Western Cooling Efficiency Center Workshop on Modern Evaporative Cooling Technologies

July 9-10, 2007, Boulder, Colorado

ADVANCED ROOFTOP UNITS

Howdy Reichmuth, Sr. Engineer

Indirect Evaporative Hybrid – the Desert CoolAire™ Unit

With support from:
NORTHWEST ENERGY EFFICIENCY ALLIANCE
www.nwalliance.org

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
The Power To Do More.®

Desert CoolAire™ Package Rooftop Unit

"Hybrid" = Indirect Evap + Dx Cooling + gas pack

- Refrigerant Capacity (DX): 48,000 btu
- Total Cooling Capacity: 60,000 btu
- Total Heating Capacity: 115,000 btu
- Compressor: 10-100% Digital modulating scroll
- VFD Blower
- Supply Air: 1800 CFM at 1 inch ESP

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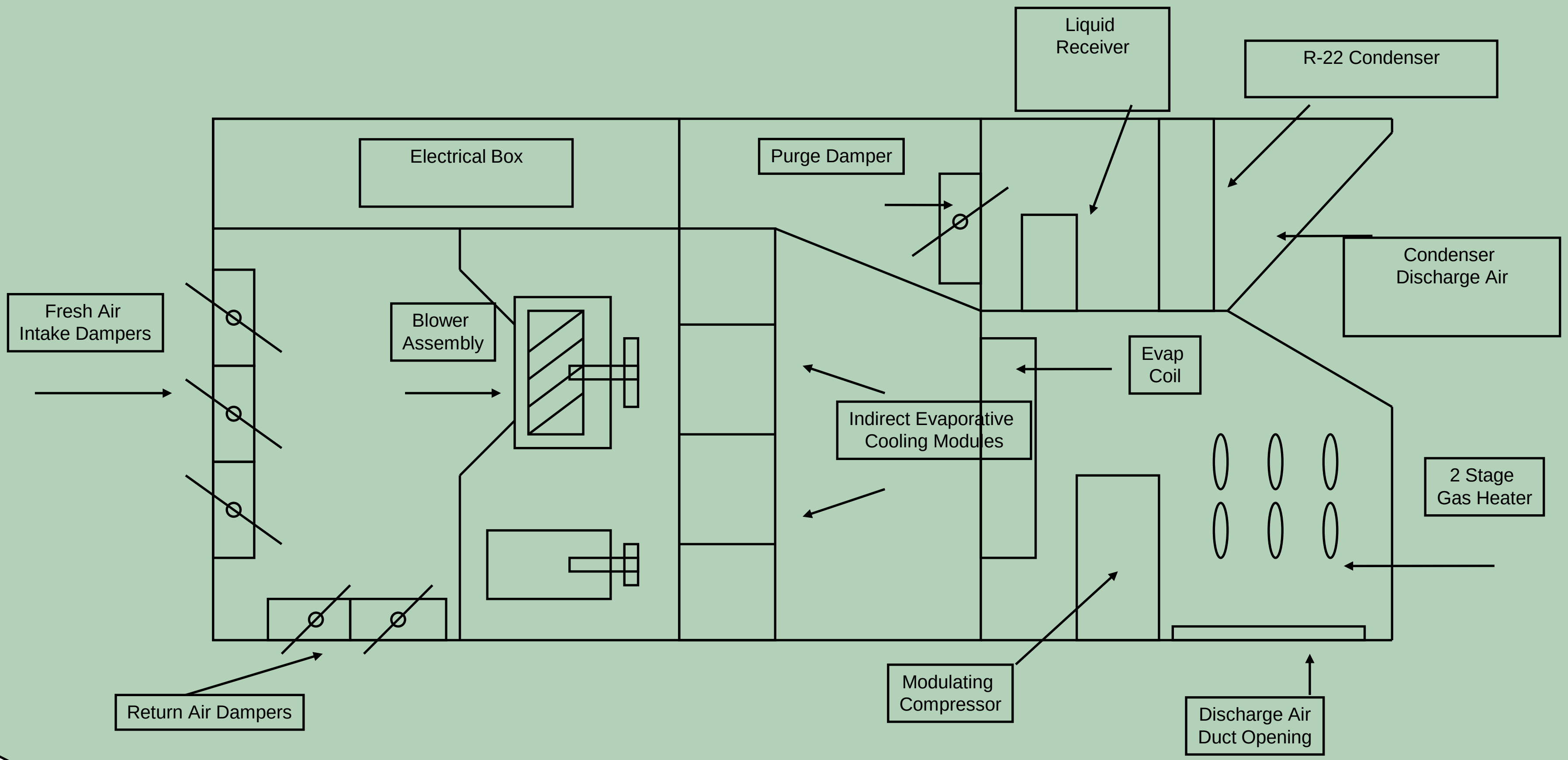
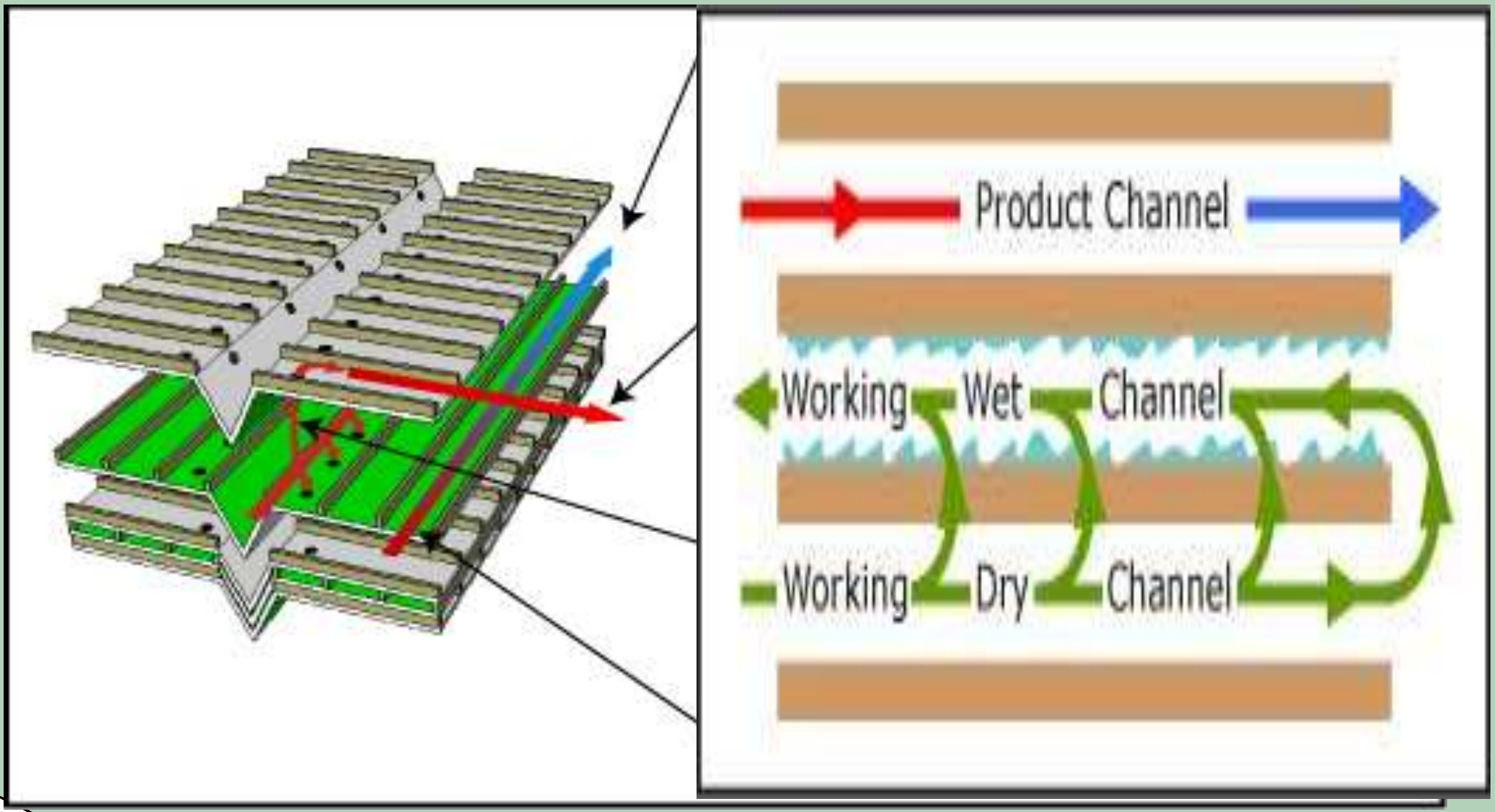
Unit Component Layout



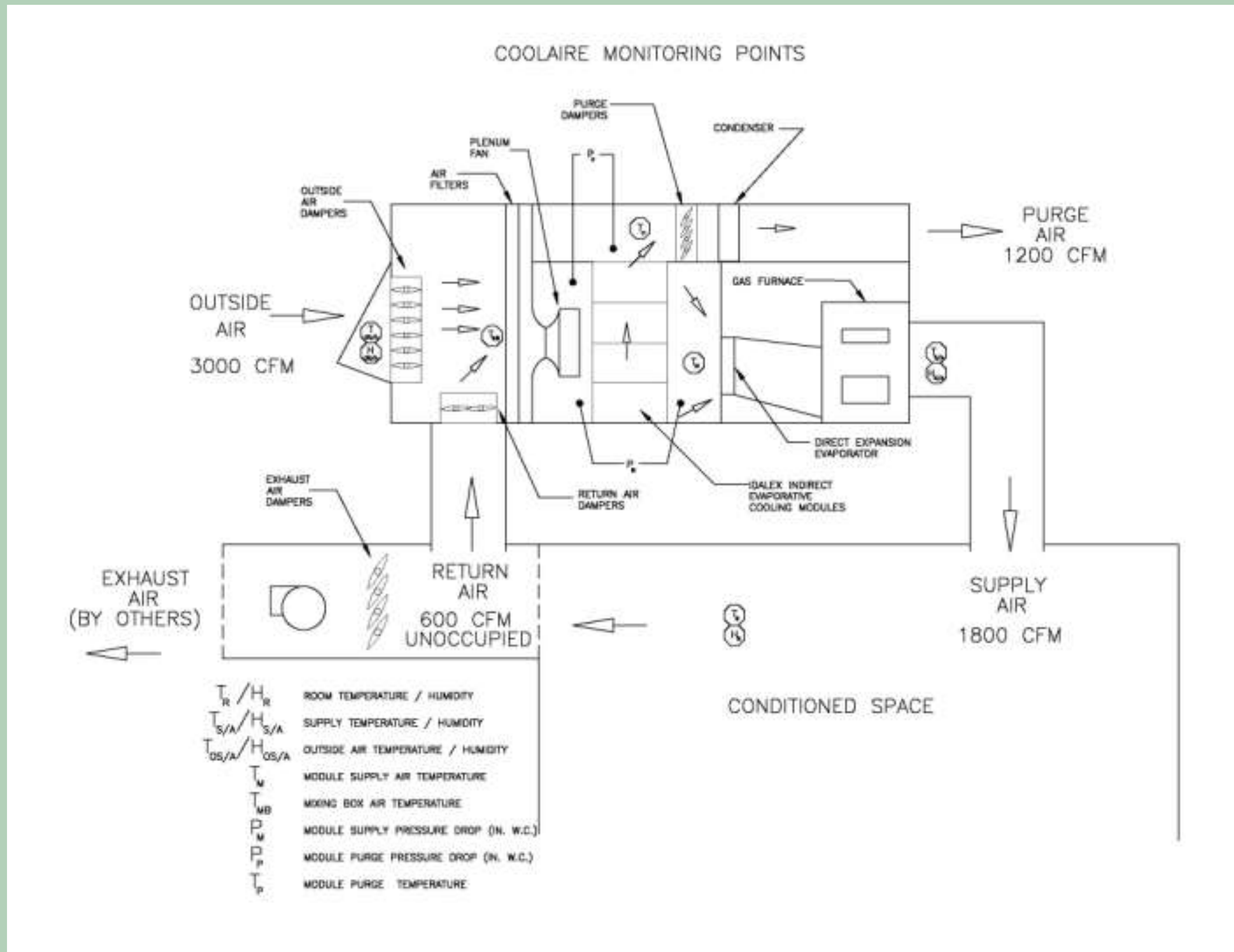
Indirect Evaporative Cooling - Maisotsenko-Cycle



The Delphi HMX

formerly manufactured by Coolerado

Monitoring, Etc.

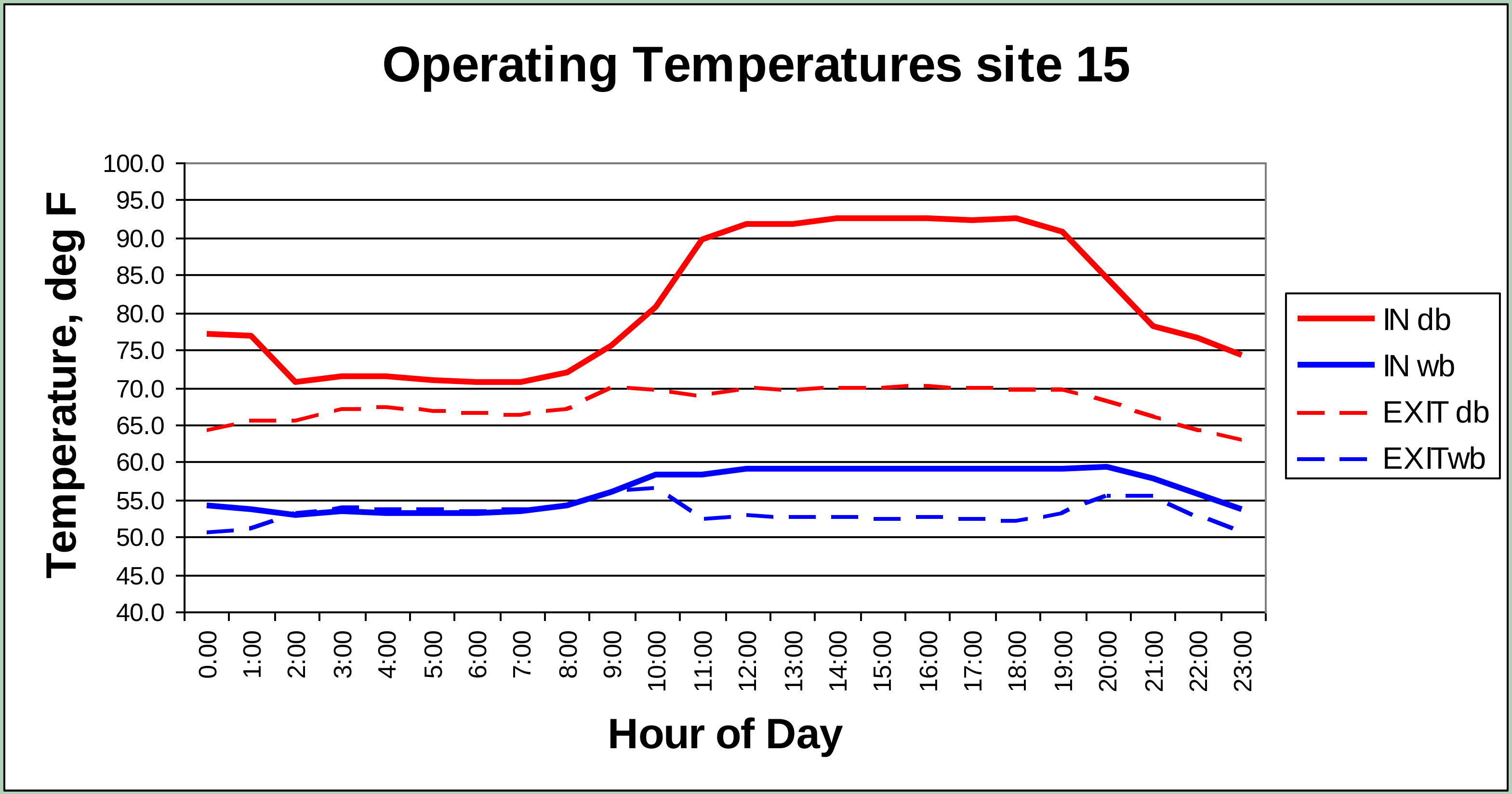


Monitoring Done By AEC

- One-minute data internet accessible
- Aggregated to one-hour data by mode
- Complemented by site measurements

Core Performance 1

A typical indirect evaporative cooling “moment”



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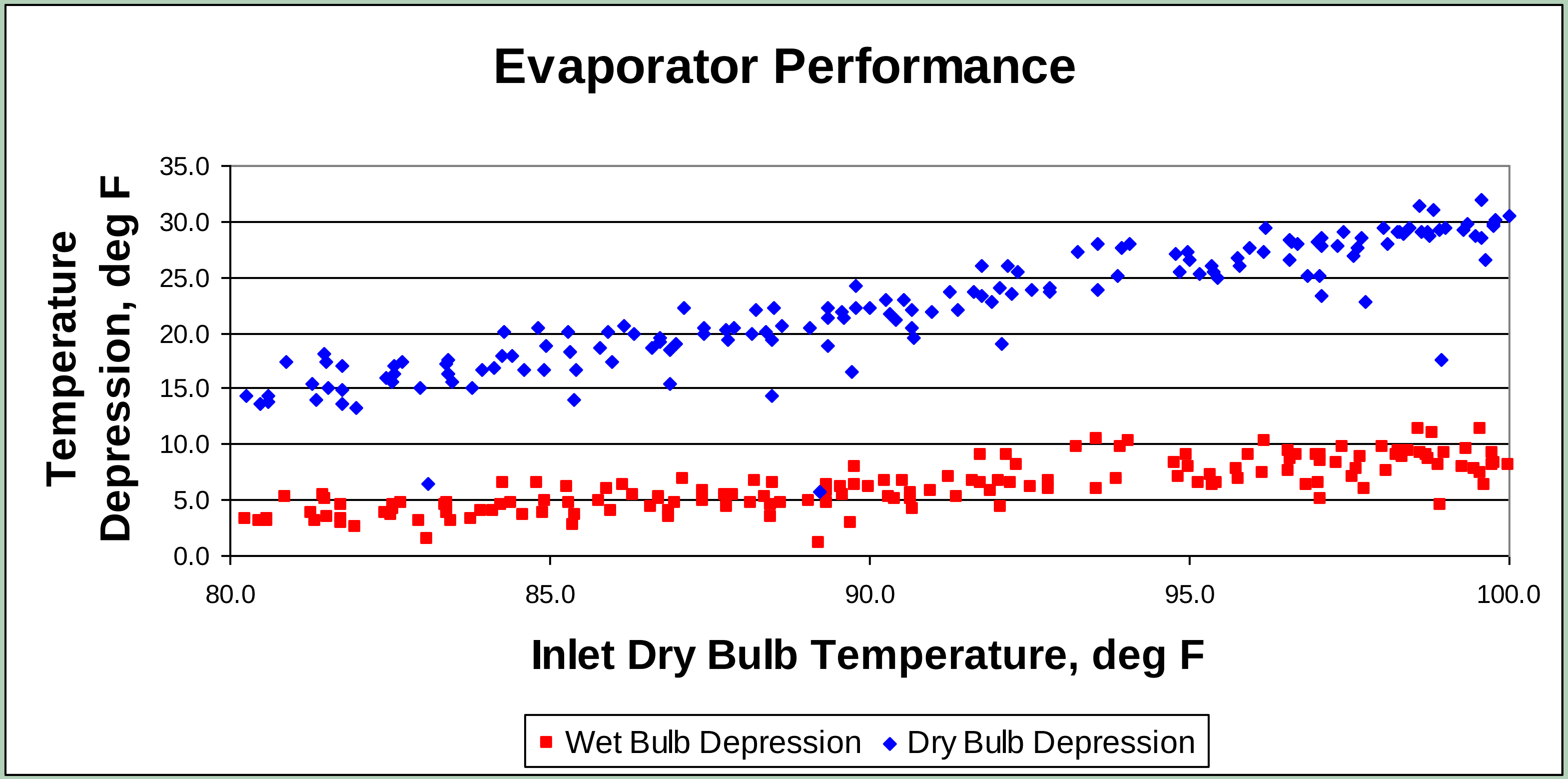
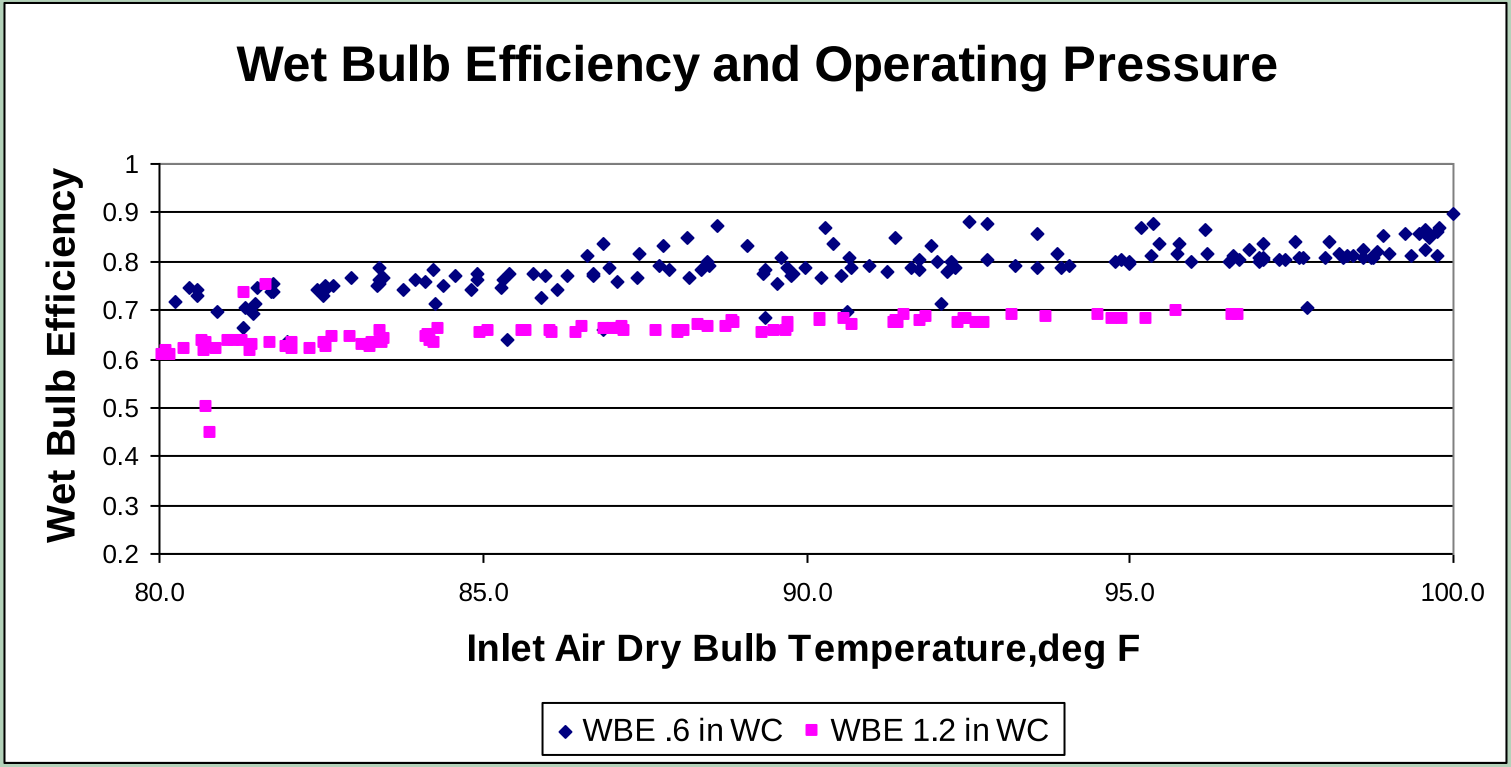
Core Performance 2

Performance varies with outdoor temperature

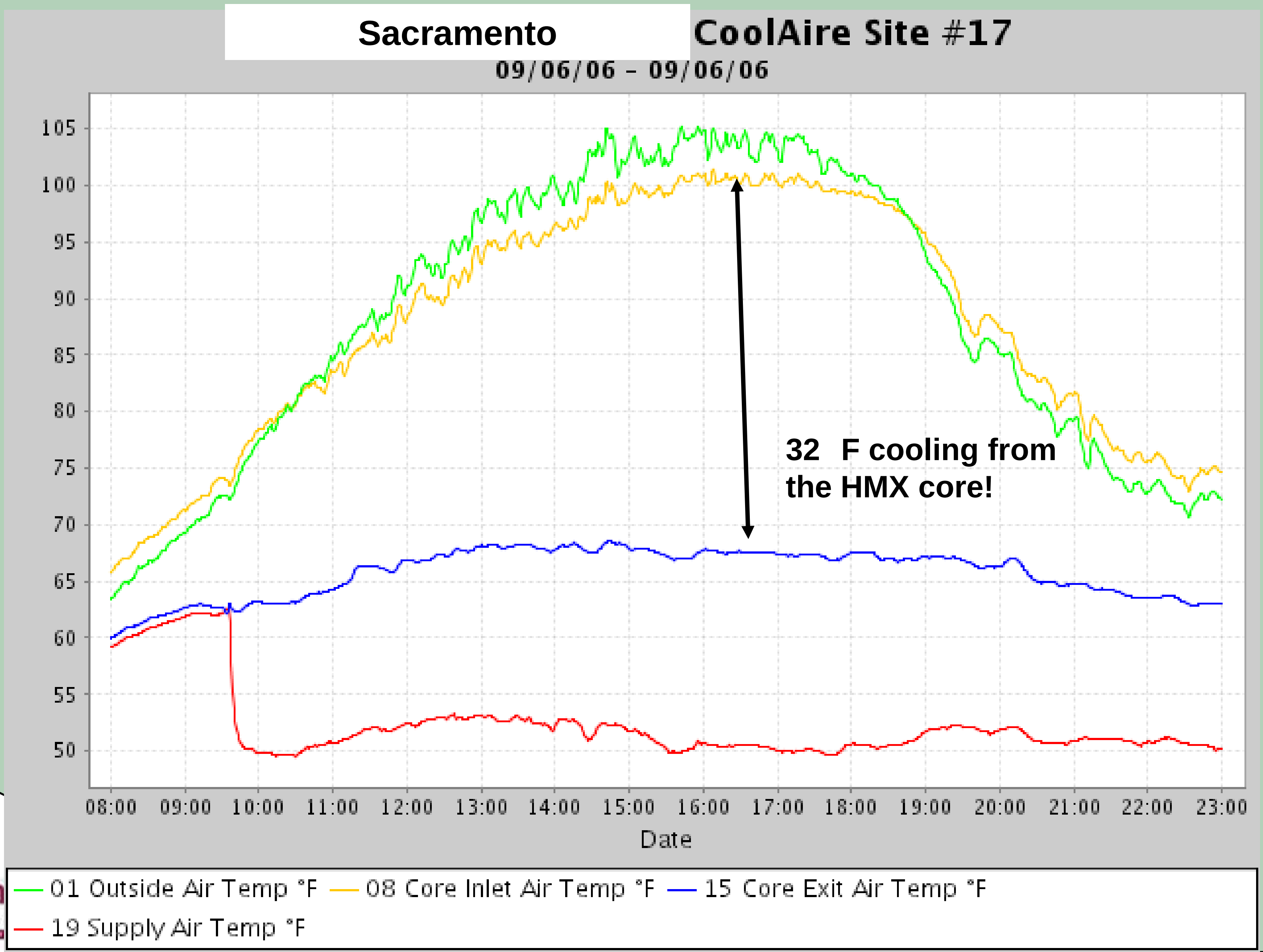


Core Performance 3

Evaporative efficiency varies with airflow

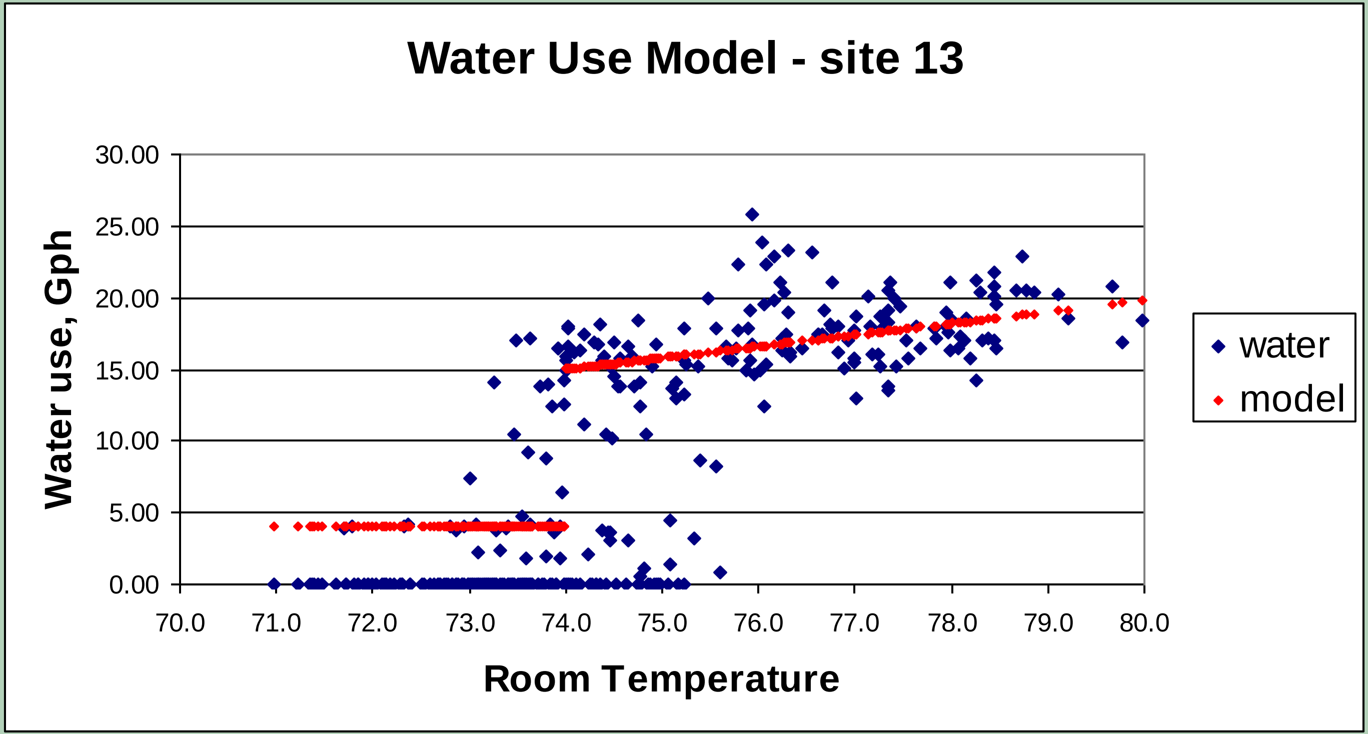


Desert CoolAire Results - *draft*



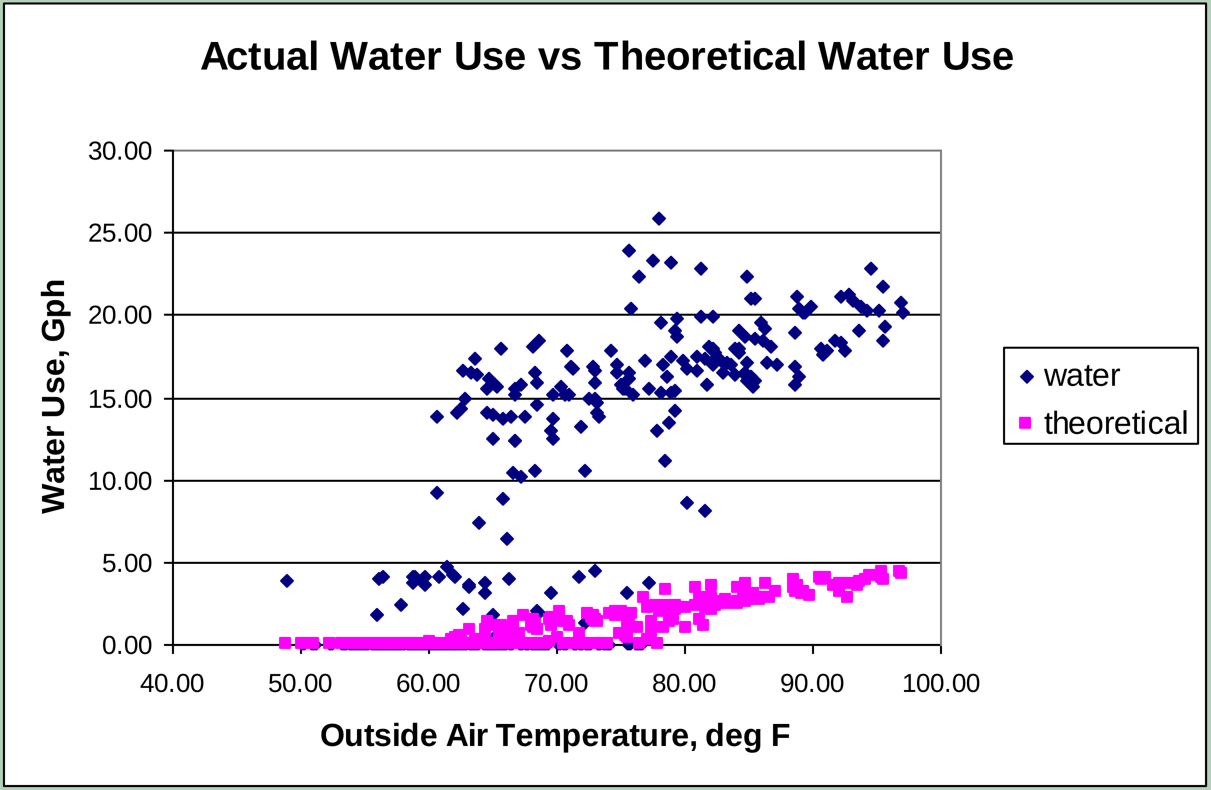
Water Performance 1

Water use varies with outdoor temperature



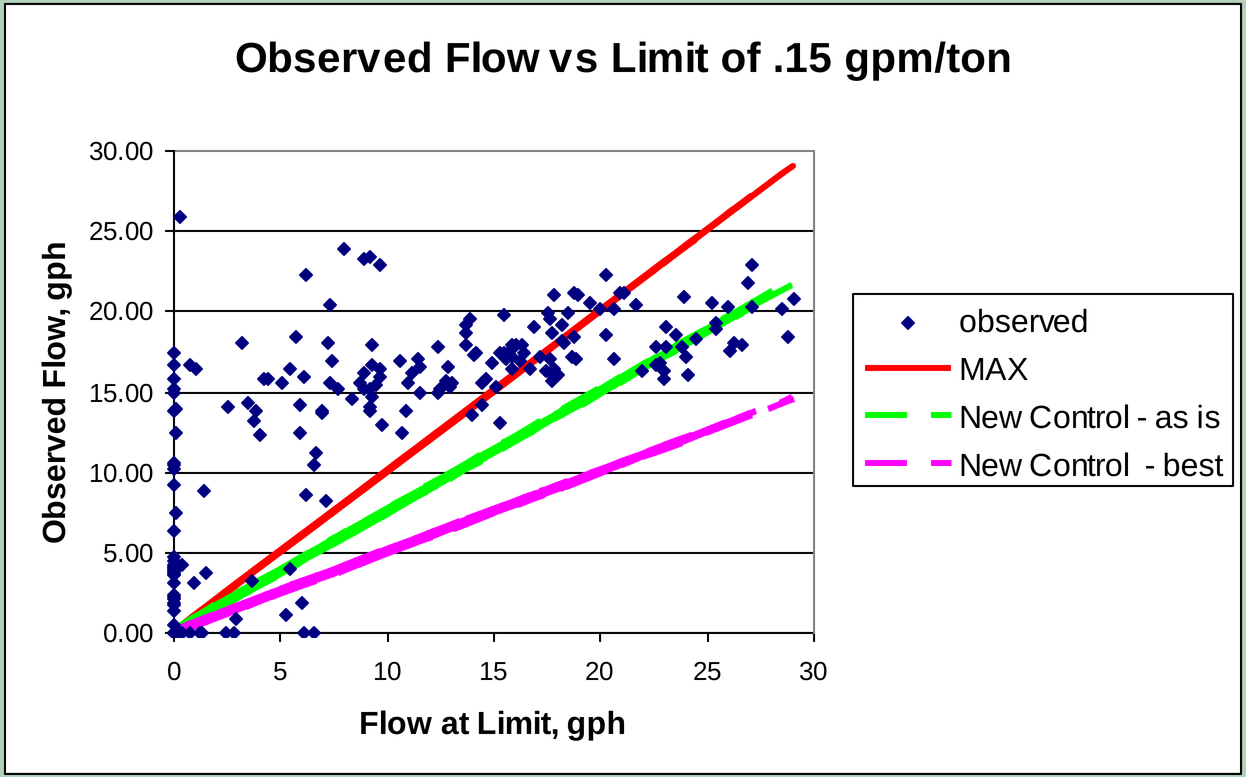
Water Performance 2

Water use compared to theoretical minimum water need



Water Performance 3

Water Performance Compared to Maximum Allowed



Location, location, location

- Applicability of indirect evaporative cooling depends on entering wet bulb
- Overall efficiency depends on high need for cooling
- Equivalent psychrometric presentation in terms of web bulb and dry bulb

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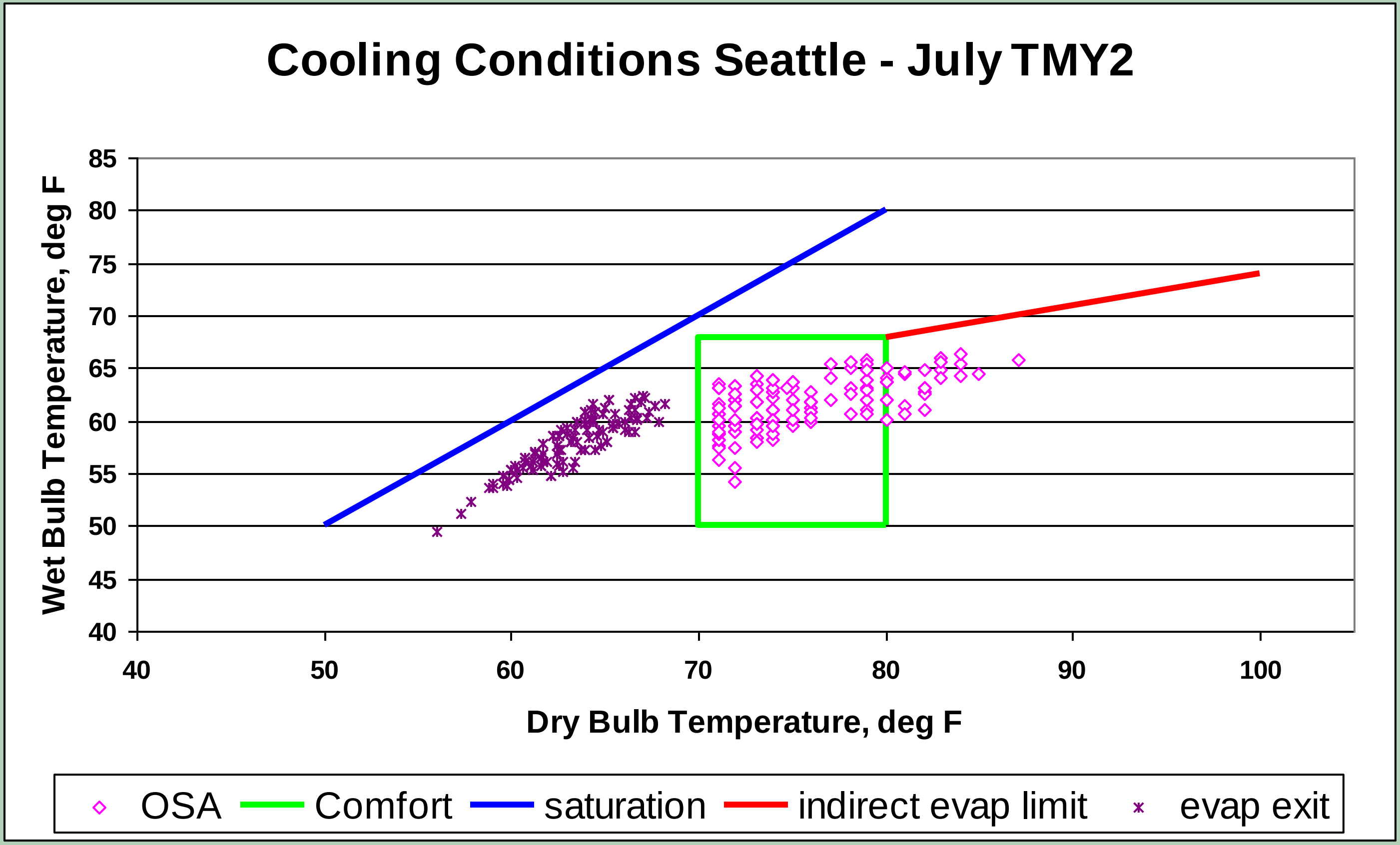
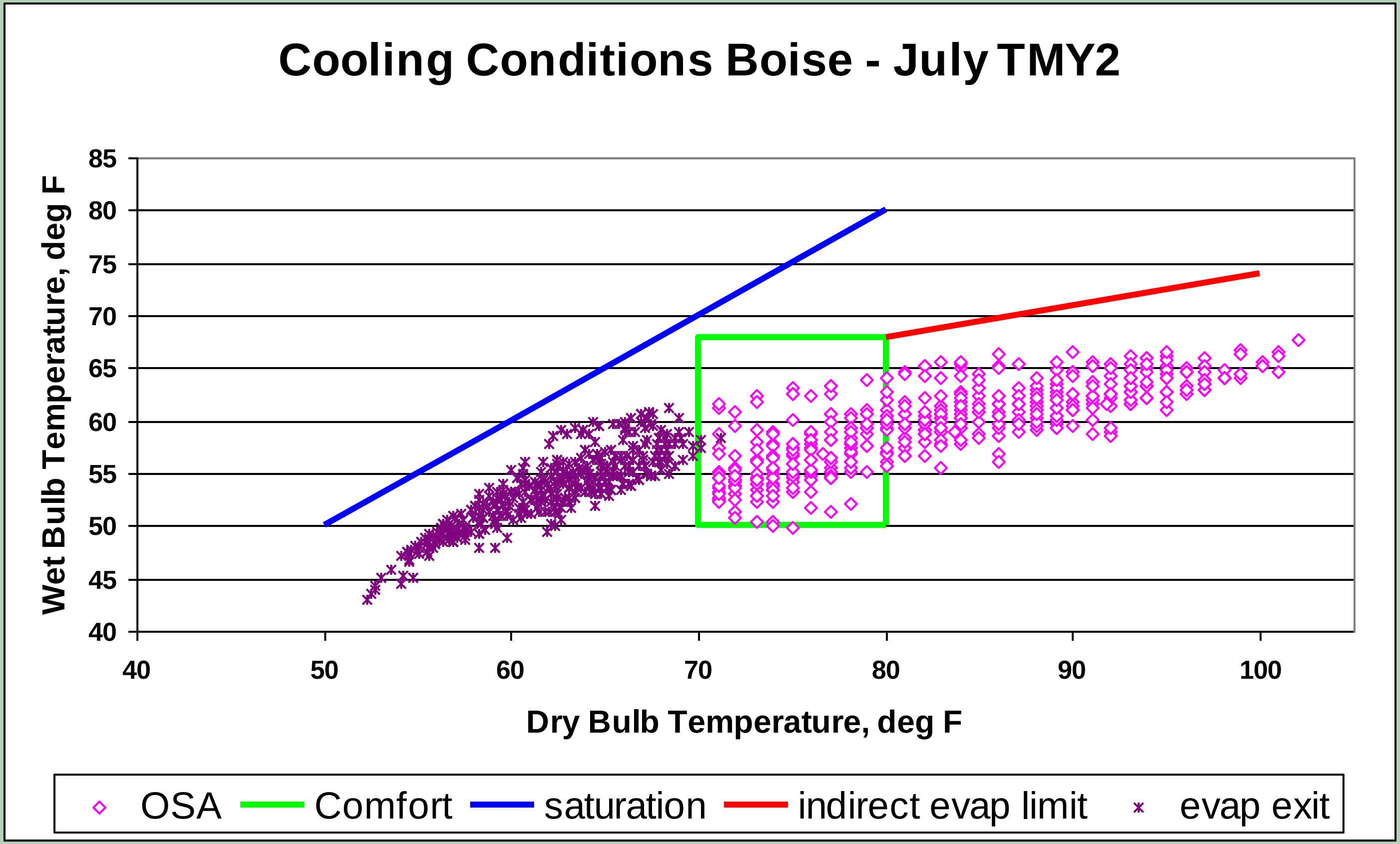
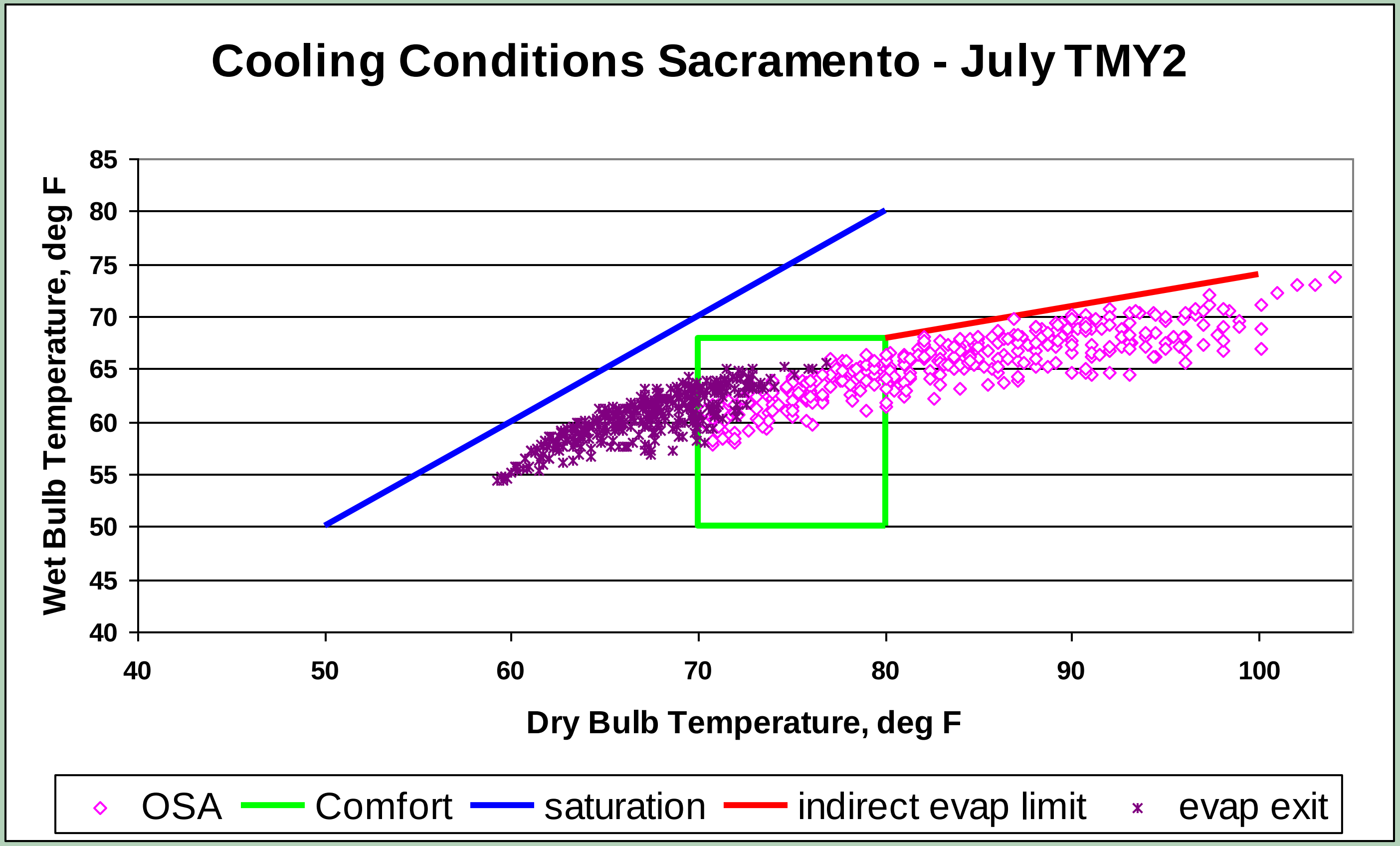
Low Cooling Situation



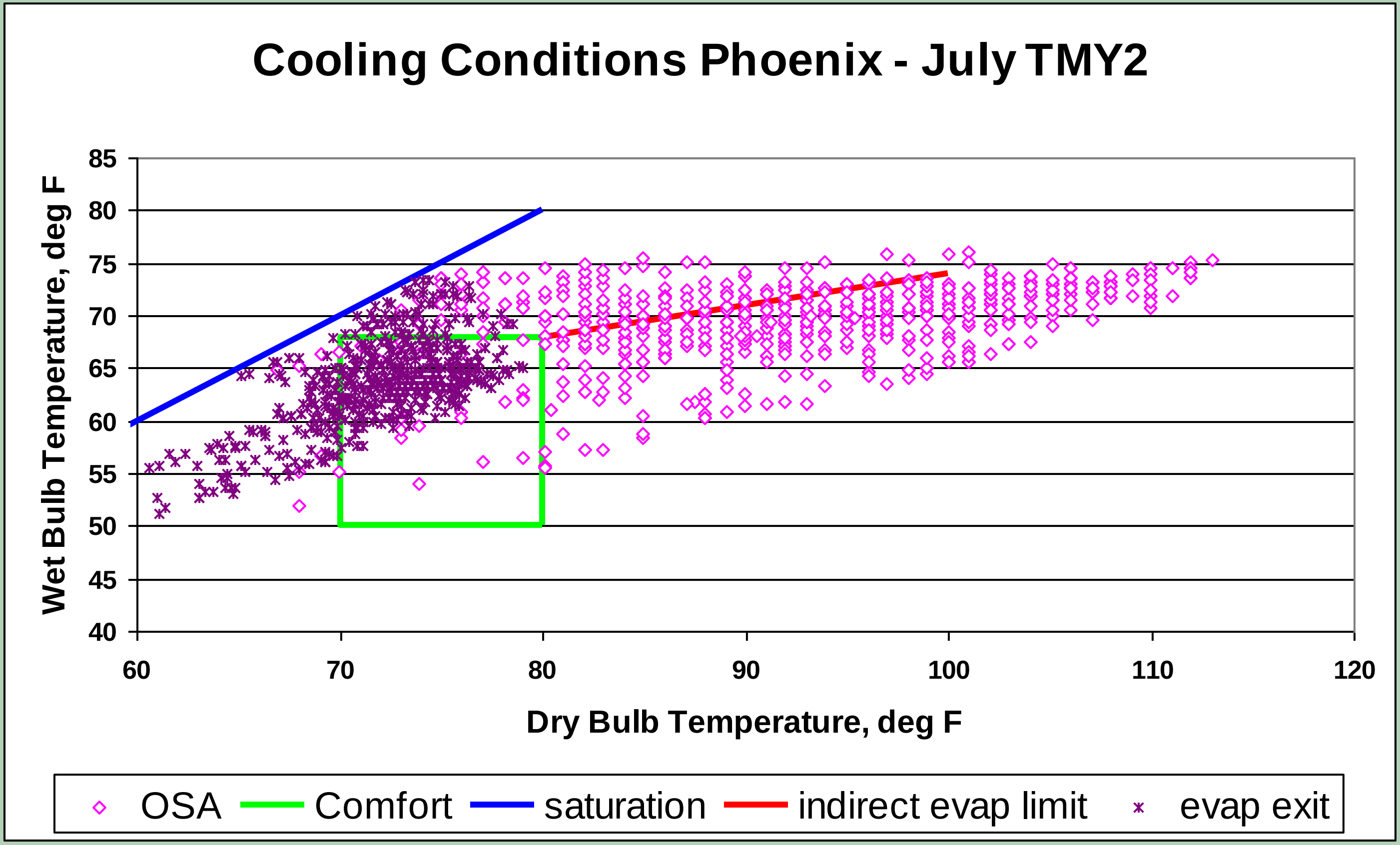
High and Dry Cooling



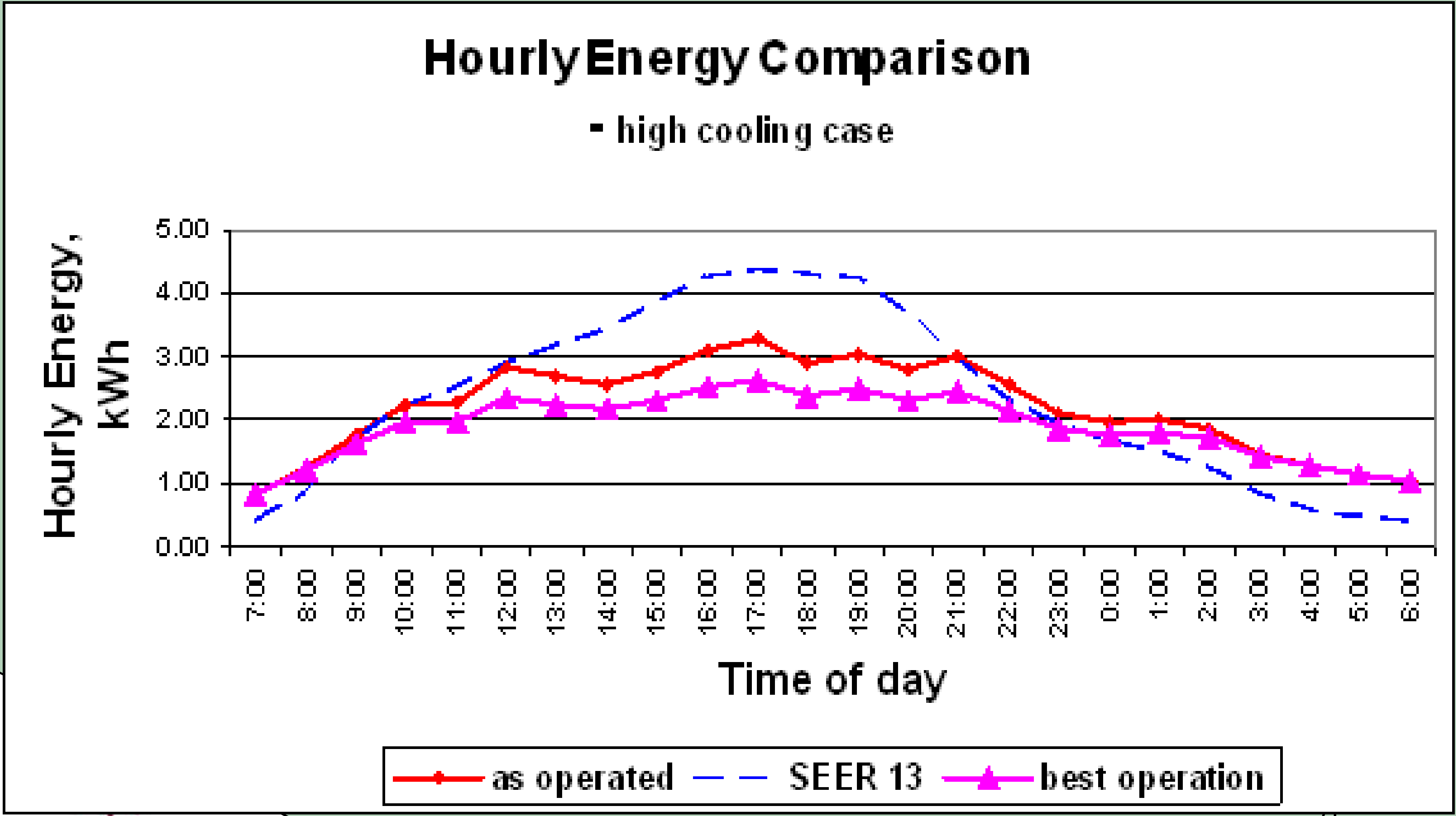
California Valley Cooling



Difficult Cooling



Desert CoolAire Results - *draft*



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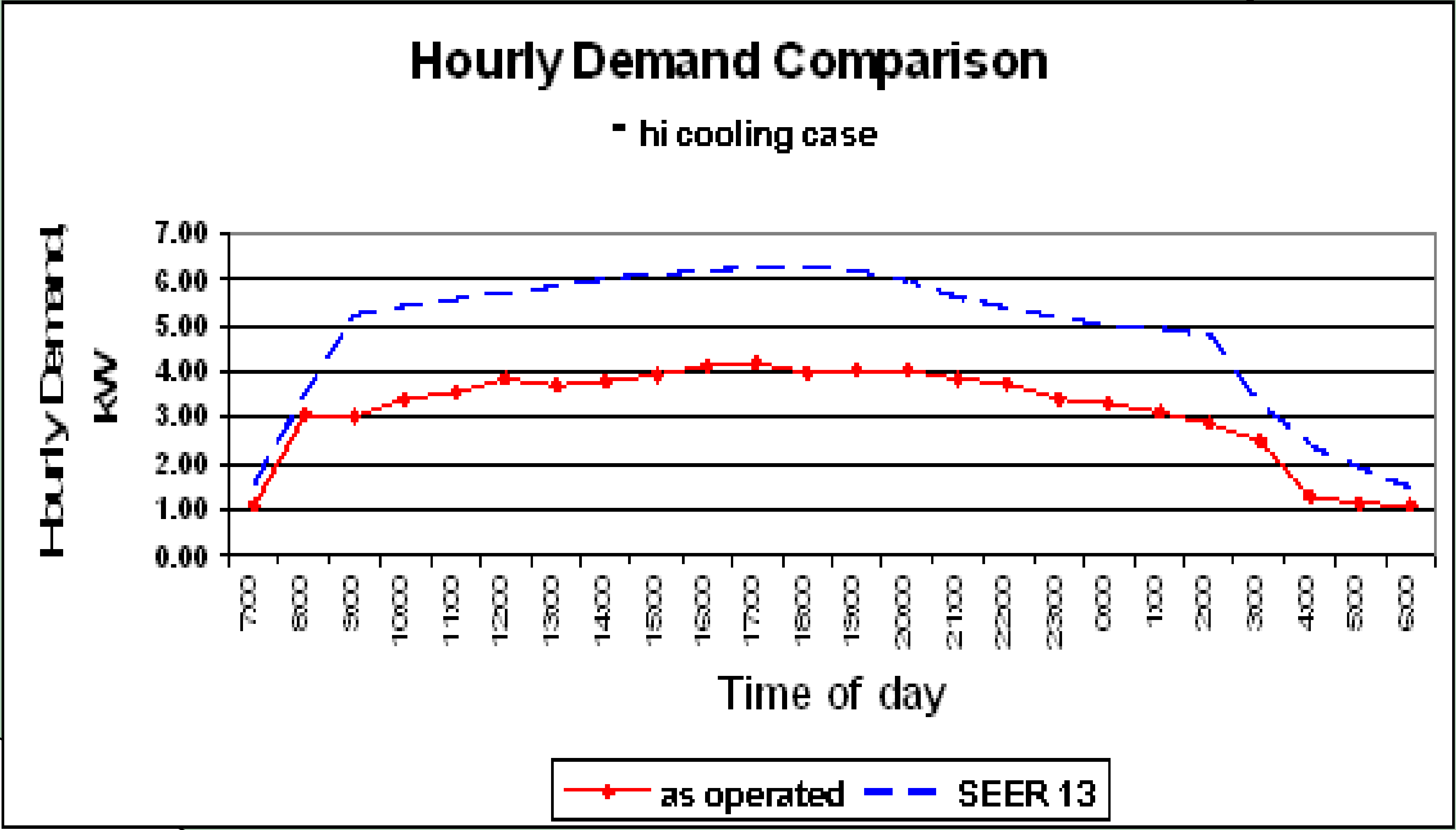
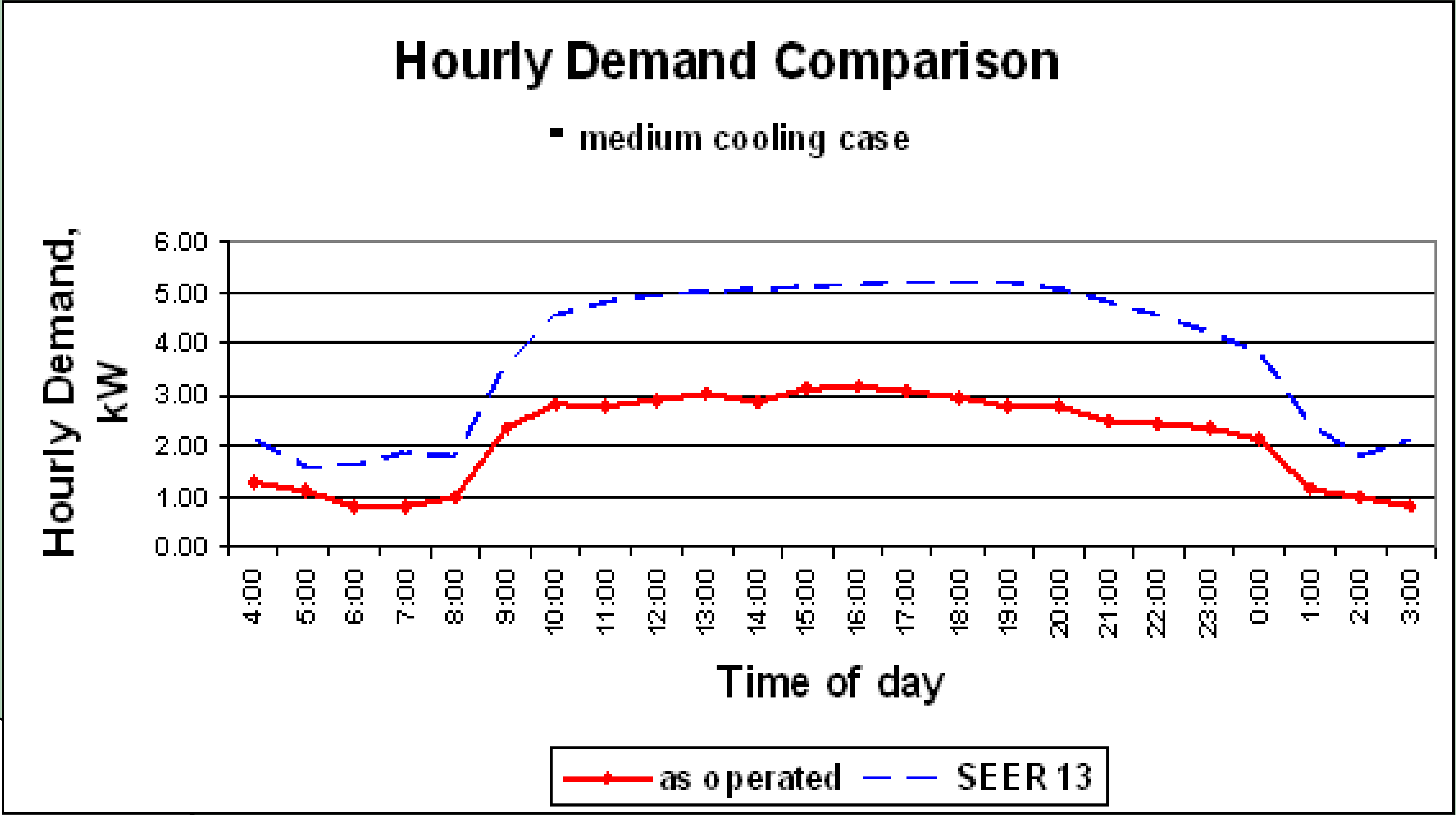


Desert CoolAire Results - *draft*



CoolAire Performance Comparison

EER Comparison of CoolAire and Reference Systems			
		High Cooling Case (Tmax 103F)	
	System	**Avg. Daily EER**	**Tmax Hour EER**
Reference	*SEER 10*	9.6	8.5
	SEER 13	11.6	10
Cool Aire	*Prototype*	12.3	15
	Gen2	19	25

Prototype Findings

- Energy Savings 6 - 23%
- Demand Savings 33 – 49%
- No Media Scaling*
- Non-optimal Prototype Design & Control (excessive fan energy, overuse of Dx, too much H2O)
- Possible 20%+ improvement with redesign

* 6 month observation

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Steps to Commercial Intro

- Lighter, Smaller and Cheaper
- Easier install
- Greater energy savings for owners
- Training on evap for standard RTU contractors
- Market the benefits
- Extend applications/change HVAC design – eg. Dedicated Outside Air Systems (D-OAS)

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Q & A

Evaporative Cooling Challenges

- Old direct evaporative technology image
- Managing mineral scale
- Putting water usage in context
- Potential changes to ventilation design for higher airflow rates
- Lack of recognition in codes and HVAC efficiency ratings
- Lack of knowledge on the part of owners, contractors, designers, facility managers
- Advanced evap. vendors too small
- Limited regulatory, policy & utility involvement

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