Optimization of Solar-Assisted Absorption Cooling Systems

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Objective

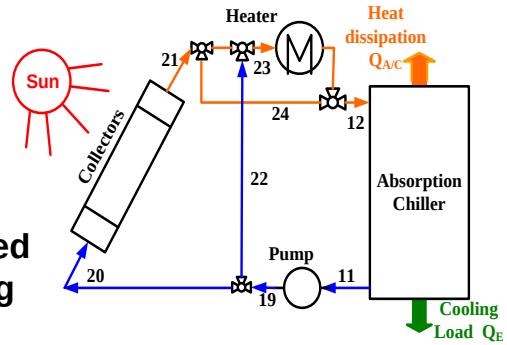
Optimization of environmentally friendly solar-assisted single-effect water/LiBr absorption cooling systems using West Lafayette, Indiana Weather data.

Approach

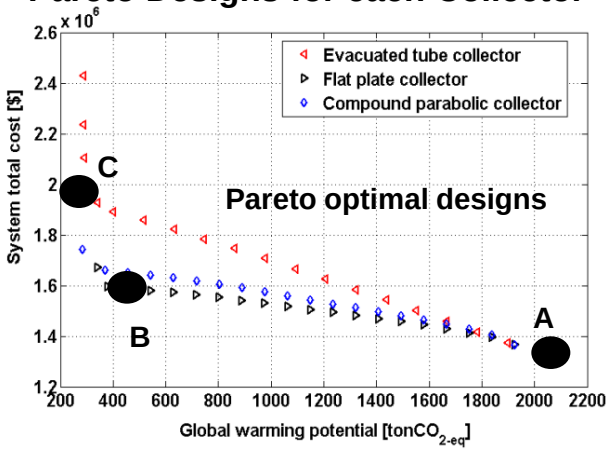
- Multi-objective optimization based on mathematical programming.
- Introduces Pareto optimality.
- The optimization problem is formulated as a bi-criterion nonlinear programming problem (NLP) that seeks minimization of the total cost and the associated environmental impact of the cooling system.
- Life cycle assessment identifies and locates the environmental burdens.
- The optimization tools generate design alternatives and select the best based on the environmental and total cost constraints.

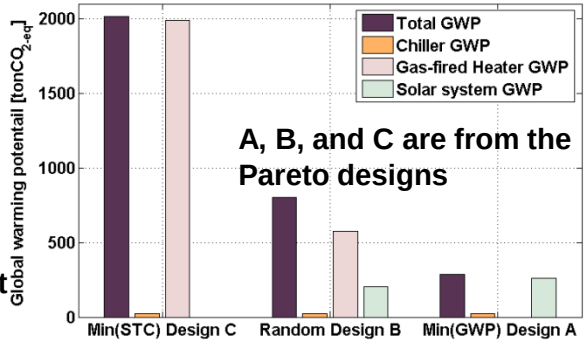
STC =System total cost
GWP= Global Warming Potential

Solar assisted cooling



Pareto Designs for each Collector





The cooling subsystems GWP for Pareto design A, B, and C

Solar thermal collectors:

- Flat plate collectors (FPC)
- Evacuated tube collectors (ETC)
- Compound parabolic collectors (CPC)

Impact

- The decision maker is able to evaluate all optimal trade-off designs that help him/her to make rational decisions.
- Provides quantitative environmental impact comparison of the cooling system designs.

Selected Publications

- B. H. Gebreslassie, E. A. Groll, and S. V. Garimella. *Proceedings ASME 2011*.
- B. H. Gebreslassie, G. Guillen-Gosalbez, L. Jimenez, D. Boer. *Energy*, 35(9): 3849-3862, 2010.
- B. H. Gebreslassie, Guillen-Gosalbez G., Jimenez L, Boer D. *Applied Energy*, 86(9):1712-1722, 2009.

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