

*Research Highlights from the
Western Cooling Efficiency Center*

Theresa E Pistochini
Sr. Development Engineer

 **Utility Energy Forum**



WCEC MISSION

“Accelerate the development and commercialization of efficient heating, cooling, and energy distribution solutions through stakeholder engagement, innovation, R&D, education, and outreach.”

WCEC AFFILIATES & PARTNERS



WCEC EXPERTISE

- Unique Leadership in
 - Climate-appropriate California cooling technologies
 - Evaporative cooling research
 - Aerosol application of sealants
 - Laboratory testing simulating hot/dry climates

- Significant Expertise in
 - 3rd party technology evaluation
 - Modeling of buildings/systems/components
 - Field monitoring of HVAC technologies
 - Distribution systems for ventilation and thermal energy
 - Test standards development
 - Human behavior with respect to HVAC technologies
 - Internet control of HVAC systems

WCEC Environmental Chamber



Climate Appropriate RTUs

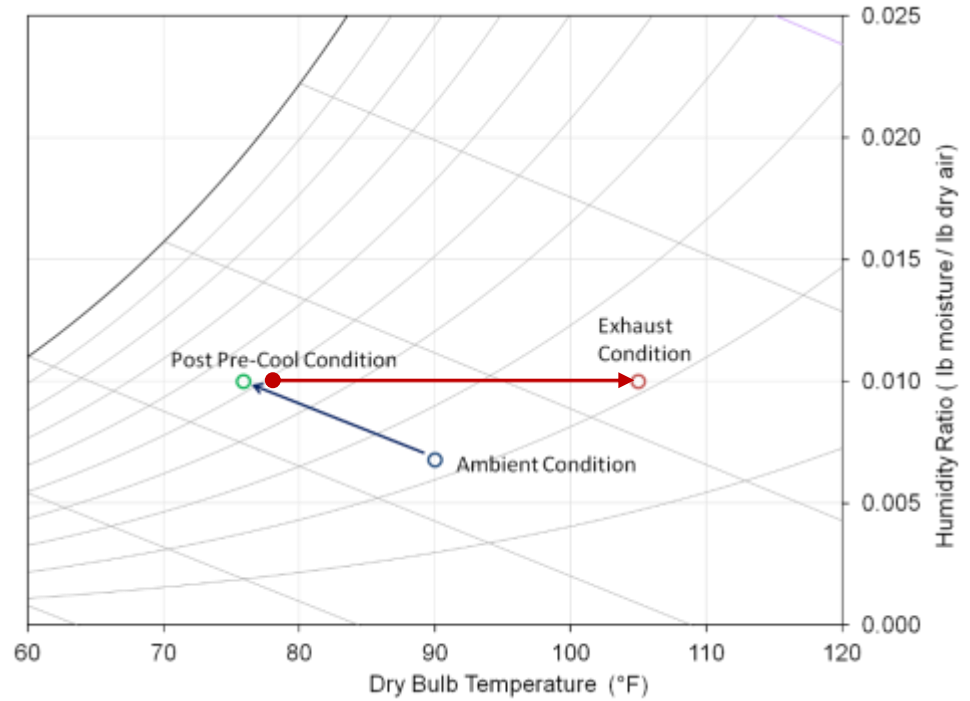
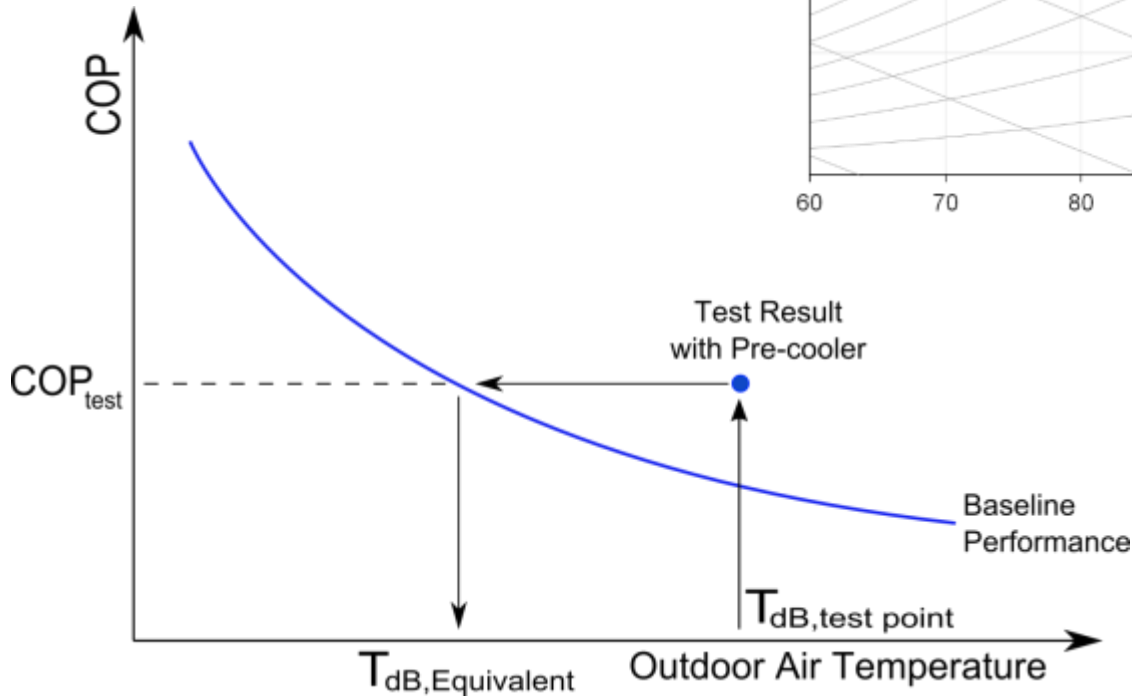


ASHRAE Standards Project Committee SPC 212P - Evaporative Pre-cooler Test Protocol

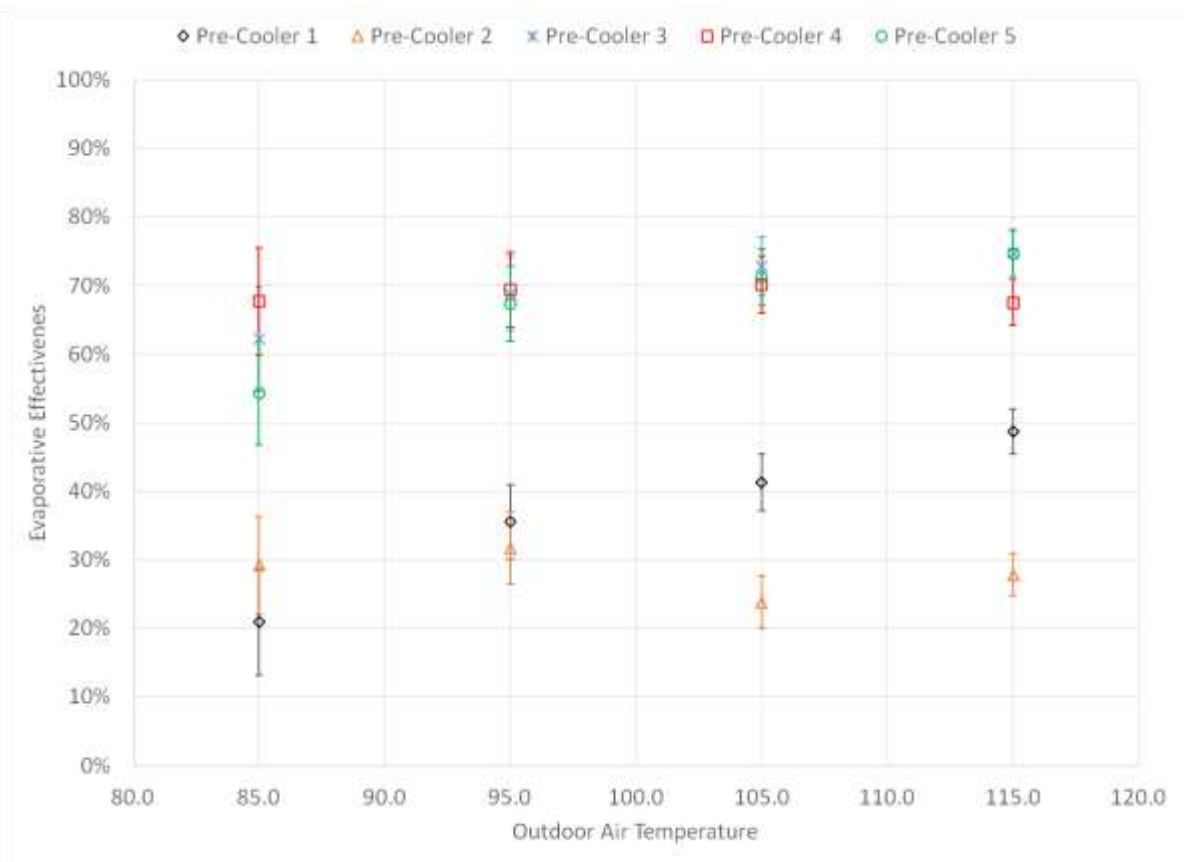
- Laboratory test of evaporative condenser air pre-coolers
- Test protocol development (ASHRAE Standards Project Committee SPC 212P)
- WCEC tested five pre-coolers on 4-ton York RTU
- Results reported to manufacturers



Measuring Evaporative Effectiveness

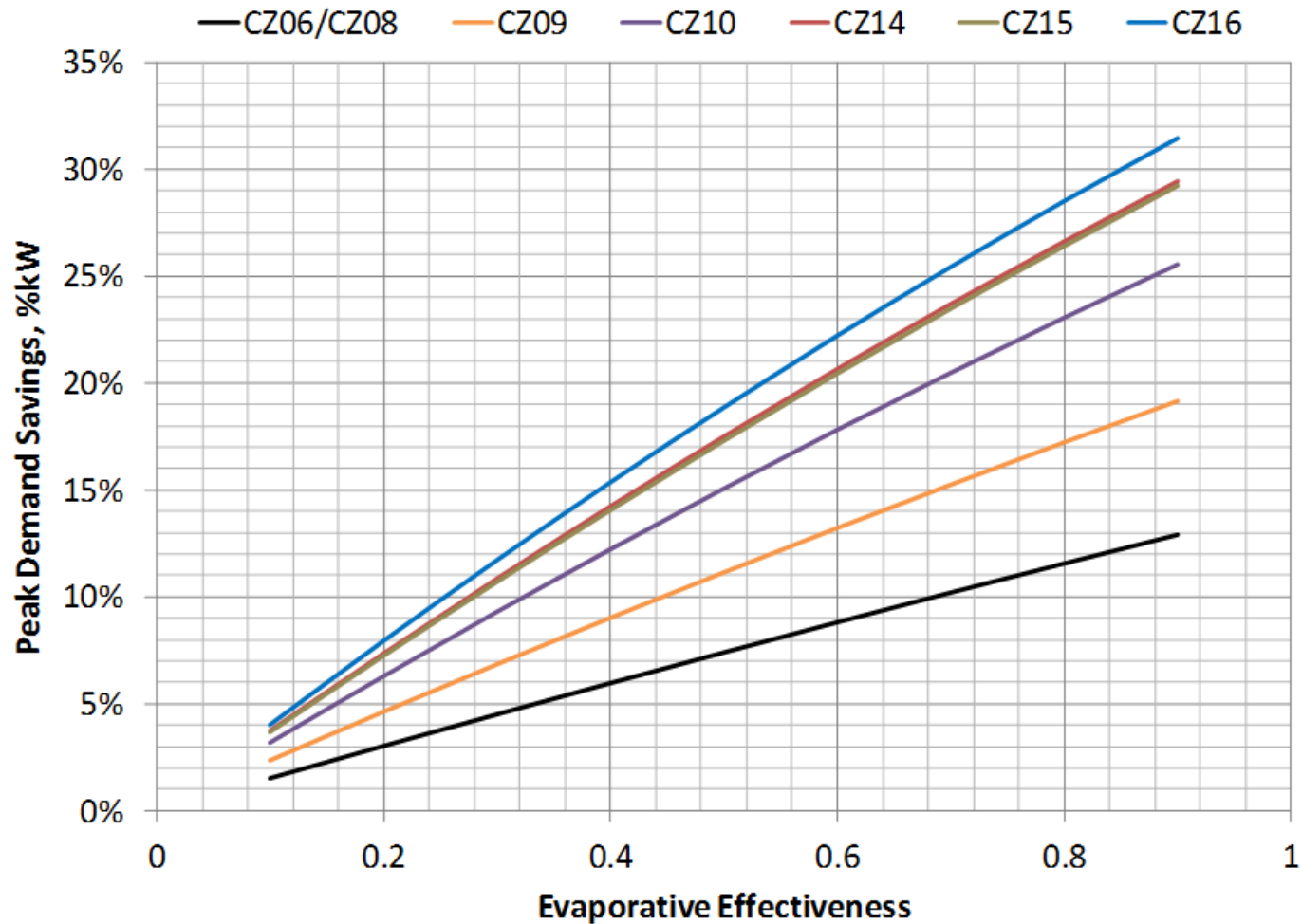


RTU Retrofit Project- Evaporative Pre-cooler Test Results



- WCEC tested five pre-coolers on 4-ton York RTU
- Results reported to manufacturers
- Caused one manufacturer to improve product

Evaporative Pre-cooler Test Results



Source: http://www.etcc-ca.com/sites/default/files/reports/HT11SCE021_Condenser_Evap_Air_Final.pdf

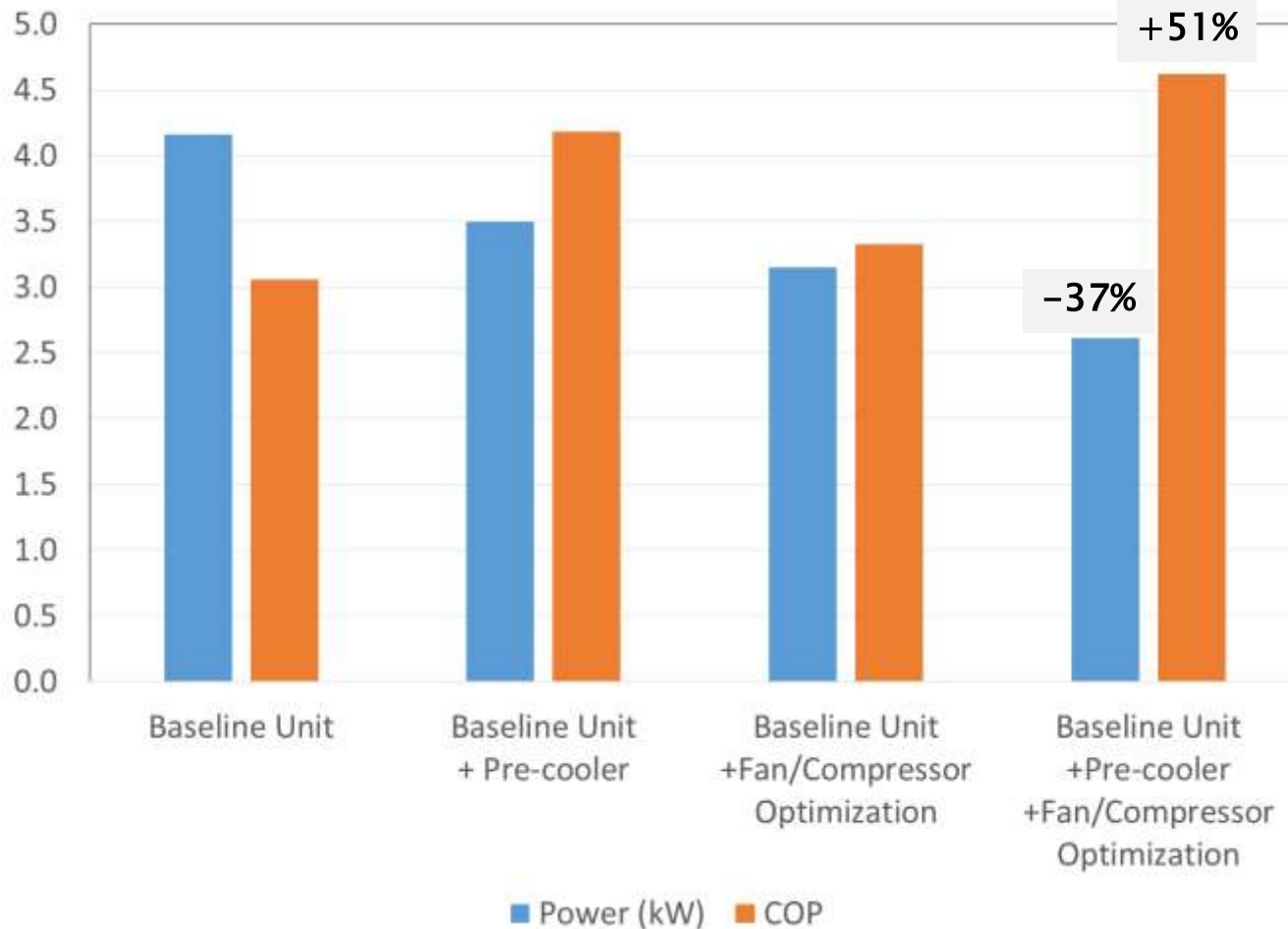
Compressor and Fan Speed Testing

- VFD installed on scroll compressor in 'baseline' 13 SEER packaged unit.
- Evaporator fan speed varied using taps on ECM motor
- Test Conditions:
OA = 85°F, 95°F, 105°F
RA = 80°F DB, 67°F WB



Lab Data – Potential of RTU Optimization

Example 95°F DB/67°F WB



Sub Wet-Bulb Evaporative Chiller



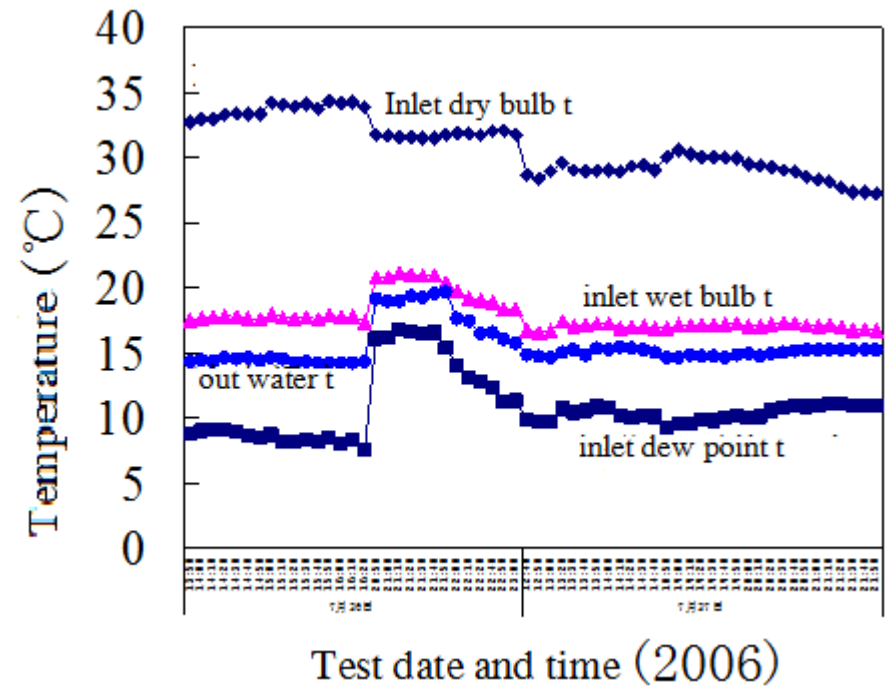
Sub Wet-Bulb Evaporative Chiller



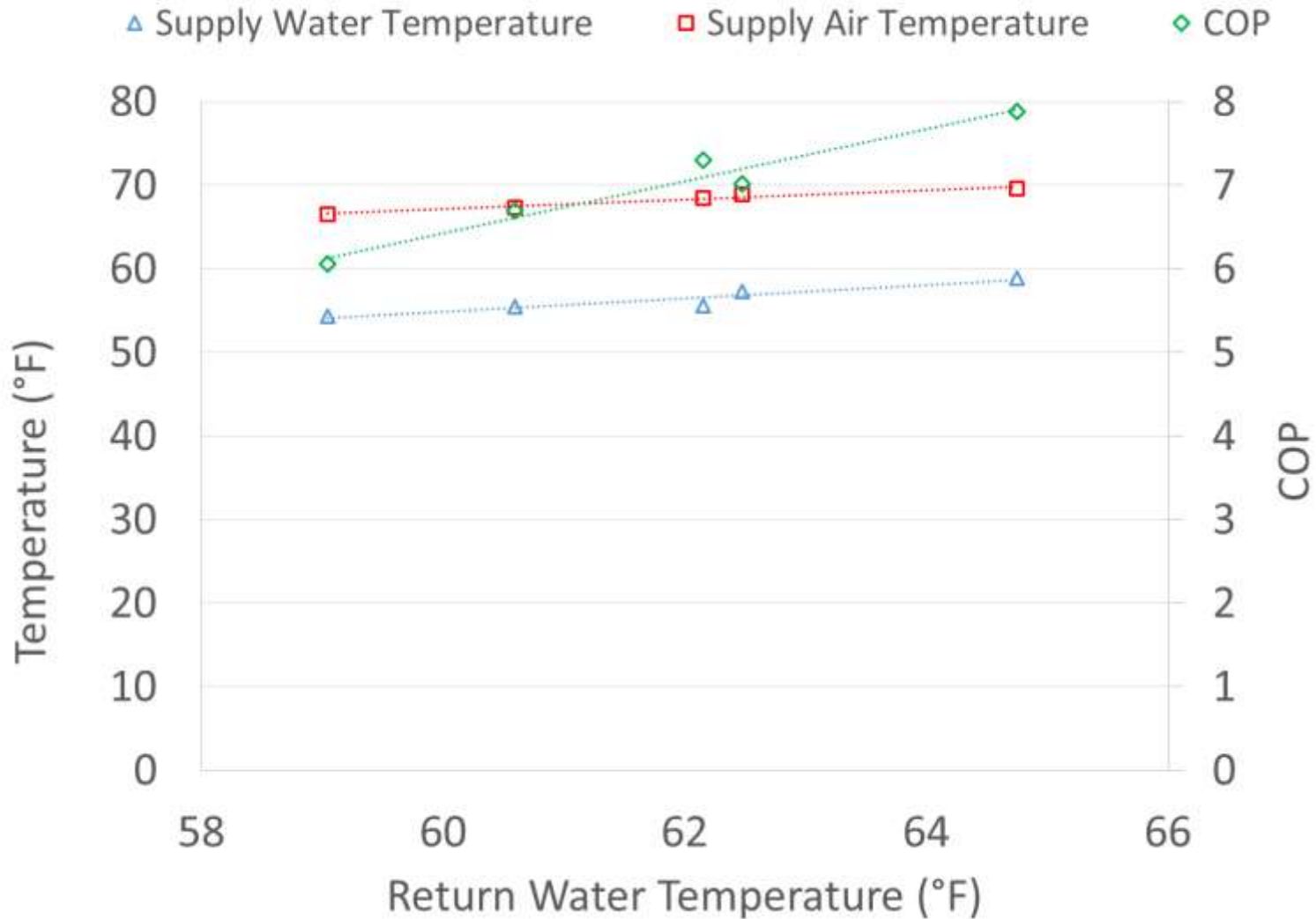
- Uses direct and indirect cooling process to chill water below ambient air wet bulb temperature

Tsinghua University Chiller

- ▶ Installed >1 million sqft of floor space in China



Sub Wet-Bulb Evaporative Chiller



Aerosol-based Sealing of Enclosures

WCEC EXCLUSIVE INVENTION: Aerosol-Based Envelope Sealing Technology

Seals leaks remotely with fog of sealant particles



- Tremendous success in apartments and single-family homes
- New contract to seal large buildings
- Unprecedented licensing interest
 - Two provisional patents filed
 - Five serious contenders



Also significantly reduces sound transmission between apartments

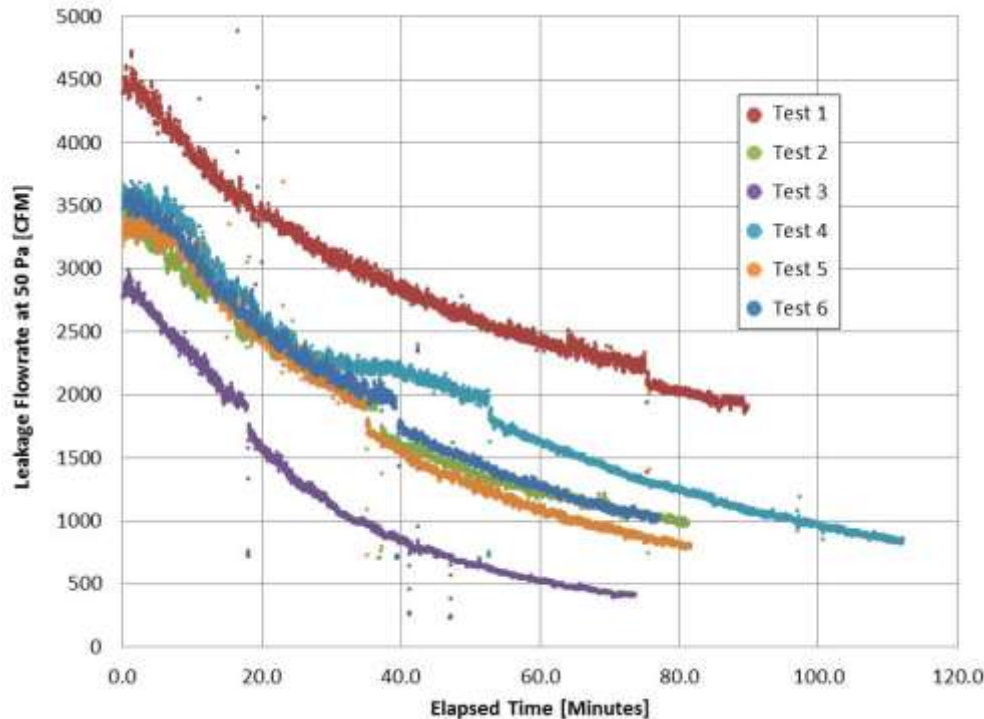
Pre-Sheetrock Sealed Leaks



Post-Sheetrock Sealed Leaks



Envelope-Sealing Tracking and Performance: 2,000+ sq. ft. homes in Clovis



LARGEST HOUSE
SIZE SEALED
3,550 sq. ft.



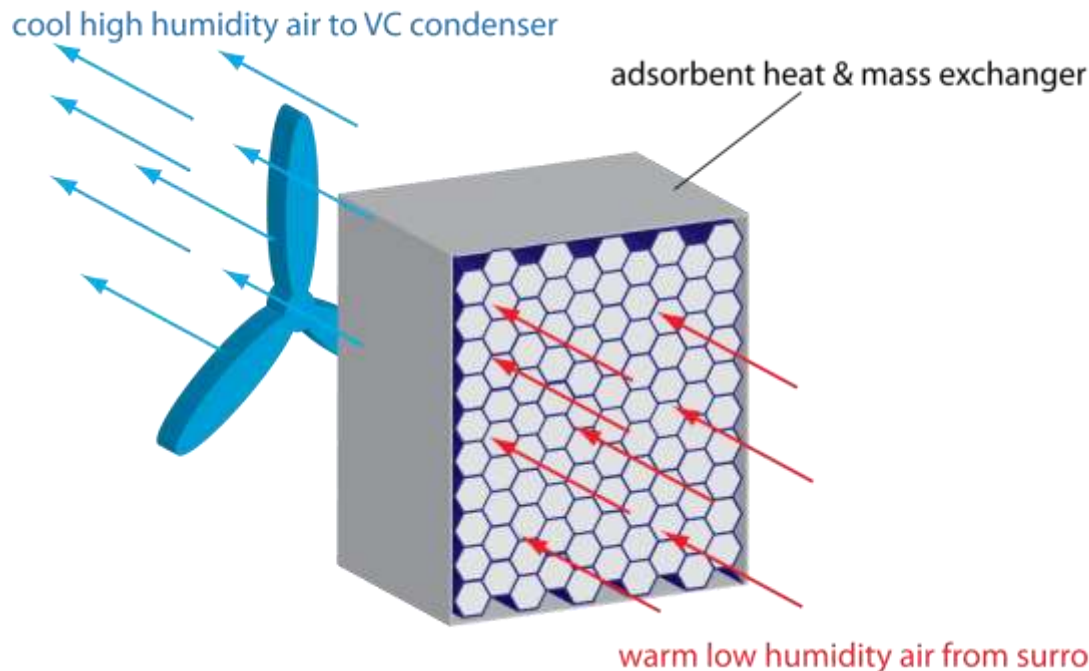
AVAILABLE LEAKS
SEALED
62-85%



TIME TAKEN TO
SEAL
94-112 minutes

Seals envelopes more effectively and in a fraction of the time of standard practices

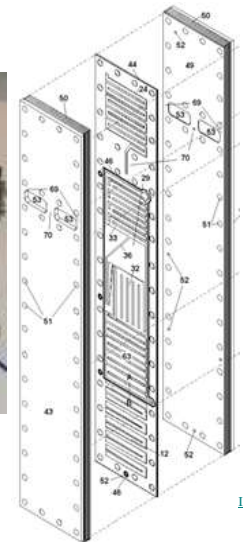
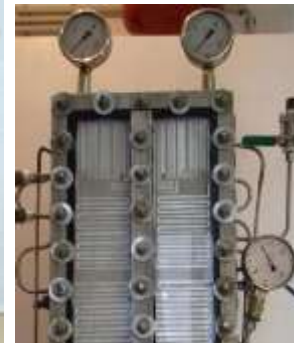
Proposed Research: Waterless Evaporative Pre-cooling



Research Question: Can temperature swings between day and night time be used to capture moisture onto an adsorbent heat and mass exchanger at night and use it to pre-cool condenser air during daytime?

Proposed Research: Performance Testing of a Mini-Channel Absorption Chiller

- Miniaturization of ammonia-based absorption chiller technology.
- Partnership with Tranquility America Icebook
- Cycle could be powered with
 - Waste heat
 - Solar energy
 - Natural gas



CASE STUDIES | PRESS
ARTICLES | NEWS |
HVAC PRESENTATIONS |
NEWSLETTER | REPORTS
PUBLICATIONS |
INTERVIEWS | RESEARCH
EDUCATION |
DEMONSTRATION BRIEFS |
OVERVIEW | OUTREACH |
MISSION | CONTACT |
TECHNICAL SERVICE
AGREEMENTS |

wcec.ucdavis.edu

| TECHNOLOGY TOPICS |
SECTOR RESEARCH |
BEHAVIORAL RESEARCH |
SYSTEMS INTEGRATION |
CONTROLS | DEMAND
SIDE MANAGEMENT |
E V A P O R A T I V E
TECHNOLOGIES |
RADIANT COOLING |
MULTI-TENNANT LIGHT
COMMERCIAL |