)

[2] Neyer, D., Koll, R., “Monitoring data analysis of technical issues and performance” IEA SHC task 53, Deliverable C3 report, 2018.