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neea

Evaporative Cooling in the NW

WCEC Affiliates Meeting May 7, 2013 Energy Center, UC Davis

NEEA-NBI Evaporative Projects

- 2007: Proof-of-concept, 5-ton Desert Aire Indirect/DX hybrid, multiple sites NW/CA
- Commercialized as the Coolerado *H80*
- 2010: Speakman 5-ton Indirect Direct (IDEC)/DX hybrid @ 2 Idaho sites
- 2012: Green Aire *Air$_2$0* 5-ton IDEC add-on; 1 Idaho site
- *2013:* Next generation *Air$_2$0* testing

Indirect DX Evaporative Hybrid – the Desert CoolAire™ Unit

With support from:

Northwest Energy Efficiency Alliance
www.nwalliance.org

CoolAire Protoype 2006

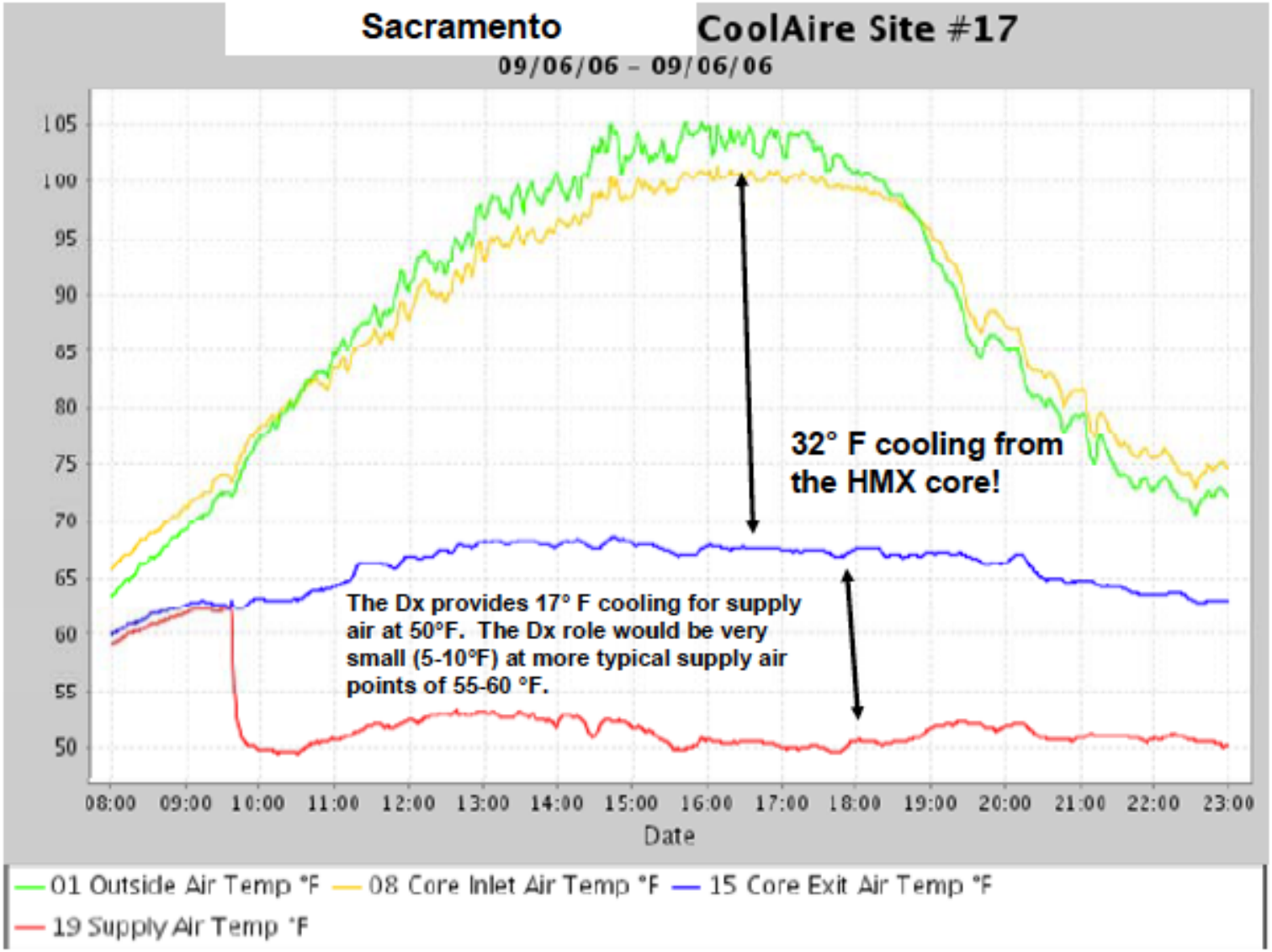

Figure 0-1 CoolAire Monitored Data from Sacramento at 100°+F

2006 - CoolAire Findings

- Zero compressor use projected for most of cooling season
- In NW, compressor could be locked out on peak with 65°F delivered
- Demand savings 2-3 kW (33-49%) coincident with peak
- Evaporative section measured at 25 EER; whole system measured at 15 EER at 103°F
- 4-ton compressor oversized for supplemental cooling—1-1.5 tons could be sufficient
- Little scaling observed; bio-growth on some cores; new core material developed
- Water use and fan power adjustments recommended

Indirect/DX Hybrid - Coolerado *H80*
Western Cooling Challenge

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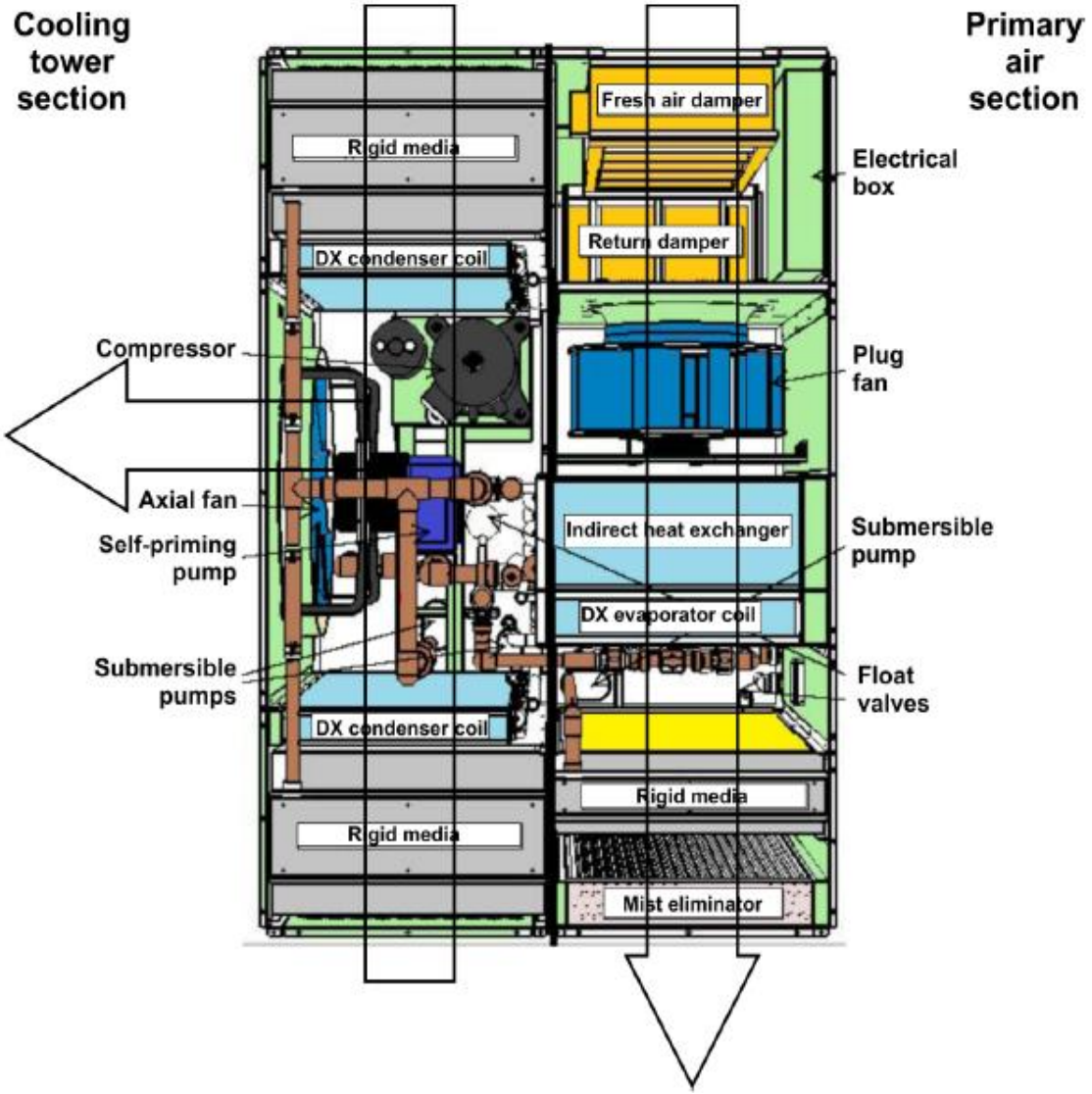
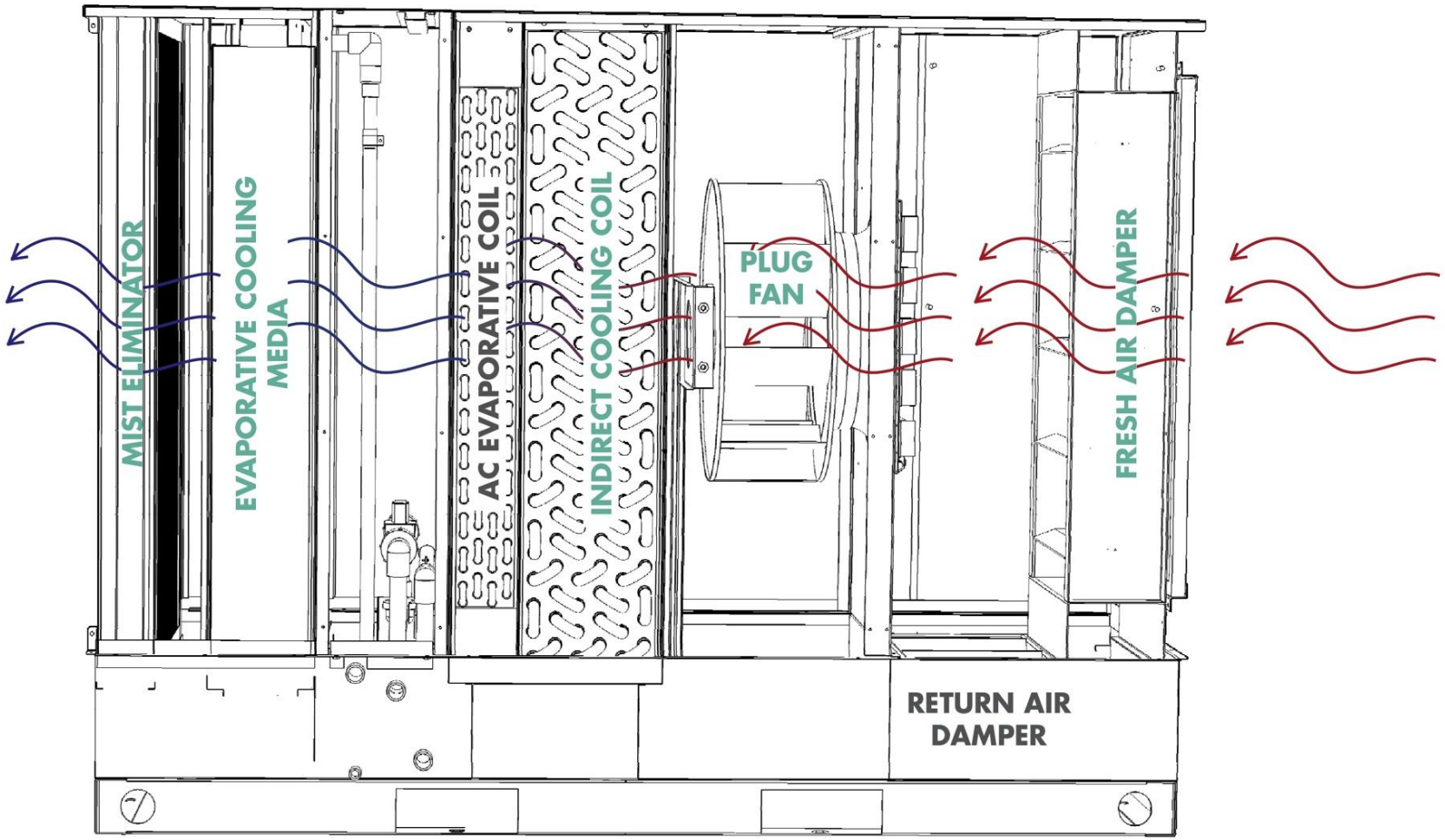
2007 - Evaporative Cooling Challenges

- 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
- Too few & small advanced evap manufacturers
- Limited regulatory, policy & utility involvement

Speakman *Quattro* IDEC – DX Hybrid



IDEC Hybrid


MIST ELIMINATOR
EVAPORATIVE COOLING MEDIA
AC EVAPORATIVE COIL
INDIRECT COOLING COIL
PLUG FAN
FRESH AIR DAMPER
RETURN AIR DAMPER


AIR 2O™ | QUATTRO™
HYBRID
CANCELED
pressure

NW RTUs - An Aging Fleet

Age Years		Under 5 tons	5 to 10 tons	Over 10 tons
		44%	36%	20%
0 to 4	17%	30,000	24,000	14,000
5 to 10	32%	56,000	46,000	26,000
10 to 19	35%	62,000	50,000	28,000
20+ years	16%	28,000	23,000	13,000

51% = 204,000 of the units have been on the roof for over a decade

GreenAire *AIR$_2$O™* 5-Ton

↻ AIR$_2$O CRS 2500	
DATA	
Area covered (industrial applications)	100 – 150 m² (1000 – 1600 ft²)
Area covered (residential applications)	200 – 250 m² (2100 – 2700 ft²)
Weight – Operating ❙ dry ❙ shipping	425 Kg. / 900 Lbs. ❙ 250 Kg. / 500 Lbs. ❙ 273 Kg. / 600 Lbs.
Dimensions (L X W X H)	1242 mm (48 7/8") X 1117 mm (44") X 1182 mm (46 9/16")
COOLING PERFORMANCE	
Total equivalent capacity [1]	5 TON (17.58 KW)
[1] Based on outdoor ambient condition of 100 °F / 37.8 °C DB and 70 °F / 21.1°C WB	
Total supply air	2500 CFM (4250 m³/h)
SUPPLY AIR PERFORMANCE	
Ext. static pressure	1 IWG (250 Pa)
Motor rating	1.5 HP
ELECTRICAL DATA	
Power supply	240 VAC 1 PH 50/60 HZ
TOTAL CURRENT (A)	11 A
Max. overcurrent device	20 AMPS
TOTAL POWER CONSUMPTION (KW)	2 KW

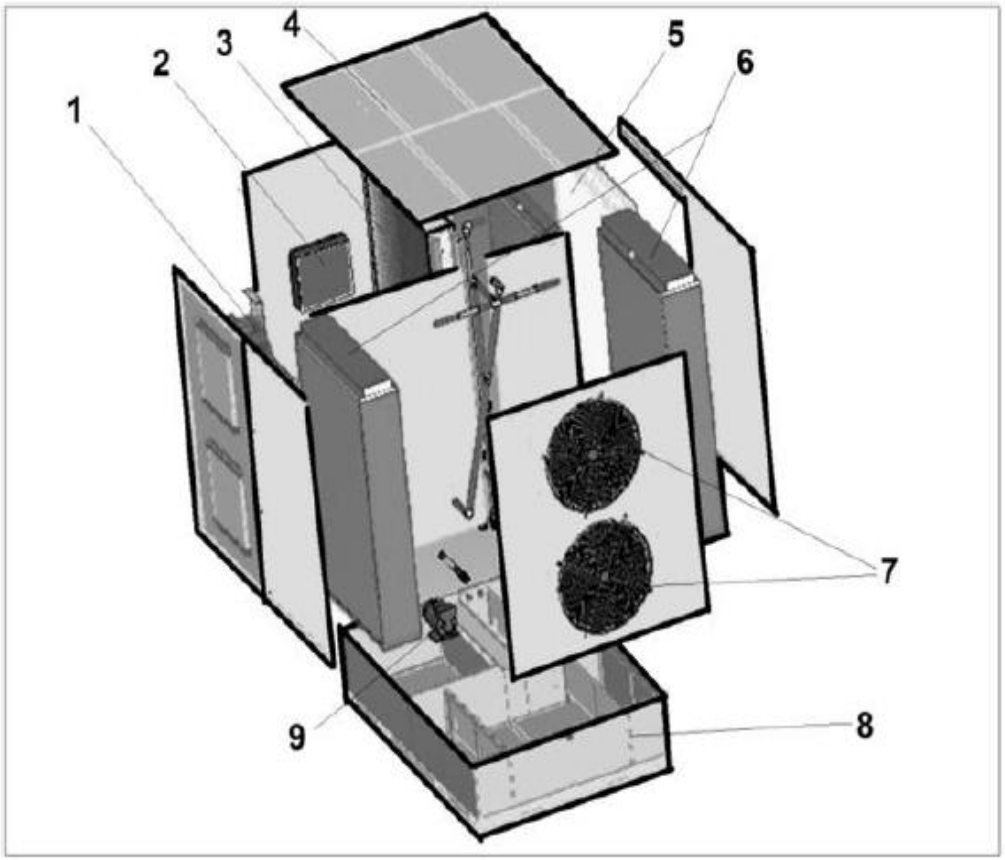
AIR$_2$O IDEC Arrives

IDEC Overview

- *GreenAire AIR$_2$0* Indirect/Direct evap RTU-Idaho
  - 3 gen unit (2nd gen IDEC/DX hybrid)
  - Add-on to existing 5-ton RTU
- IDEC/RTU interface fabricated in the field

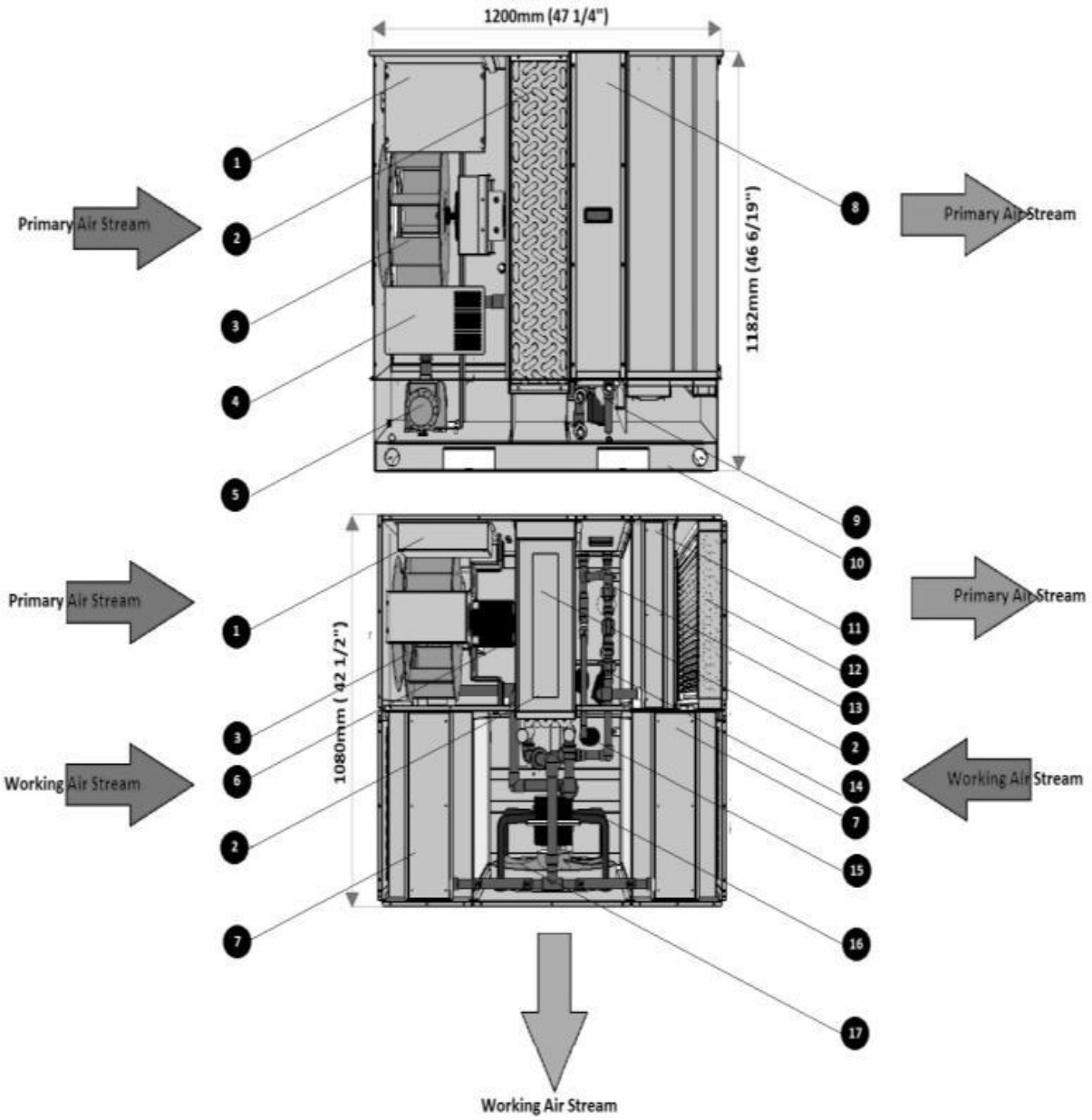
AIR$_2$O Integration w/5-Ton DX RTU

AIR$_2$0 Components



1	Centrifugal Fan
2	Control Box
3	Indirect Heat Exchanger
4	Top Cover
5	Direct Media
6	Indirect Media
7	Axial Fan (single Fan only for CRS2500,CRS500)
8	Water Sump
9	Indirect Water Pump

AIR$_2$O 5-Ton IDEC



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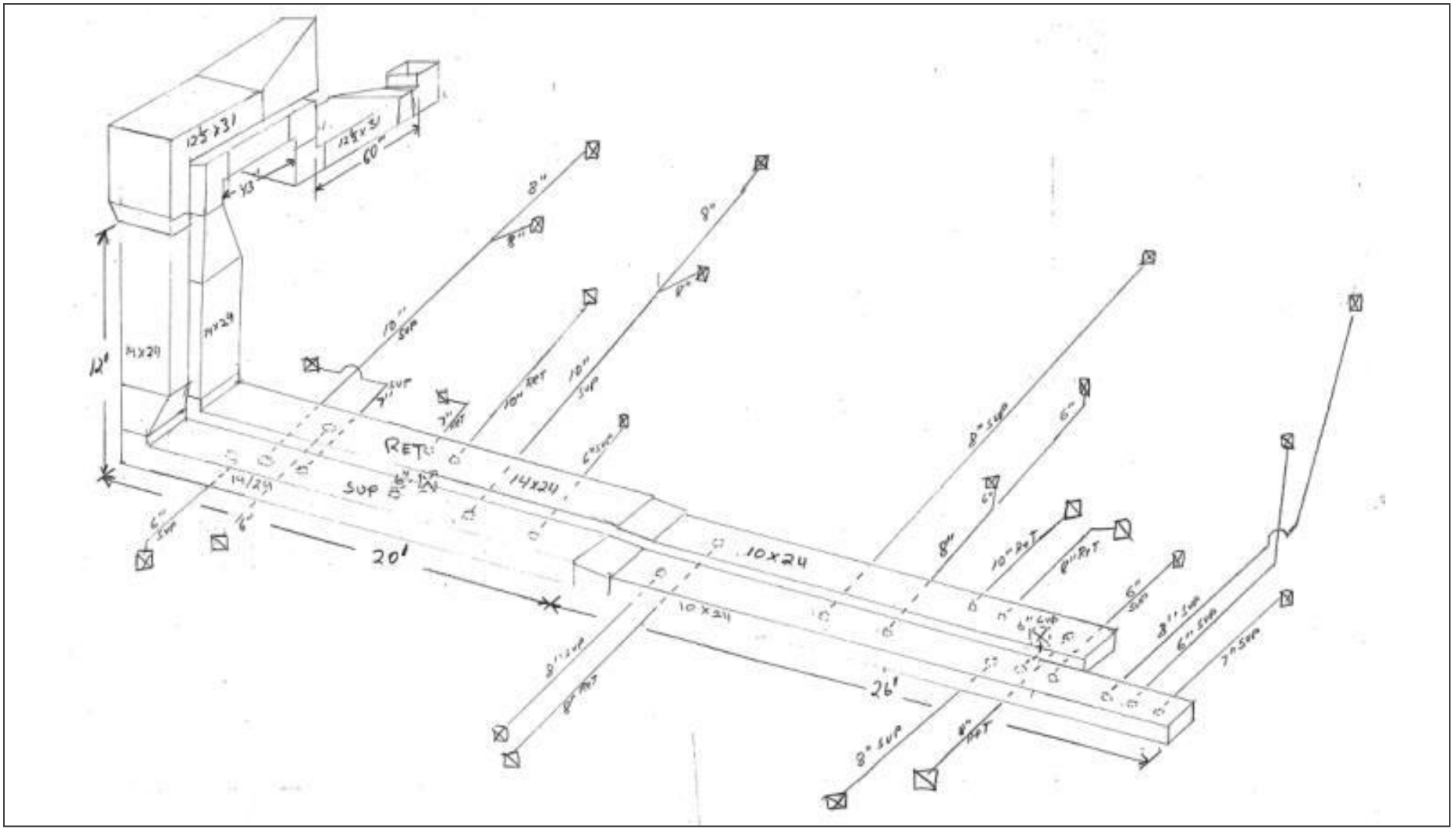
Munters Media

Direct - CELdek® 5090

Indirect - Munters CELdek®7090

Existing Duct Work



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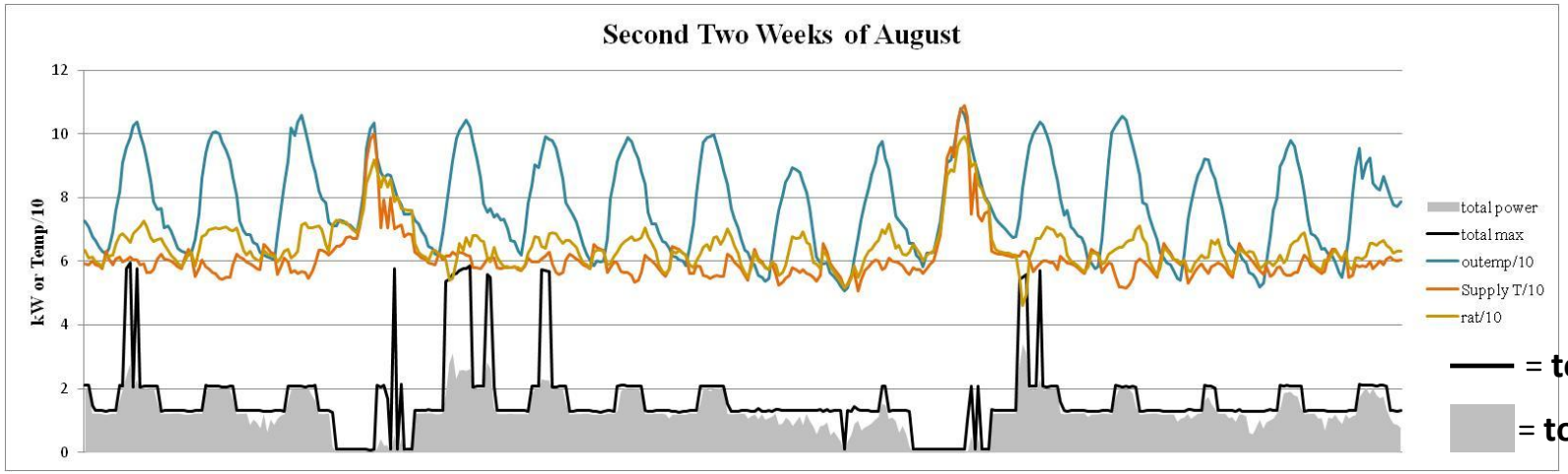
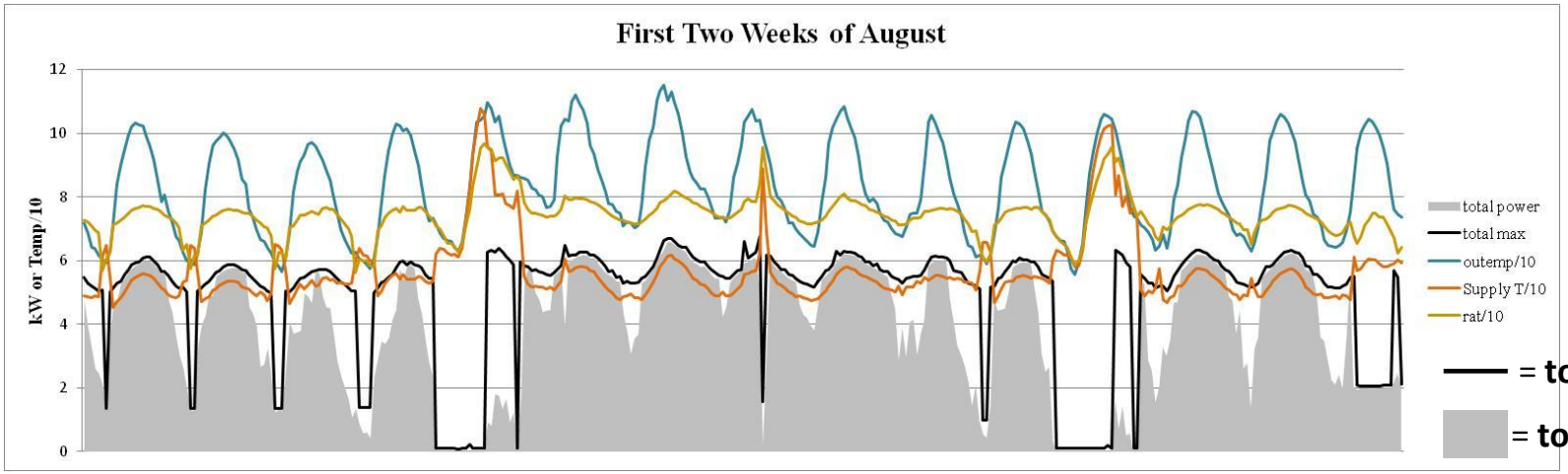
Idaho RTU vs. RTU/IDEC (2012)

RTU + IDEC cooling



RTU only cooling



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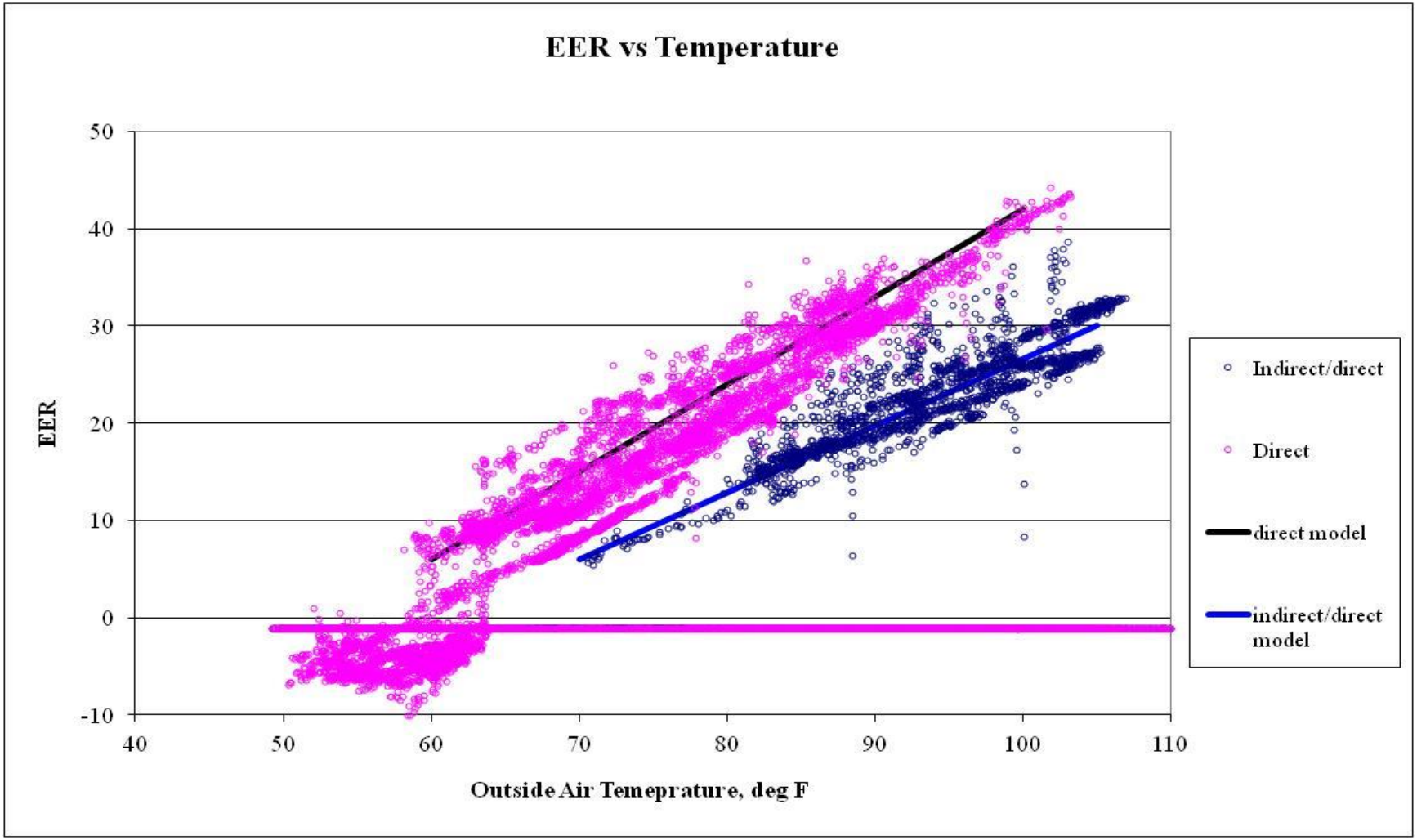
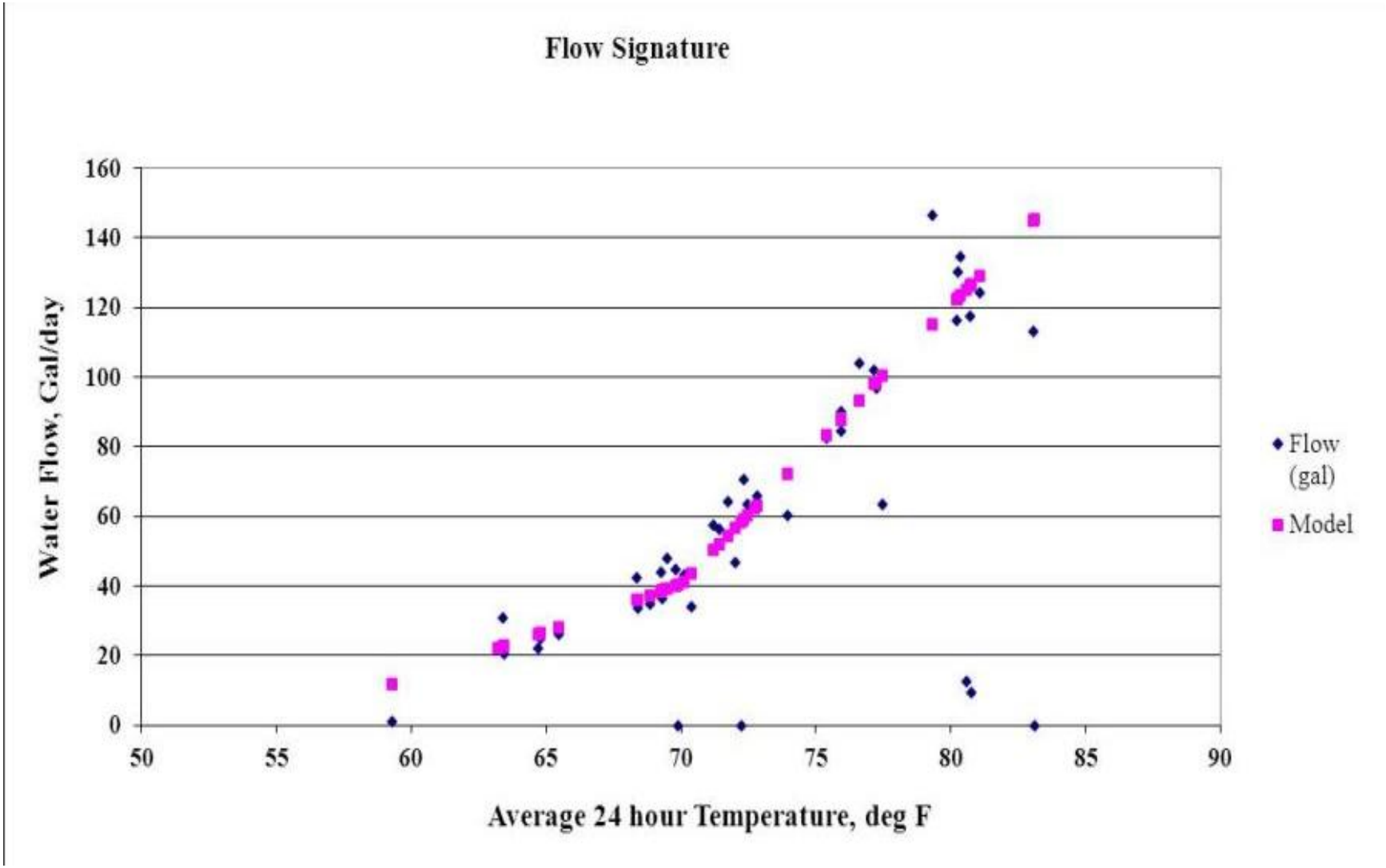
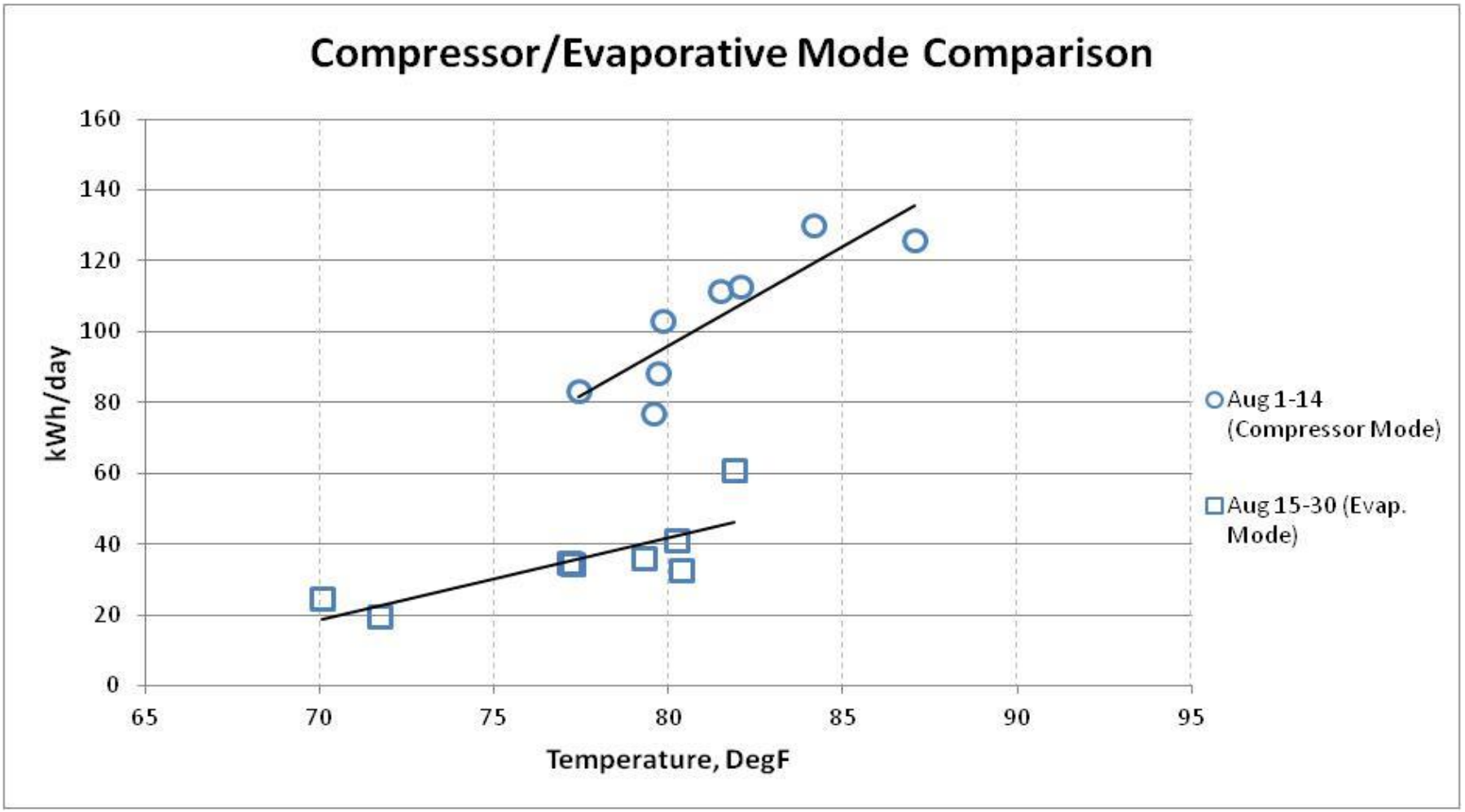
IDEC Performance



IDEC Water Signature



IDEC Savings Potential



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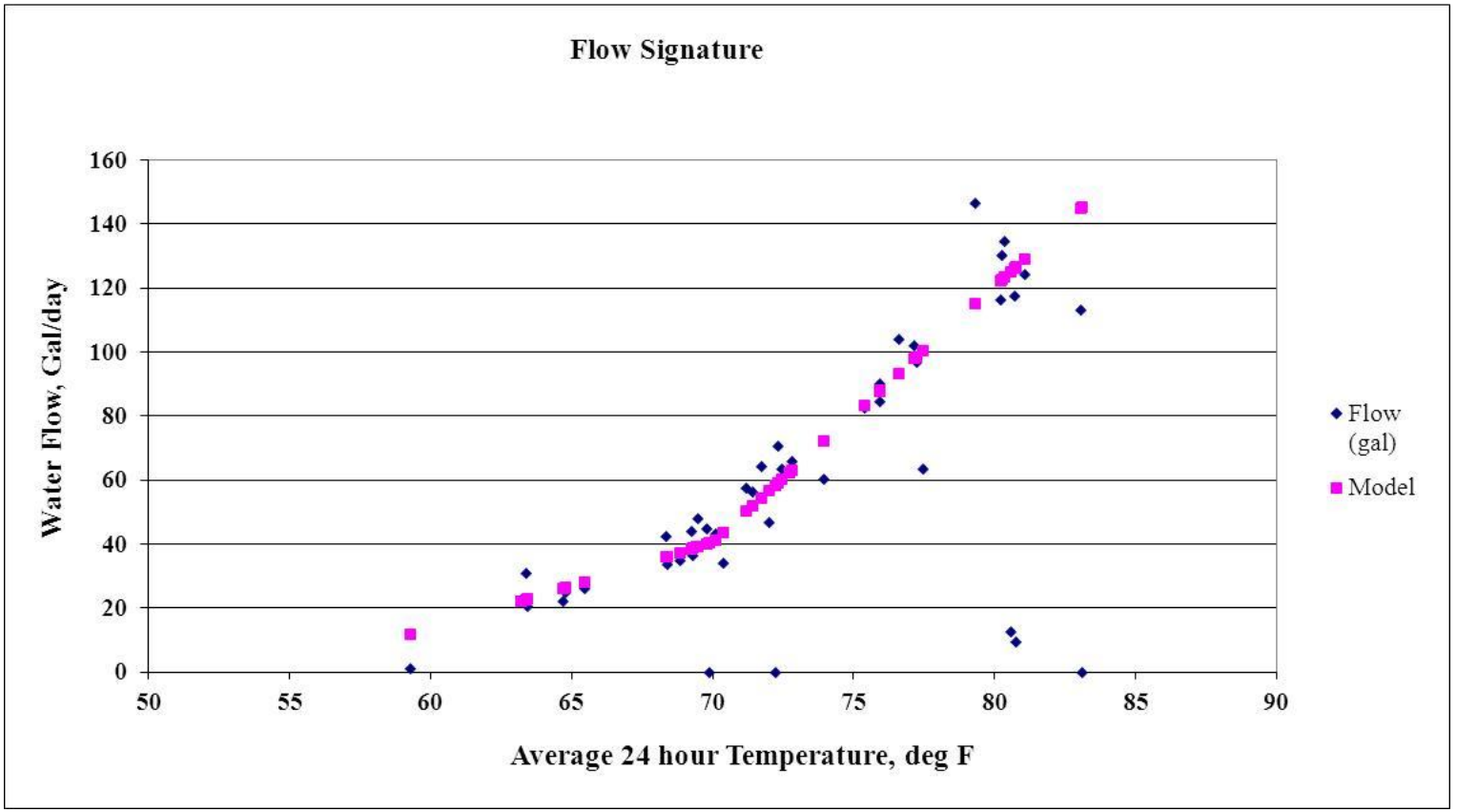
Savings Summary

Equipment	RTU	IDEC
Electric Energy (kWh)	6,475	2,849
Electric Demand (kW)	5.5	2.2

kWh savings 56% (3,600 kWh/yr)
-additional savings achievable with refinement of control settings

kW reduction 65% (3.5 kW)

Water Usage



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Gen 4 *AIR$_2$0*

- Water pump downsized 580w ↓ 380w
- Single speed motor to 3-speed
- Blower wheel depth change/w backward curve
- All LCD control board
- True 3-stage: economizer, direct, IDEC
- Improved purge control
- Redesign for 100% coil/pump drain down
- Control board fully integrated
- Improved interface with RTU

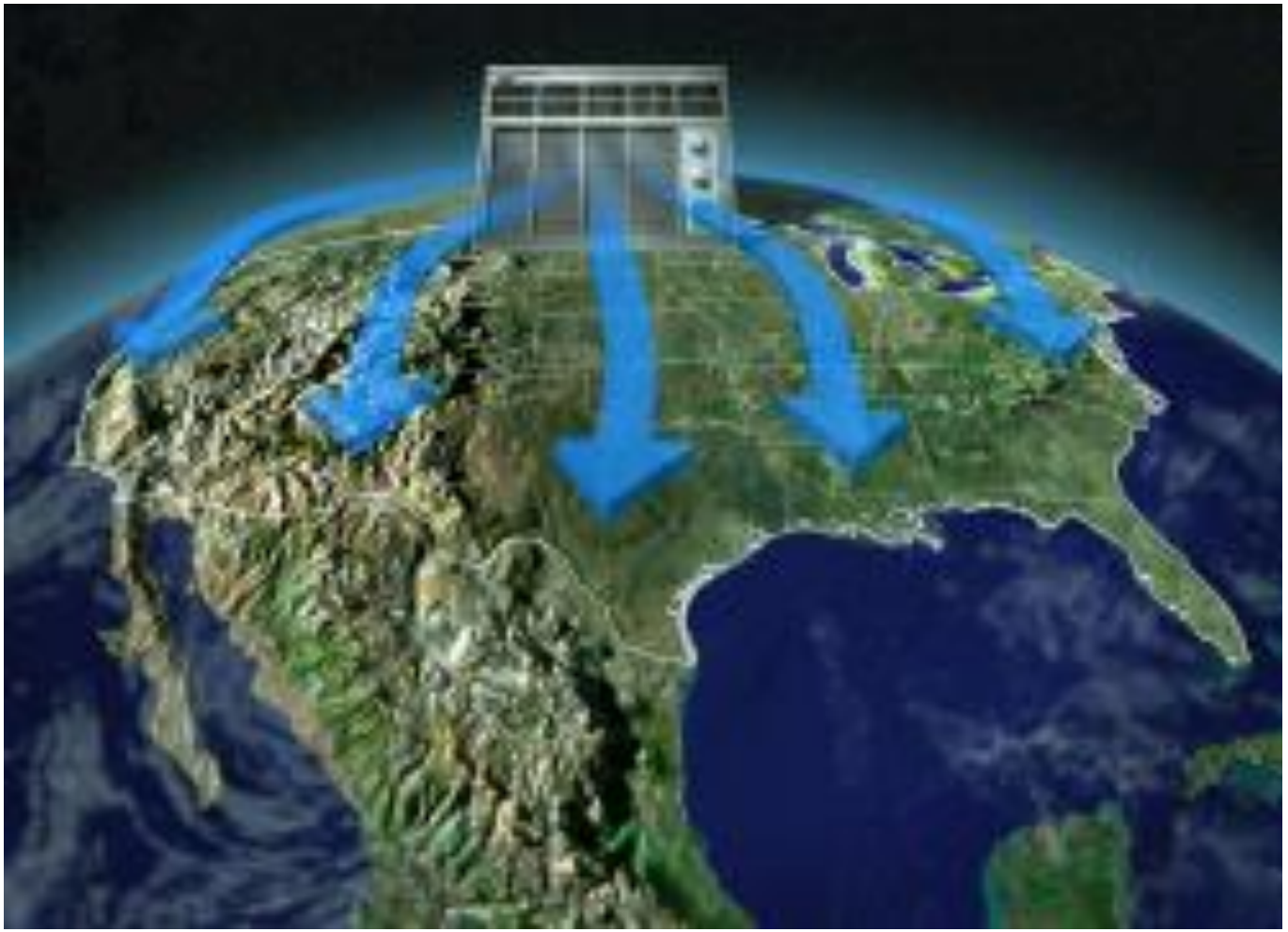
IDEC Cross Country

City	Rank	Total Evap. IDEC Direct Hrs/Yr	Evaporative Direct Hrs/Yr	Evaporative Indirect/Direct Hrs/Yr	DX AC Hrs/Yr	Total Non-Economizer Cooling Hours	% Without DX AC	IDEC Add-on kWh Savings	kW Peak Demand Yearly Savings	Water Consumption Avarge G/Ton/Hr
Phoenix, AZ	1	4579	2905	1674	1184	5763	79%	51%	59%	1.2
Las Vegas, NV	2	4328	3052	1276	223	4551	95%	62%	65%	1.3
Fresno, CA	3	3530	1970	1560	347	3877	91%	57%	53%	1.1
Albuquerque, NM	4	3007	2493	514	13	3020	100%	67%	64%	1.2
Salt Lake City, UT	5	2497	2119	378	2	2499	100%	55%	48%	0.6
Lubbock, TX	6	2471	1499	972	1295	3766	66%	42%	52%	0.8
Denver, CO	7	2288	2080	208	18	2306	99%	68%	64%	1.1
Boise, ID	8	2041	1773	268	1	2042	100%	68%	73%	1.1
Los Angeles, CA	9	2035	1333	702	727	2762	74%	47%	40%	0.4
Oklahoma City, OK	10	1283	783	500	2397	3680	35%	18%	36%	0.3
Atlanta, GA	11	1274	807	467	2793	4067	31%	16%	28%	0.3
New York City, NY	12	1146	729	420	1725	2871	40%	24%	26%	0.3
Chicago, IL	13	1141	696	445	1201	2342	49%	31%	33%	0.4
Charlotte, NC	14	1061	785	276	2768	3829	28%	15%	23%	0.2
Austin, TX	15	1046	653	393	4252	5298	20%	14%	20%	0.2
Seattle, WA	16	1029	824	205	5	1034	100%	63%	59%	0.7
Boston, MA	17	1016	667	349	1166	2182	47%	29%	31%	0.4
Indianapolis, IN	18	995	692	303	1824	2819	35%	18%	34%	0.3
Madison, WI	19	971	632	339	1005	1976	49%	25%	30%	0.3
San Francisco, CA	20	969	858	111	16	985	98%	66%	52%	0.6
San Antonio, TX	21	959	675	284	4621	5580	17%	12%	23%	0.2
Washington, DC	22	927	601	326	2099	3026	31%	19%	33%	0.3
Kansas City, KS	23	783	543	243	2514	3297	24%	11%	28%	0.2
Omaha, NE	24	708	456	252	2216	2924	24%	12%	31%	0.2

2013 - Evaporative Cooling Challenges

- Old direct evaporative technology image **[still swamped]**
- Managing mineral scale **[coming along]**
- Putting water usage in context **[appear modest]**
- Changes to ventilation design for higher airflow rates **[?]**
- Lack of recognition in codes and HVAC efficiency ratings **[same]**
- Lack of knowledge on the part of owners, contractors, designers, facility managers **[workforce education & training!!!!]**
- Too few & small advanced evap manufacturers **[more & growing]**
- Limited regulatory, policy & utility involvement **[slow, but growing]**
- **Performance monitoring/reporting [present in some products]**
- **Fault detection & diagnostics [present in some products]**
- **Above NEMA Premium motors [not yet]**

Total US Cooling Solution



CTU - Country Top Unit

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50 ZILLON TONS @ EER 912

Thanks!

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