SinBerBEST
Building Efficiency and Sustainability in the Tropics

BREATHING FAÇADE FOR TROPICAL CLIMATES

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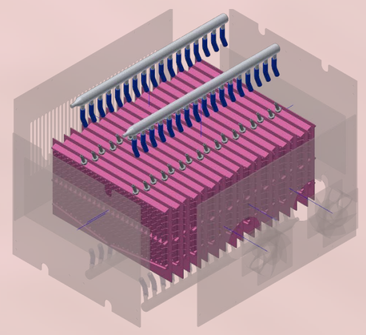
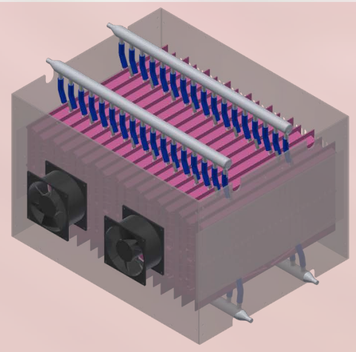
Project Goals

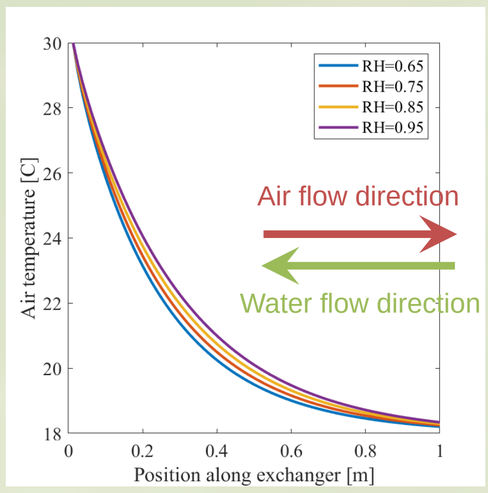
To develop a low-cost, polymeric heat exchanger to cool and dehumidify outdoor air in a way that is energy-efficient enough to be used in a "breathing" façade, providing natural ventilation and improved indoor comfort for the building's occupants.





Theory and Modeling

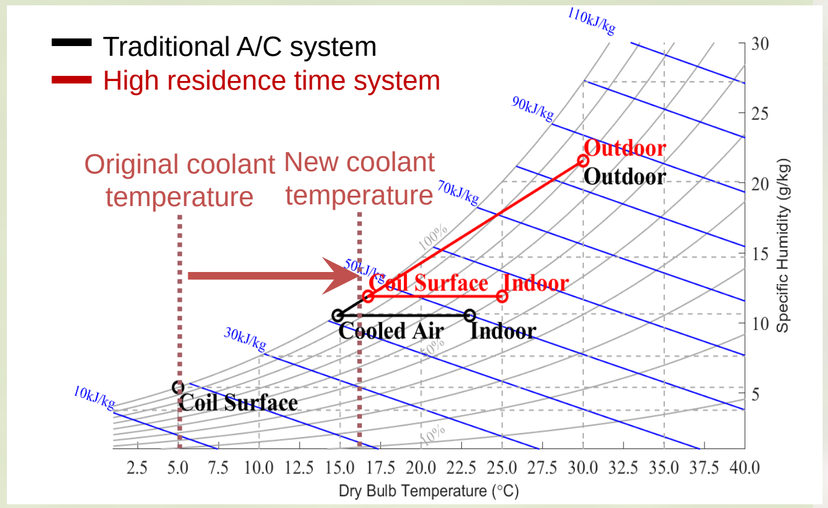
High residence time of the air within the heat exchanger in counterflow with chilled water is shown to yield a contact factor close to 1, meaning the air temperature leaving the heat exchanger is within a few degrees of the chilled water entering the system.



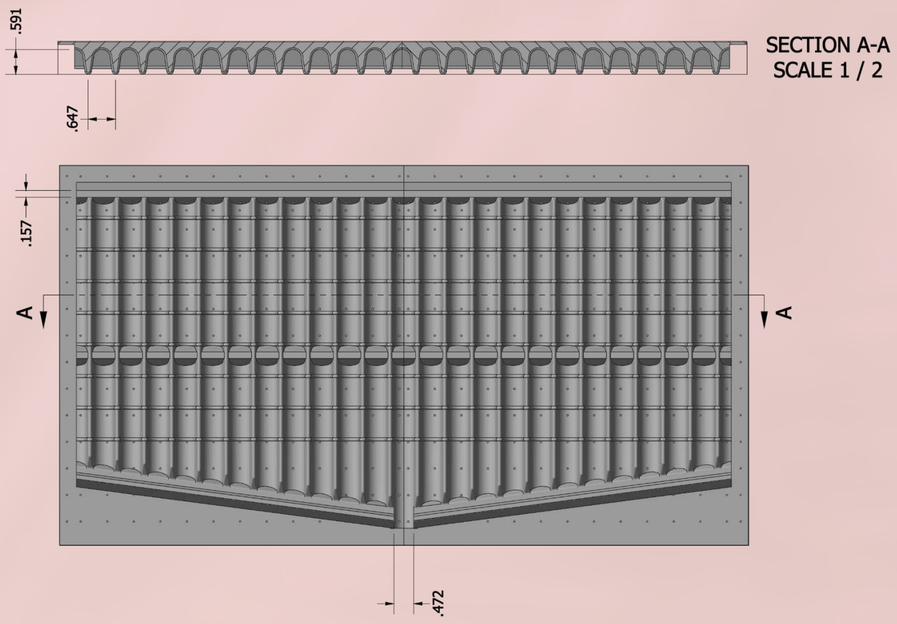
(Computational model constructed by B. Barrett)

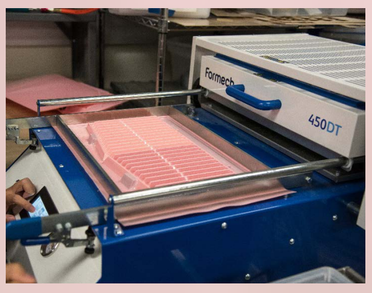
Comparison to Typical Air Conditioners

The improved efficiency provided by this system means a higher coolant temperature can be used to achieve a comfortable level of air conditioning, reducing the energy used by the chiller and enabling the use of alternative methods of refrigeration.



Prototyping





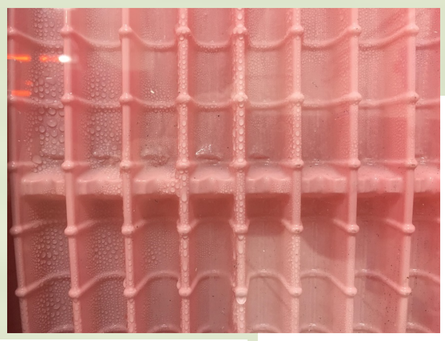
The polymeric heat exchanger was designed to be manufactured out of PET, a readily-recyclable thermoplastic commonly used in water bottles. Prototyping of the heat exchanger was performed at Makerspaces on campus at UC Berkeley

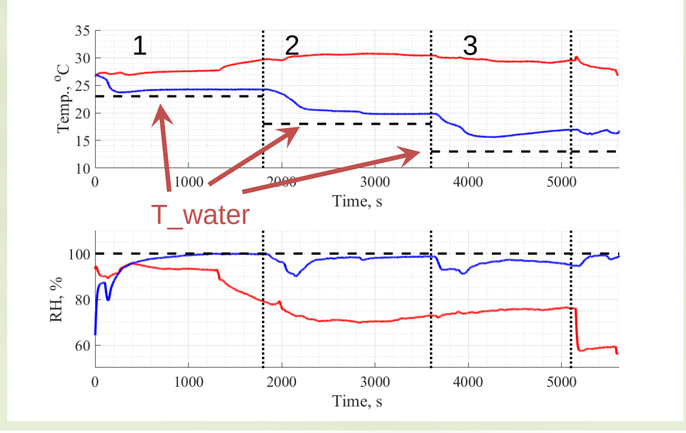
(https://engineering.berkeley.edu/2016/12/jacobs-hall-ranks-platinum-sustainability)

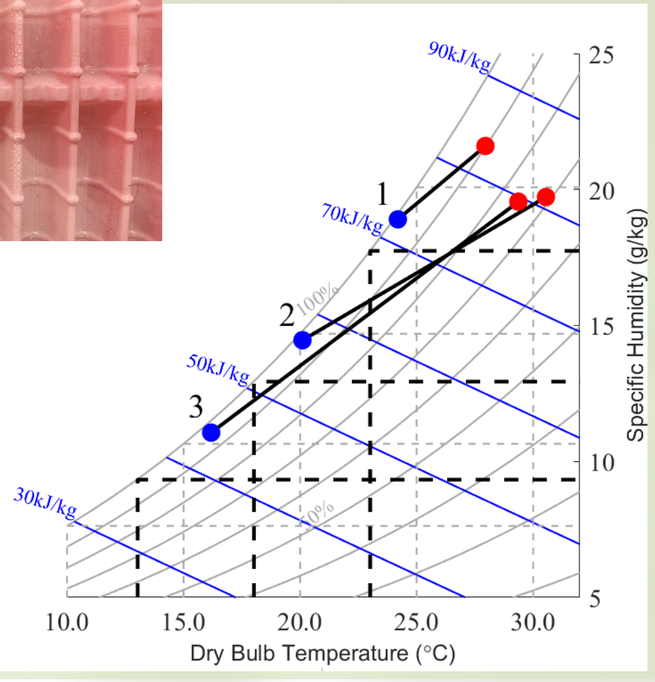
Lab Testing

Input air properties

Output air properties

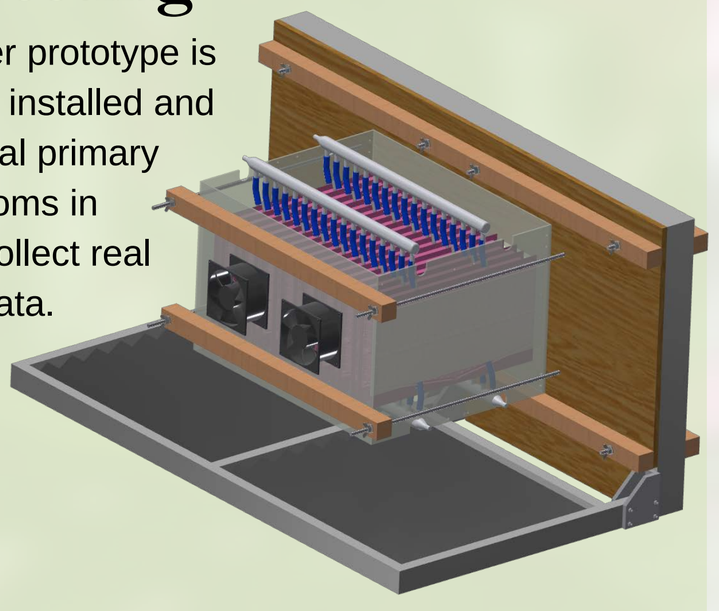






In Situ Testing

Heat exchanger prototype is currently being installed and tested at several primary school classrooms in Singapore to collect real performance data.



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