Performance of the Merced Demonstration XCPC Collector and Double Effect Chiller

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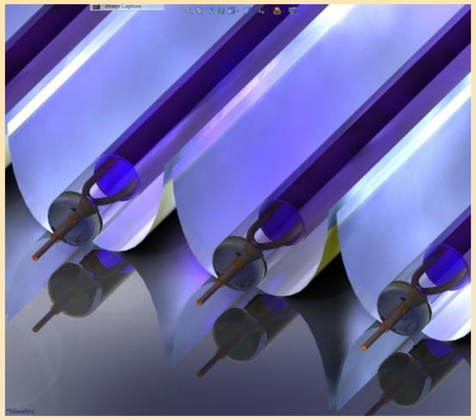


N/S XCPC Solar Thermal Collector
External Compound Parabolic Concentrator

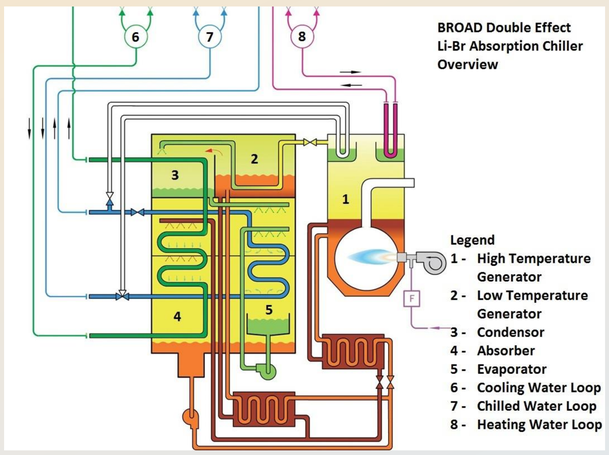
Trough reflector paired with evacuated tube receiver converts solar radiation into heat.

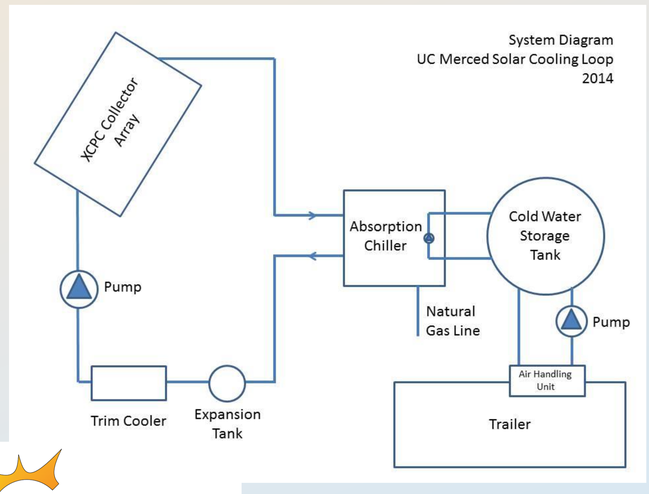
Non-tracking (North-South ~ 8 hour window)
40% thermal efficiency at 200 °C
Collects diffuse sunlight (cloudy days)
Rugged and tolerant to dusting

Absorption Cooling

Thermally driven cooling cycle: water is sprayed over A/C pipes in evacuated chamber, absorbing heat from A/C pipes at low temperature producing a cooling effect.

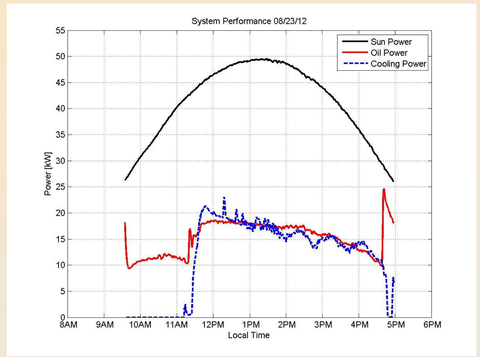
Broad Double Effect LiBr Absorption Chiller
Dual Fired (natural gas backup)
LiBr + H_20 refrigerant pair
Double Effect (2 stage) requires 140 °C
COP ~ 1.1 (cooling provided per heat)

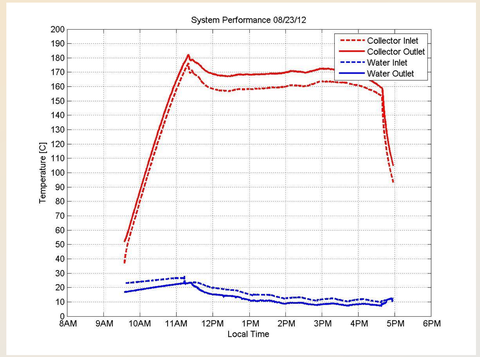




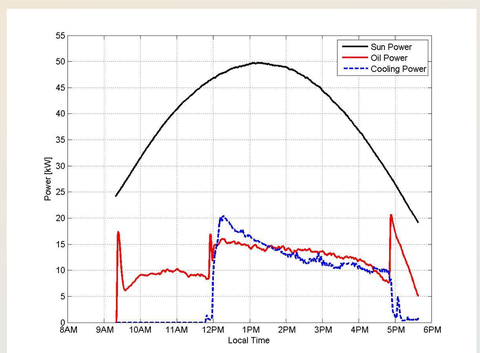
UC Merced - Solar Cooling System

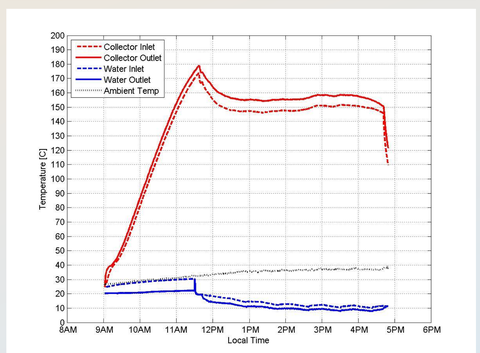
<u>Collector Array</u>	
Aperture Area:	53.3 m^2
Orientation:	North-South
Inclination Angle:	20°
Concentration:	1.15
# of Troughs:	160
<u>Absorption Chiller:</u>	
Cooling Capacity:	6.6 tons (23 kW)
COP:	1.1
CW Storage:	500 gallons



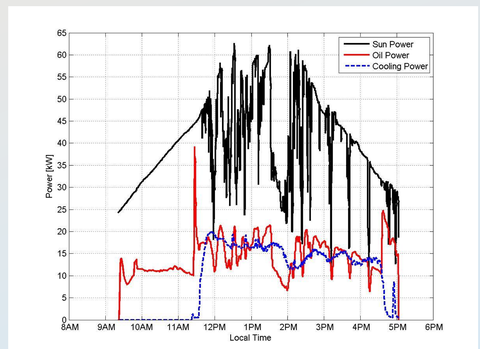


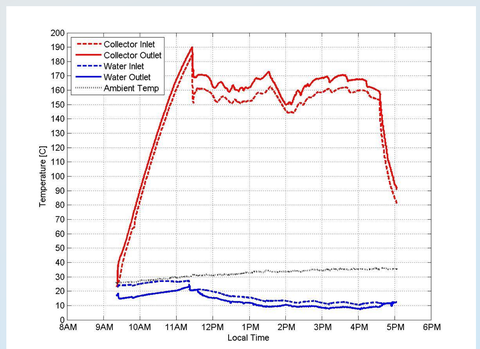
Typical
η_{col} ~ 0.38
Solar COP ~ 0.4





Dirty
η_{col} ~ 0.32
Solar COP ~ 0.33





Cloudy
η_{col} ~ 0.35
Solar COP ~ 0.36

Conclusions

Solar Cooling successfully demonstrated using XCPC powered double effect absorption chiller for 4 seasons at UC Solar test facility in Merced.

During 1-2 hours array warmup time, chiller can be powered using natural gas. N/S XCPC provides 5-6 hours of direct solar cooling. Cold storage can provide 2-3 extended hours after sun goes down.

UC Solar