Efficiency Works™

Estes Park | Fort Collins | Longmont | Loveland

Introduction to evaporative pre-cooling

June 6, 2023

Safety minute and house keeping items

Food and beverages

- Help yourself throughout
- Garbage cans in the back

Restrooms

- Through the atrium

Emergency protocols

- Emergency exits
- Meeting location/find a Platte River employee

Upcoming events

- **July** – Efficiency Works Business tour – more information available soon
- **August** – Fort Collins exterior lighting code updates
- **Quarterly** – Selling Energy webinars for listed service providers with licenses – Let us know if you'd like to become a listed service provider and receive a license
- **Service provider 1-on-1's** – Send us an email to schedule
- **November** – Service provider social and awards

Register for Efficiency Works events: https://efficiencyworks.org/resources/events/

Bryan Curtis

Evaporative Solutions

Evaporative Solutions

Providing the Highest Quality PreCooling Systems for Air-Cooled Condensers

HydrEVAP
Evaporative PreCoolers

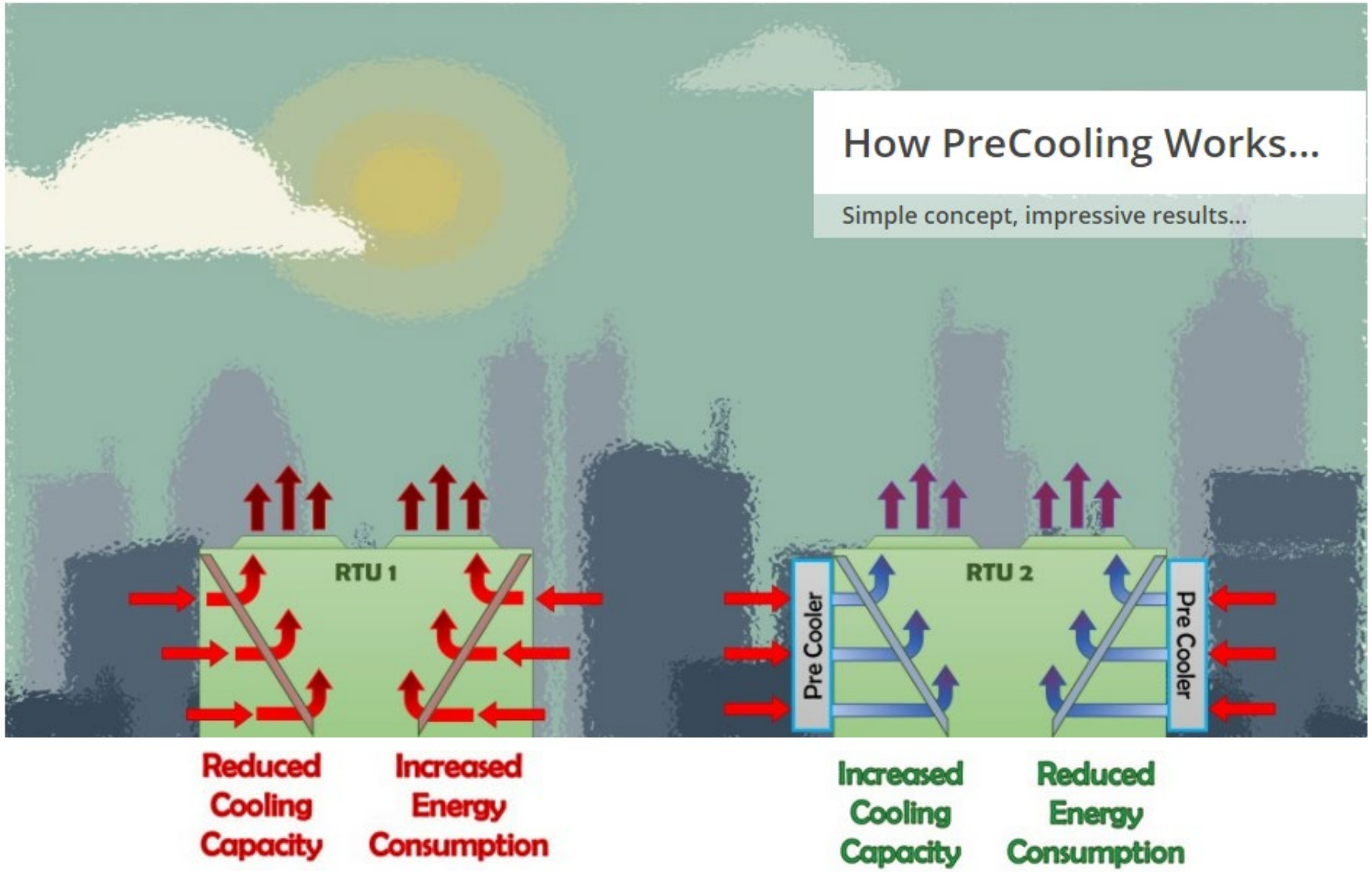
Munters CoVAP®

PEAK+

DualCool ®

Evaporative Solutions

Providing the Highest Quality PreCooling Systems for Air-Cooled Condensers



Effect of High Temperatures on AC System

National Institute of Standards and Technology
U.S. Department of Commerce

Impact of Elevated Ambient Temperatures on Capacity and Energy Input to a Vapor Compression System – Literature Review

Letter report for ARTI 21-CR Research Project: 605-50010/605-50015

S. Yana Motta and Piotr A. Domanski
National Institute of Standards and Technology
Gaithersburg, MD

Effect of High Temperatures on AC System

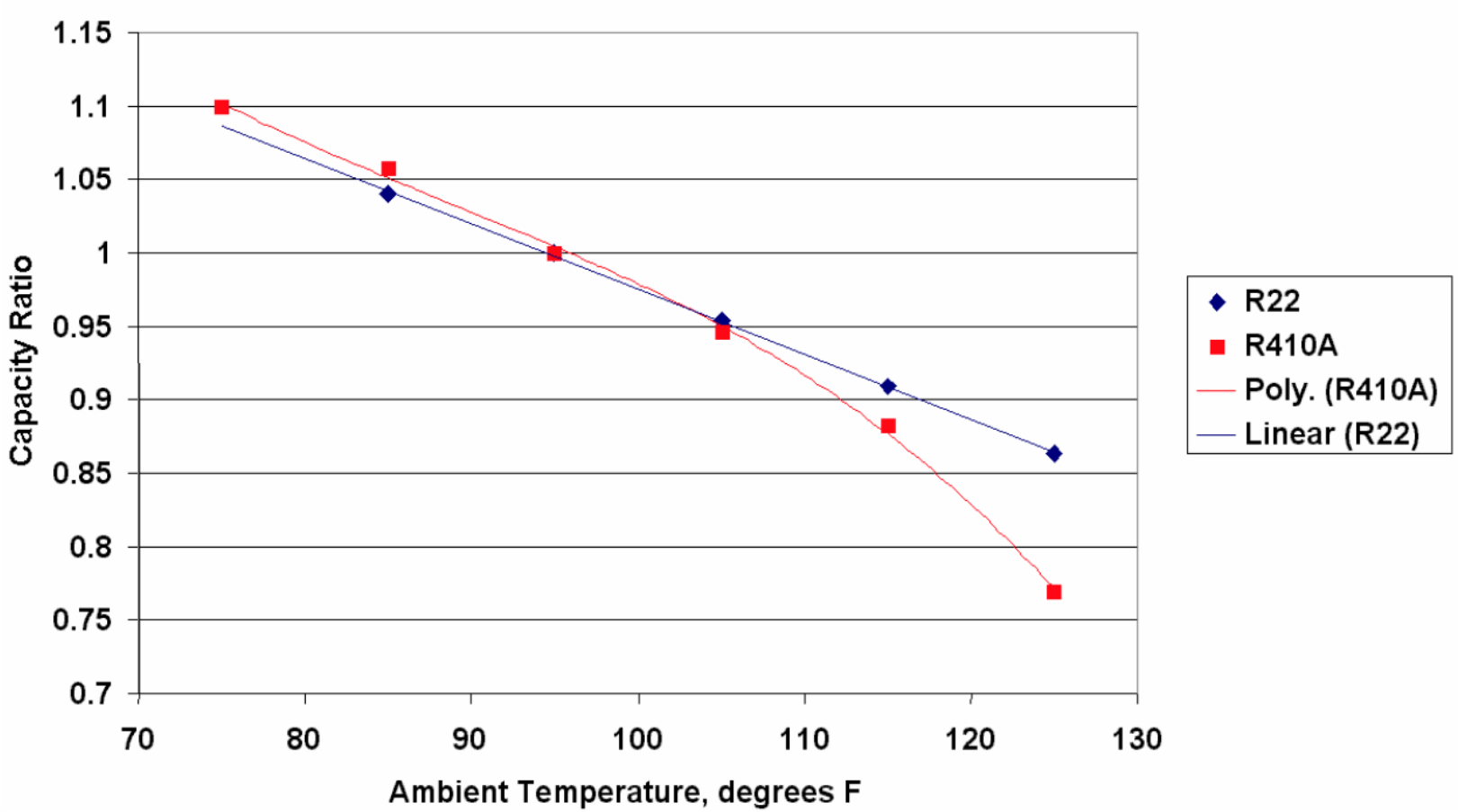


Figure 5. Comparison of capacity loss versus ambient temperature, split system A/C, 12-13 SEER (Wells et al., 1999).

Effect of High Temperatures on AC System

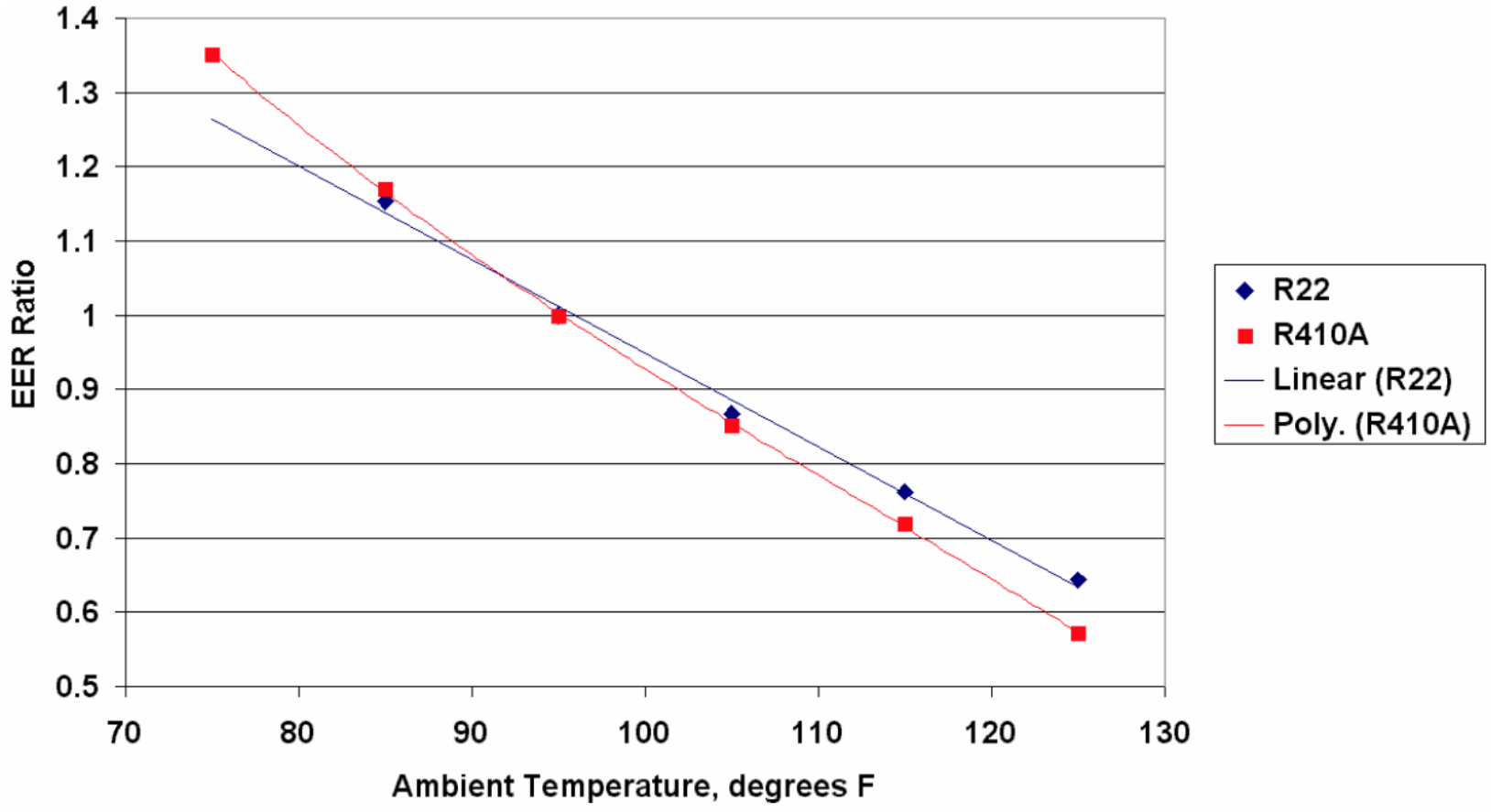


Figure 6. Comparison of EER loss versus ambient temperature, split system A/C, 12-13 SEER (Wells et al., 1999).

Effect of High Temperatures on AC System

SOUTHERN CALIFORNIA EDISON®

An *EDISON INTERNATIONAL*® Company

Performance Evaluation of Rooftop Air Conditioning Units At High Ambient Temperatures

Ramin Faramarzi, Bruce Coburn, Rafik Sarhadian, Scott Mitchell, and R. Anthony Pierce,
Southern California Edison

Effect of High Temperatures on AC System

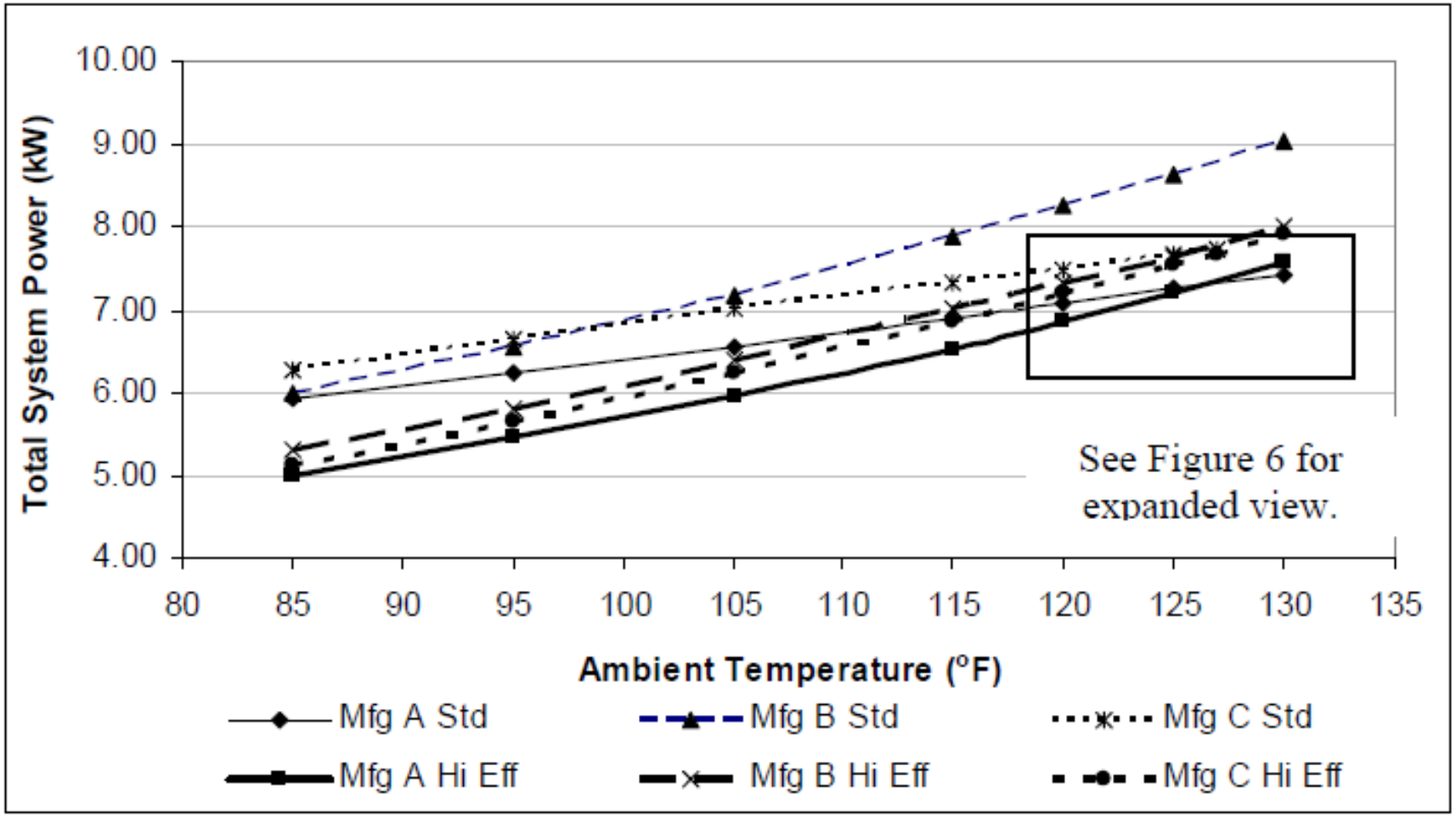


Figure 5. Total System Power Consumption Based on RTTC Test Data for All Six Standard and High Efficiency Units Subject to Various Ambient Temperatures

Effect of High Temperatures on AC System

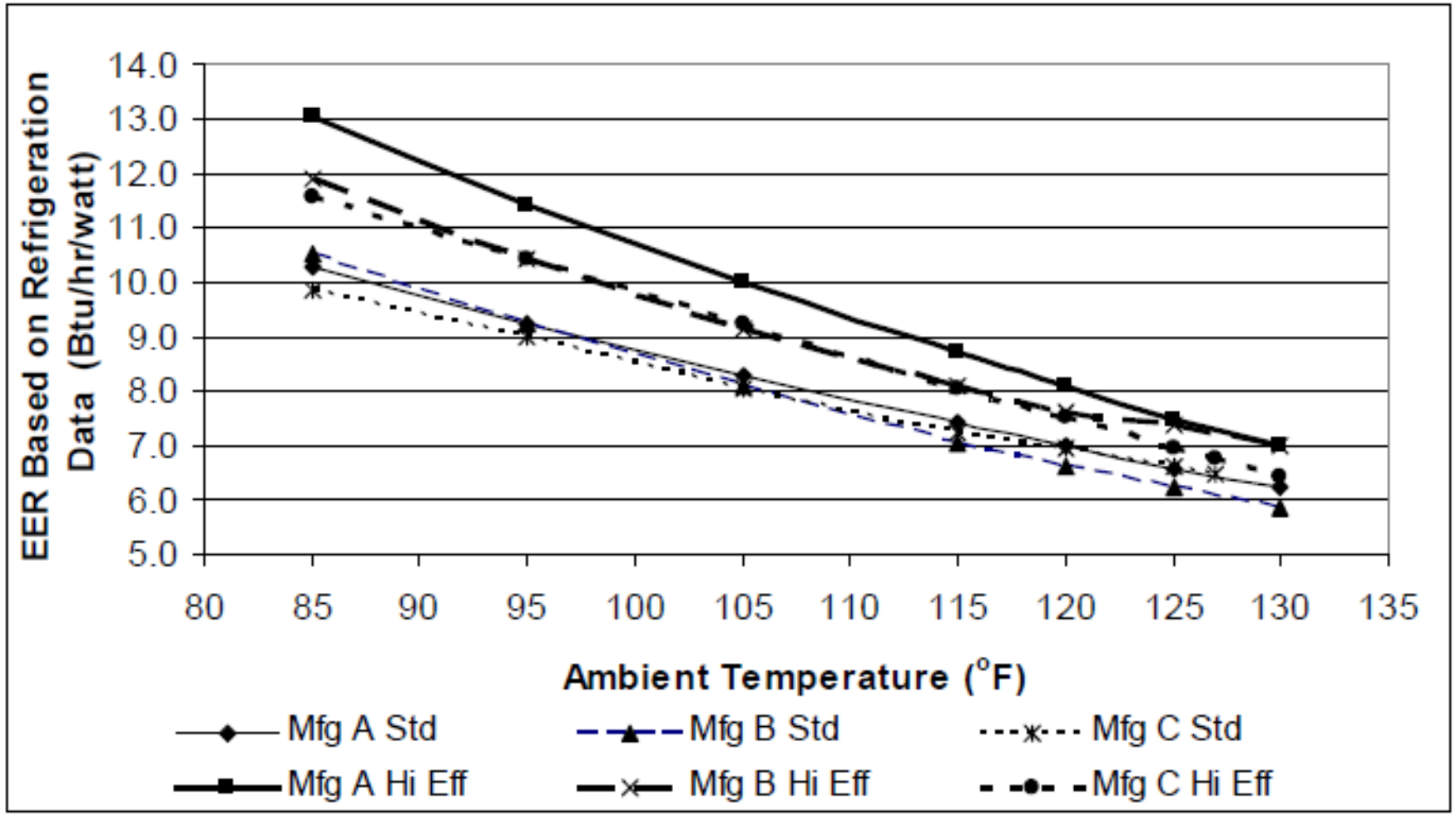
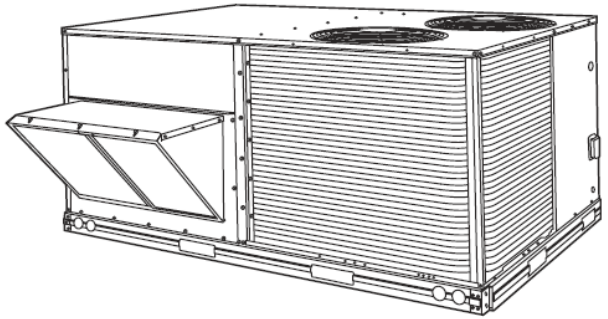


Figure 8. EERs Based on RTTC Refrigeration Side Test Data for All Six Standard and High Efficiency Units Subject to Various Ambient Temperatures

Effect of High Temperatures on AC System

Small Packaged Unit Performance Data (12.5 Tons)

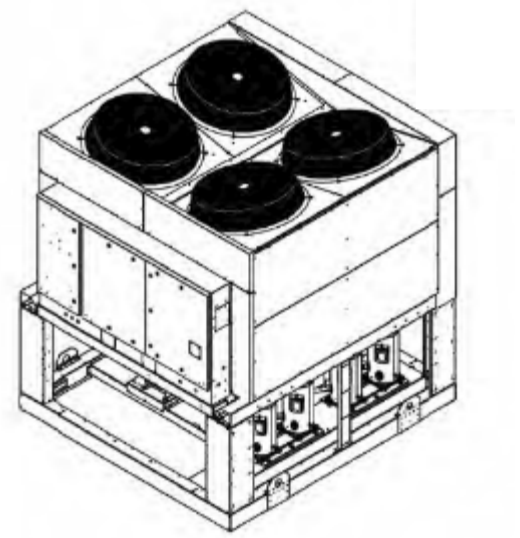


50HJ014 (12½ TONS)							
LCWT (F)		Air Temperature Entering Condenser (F)					
		75	85	95	105	115	125
45	TC	142.0	135.6	126.3	115.7	104.4	93.9
	SHC	123.6	120.9	116.5	111.2	104.2	93.8
	kW	8.95	9.97	11.01	12.09	13.22	14.44

Increase in Tons	Decrease in KW	Increase in SHC
11%	19%	6%

Effect of High Temperatures on AC System

Mid-size Scroll Compressor Chiller Performance Data (50 Ton)

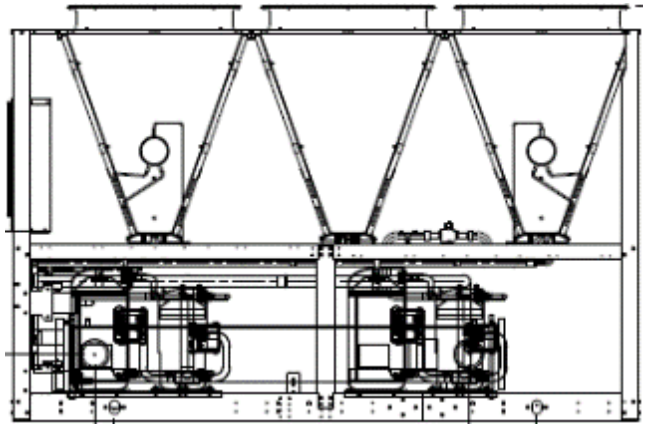


LWT (°F)	Ambient Air Temperature														
	75°F			85°F			95°F			105°F			115°F		
	Unit Tons	Power kWi	Unit EER	Unit Tons	Power kWi	Unit EER	Unit Tons	Power kWi	Unit EER	Unit Tons	Power kWi	Unit EER	Unit Tons	Power kWi	Unit EER
44	53.8	46.7	13.8	51.1	51.5	11.9	48.1	57.1	10.1	45.0	63.4	8.5	41.6	70.6	7.1

Increase in Tons	Decrease in KW	Increase in EER
11%	**18%**	**27%**

Effect of High Temperatures on AC System

Large Scroll Compressor Chiller Performance Data (100 Ton)



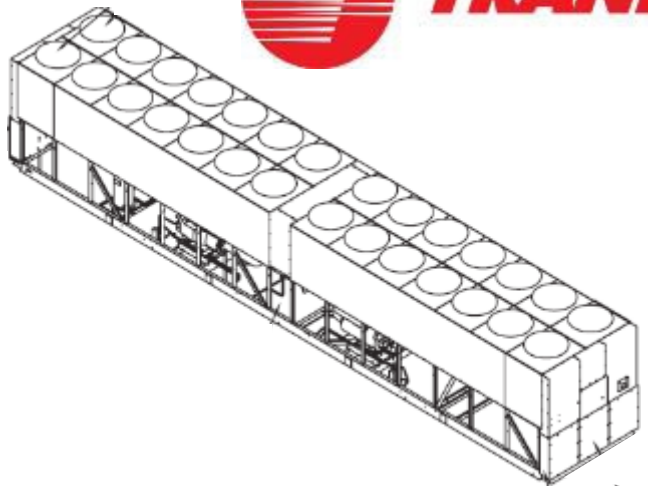
MODEL: YLAA0100SE — IPLV= 14.3

AIR TEMPERATURE ON - CONDENSER (°F)

LCWT (°F)	75.0			80.0			85.0			90.0			95.0			100.0		
	TONS	KW	EER	TONS	KW	EER	TONS	KW	EER	TONS	KW	EER	TONS	KW	EER	TONS	KW	EER
44.0	107.6	89.3	13.2	104.7	94.2	12.3	101.8	99.3	11.3	98.9	104.8	10.5	95.8	110.7	9.6	92.1	116.5	8.8

Increase in Tons	Decrease in KW	Increase in EER
11%	19%	27%

Effect of High Temperatures on AC System



Air-Cooled Rotary Liquid Chiller Performance Data (500 Ton)

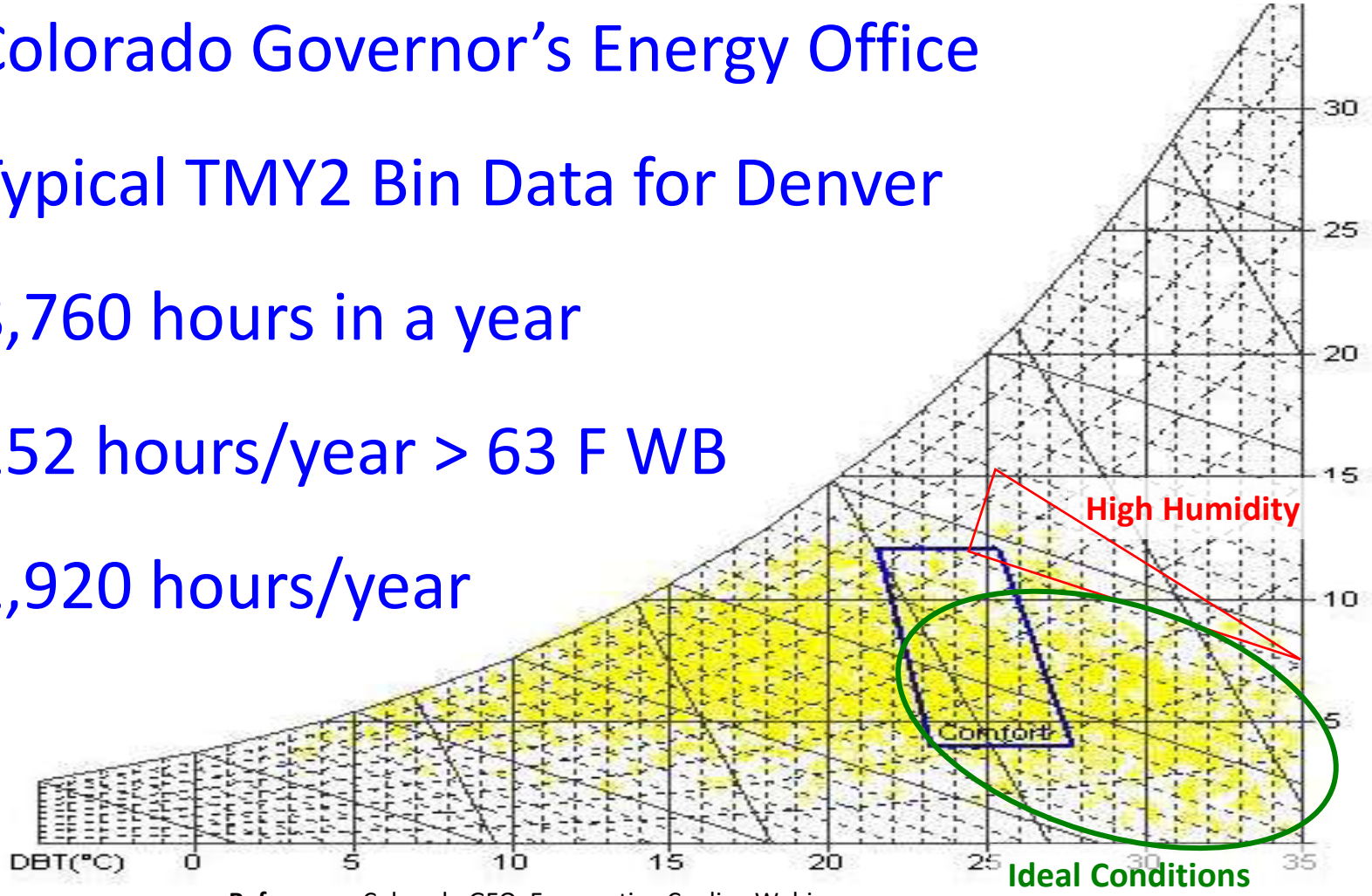
Table P-1. 60 Hz standard efficiency machines in English units

		Condenser Entering Air Temperature (F)											
		85			95			105			115		
Evaporator Leaving Water Temperature (F)	Unit Size Model RTAC	Tons	kW input	EER	Tons	kW input	EER	Ton	kW input	EER	Tons	kW input	EER
44	500 STD	515.8	519.3	11.0	483.0	560.6	9.6	448.8	607.4	8.3	413.3	659.7	7.1

Increase in Tons	Decrease in KW	Increase in EER
13%	**15%**	**25%**

Denver's Climate on the Psychrometric Chart

- Colorado Governor's Energy Office
- Typical TMY2 Bin Data for Denver
- 8,760 hours in a year
- 152 hours/year > 63 F WB
- 1,920 hours/year



Reference: Colorado GEO, Evaporative Cooling Webinar

Many chiller manufacturers offer adiabatic precooling as a factory installed option

What NOT to do…

What NOT to do continued…

…and this is why.

There is a better way!

We specialize in adiabatic precooling retro-fits and have PreCooler installations on all major HVAC Manufacturers (Trane, Carrier, York, etc…)

But what about the water usage!?!?!?!?!?

We are in a drought!!!!

How much water will be wasted!?!?!

What about the cost of the water!?!?!?

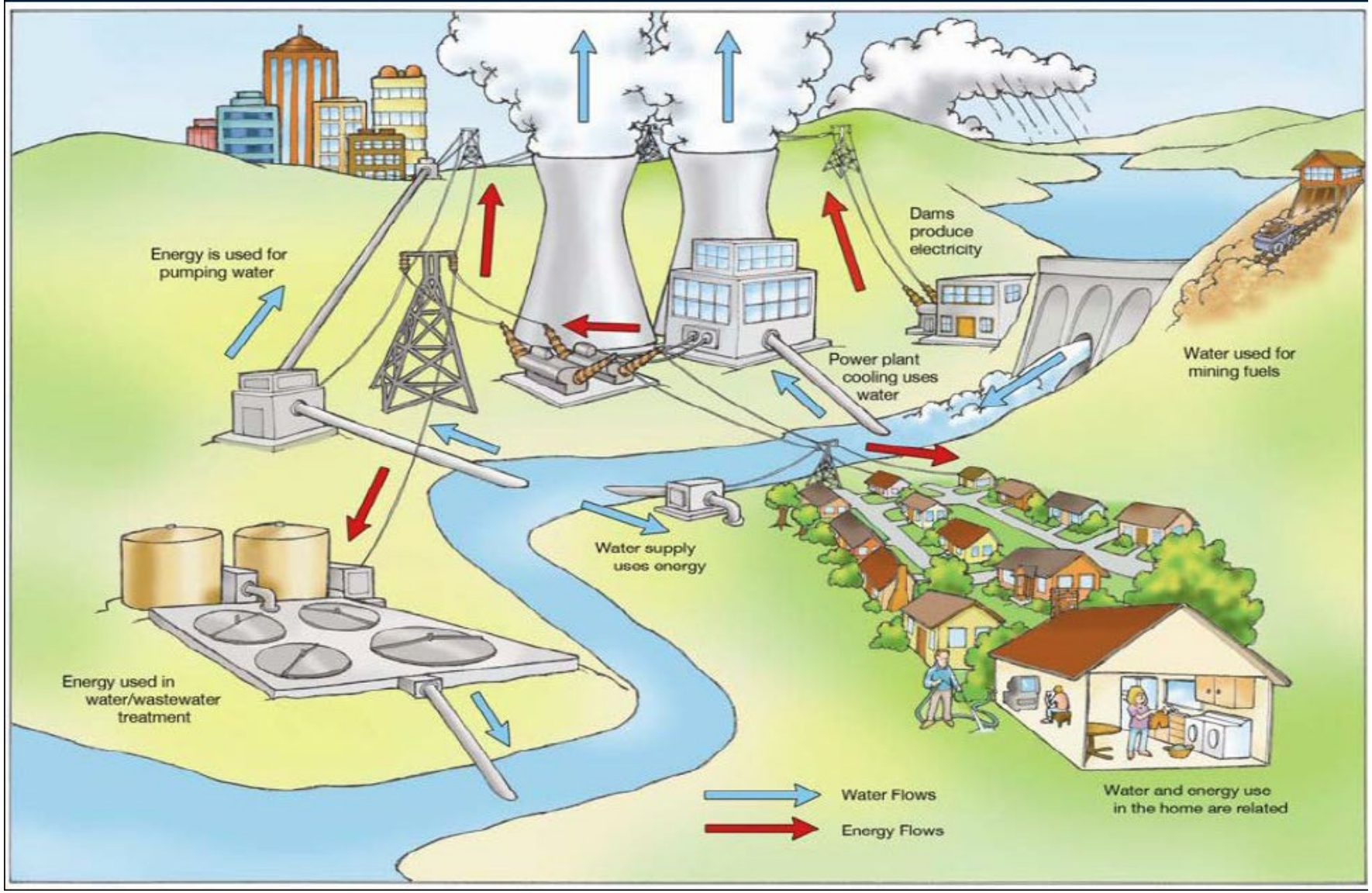
Evaporative PreCooling Actually Saves Water!

…and Money!

Critical Natural Resources

- Water and Energy are both Critical Resources
- Water and Energy Production are Interrelated
  - Water is needed to produce Energy
  - Energy is needed to store and transport Water

Water Energy Relationship

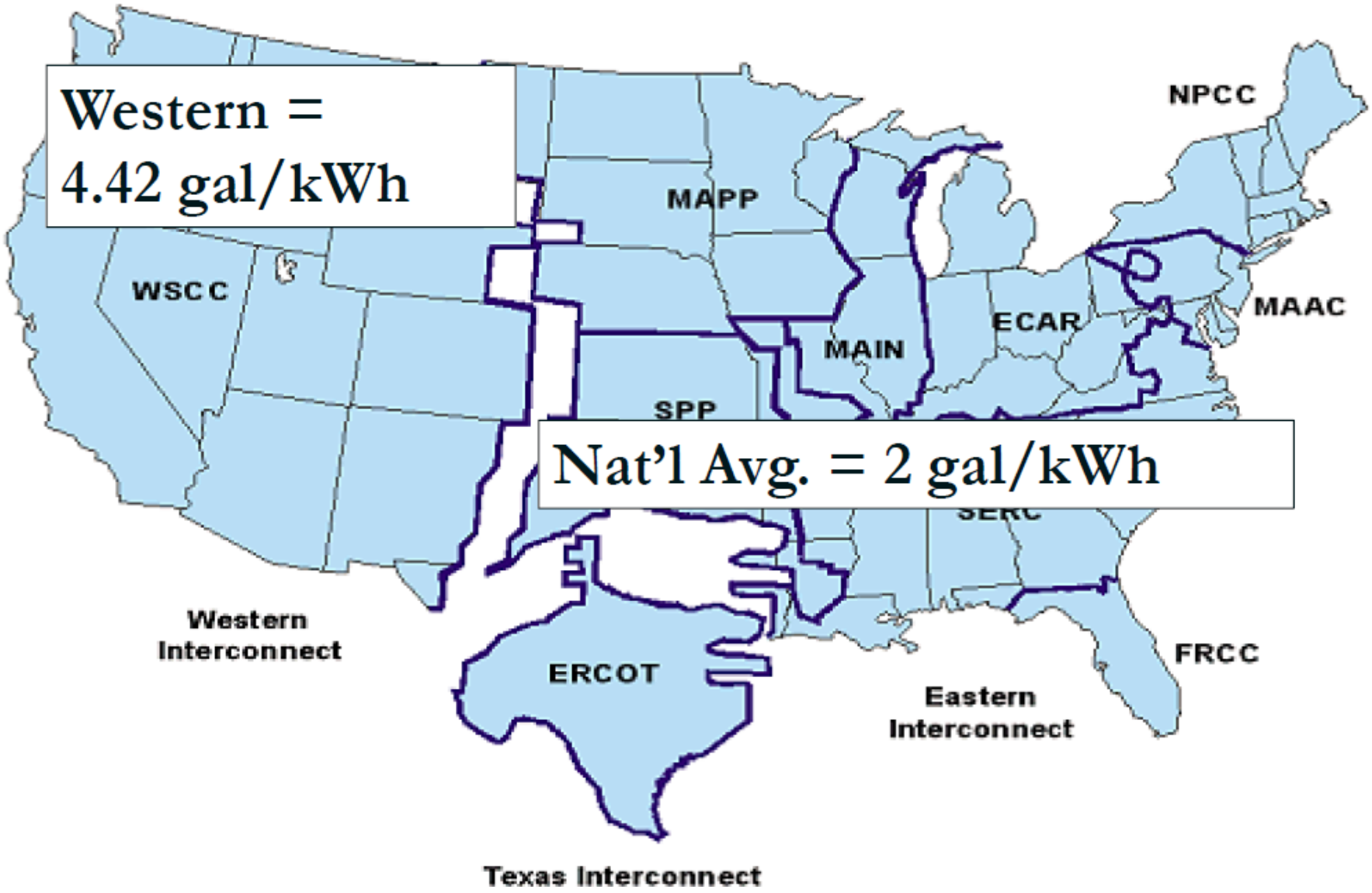


Resource Relationship: Water in Energy

- 2003 National Renewable Energy Lab report:

  On average 2 gallons of water consumed per 1 kWh electricity generated in the US

Power Grid Interconnects



Evaporative PreCooler Equipment Selection Information

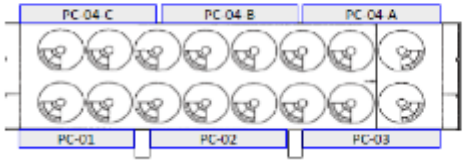
Input Information - Conditions for Evaluation			
Ambient:	93 (F°) Dry Bulb	59 (°F) Wet Bulb	13% Relative Humidity

Unit 1:	AC Unit Performance Data:		
McQuay AGS275DS	Standard (No PC's)	With PreCoolers	% Change
Cooling Capacity (Tons)	268.4 TONS	283 TONS	5%
	Increase in Cooling Capacity of : 14.2		
Energy Consumption (kW Input)	301.3 kW	213 kW	29%
	Reduction In kW of : 88.7		
Energy Efficiency (EER) (Energy Efficiency Rating)	10.2 EER	15.1 EER	48%
	(Increase in Energy Efficiency:) 4.9		

McQuay AGS275DS	Standard (No PC's)	With PreCoolers	Savings
Cost of Energy - Annual	$65,915	$46,503	$19,412
Cost of Energy - Lifetime	$988,723	$697,538	$291,185

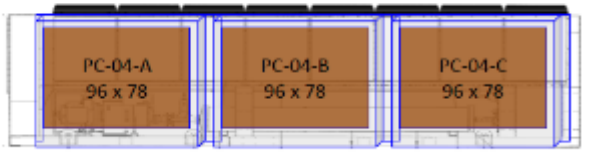
McQuay AGS275DS	Equipment Payback In :	1.1 Years
Return On Investment	Lifetime Savings - After PreCooler Cost	$270,183

Plan View



Elevation View 1

Elevation View 2



Water Saved by PreCoolers

Gallon per kWh	4.42	
kWh Saved	176473	
Water Saved	780009	
Water Used	344,636	
Net Water Savings	435,373	

Evaporative PreCooler Equipment Selection Information

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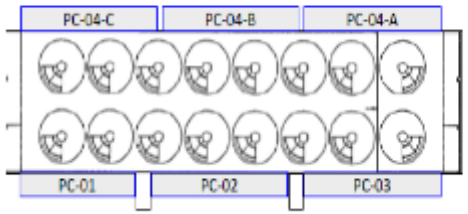
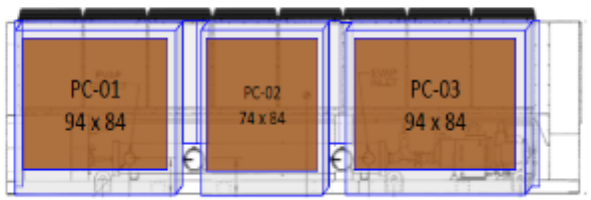
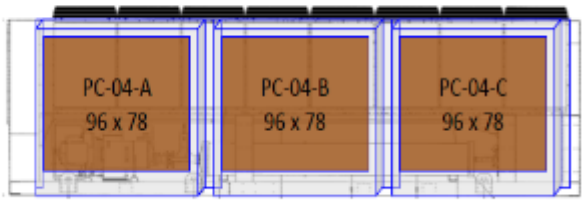


Elevation View 1



Elevation View 2



Additional PreCooler Operating Costs:	kWh Saved = 176,473	
Water Consumption	344,636	Gallons per Year
Cost/1000 Gallons	$4.85	Denver Water Commercial Rate
Water Cost	$1,672	Annual

@ 2023 Rates =

$23,471

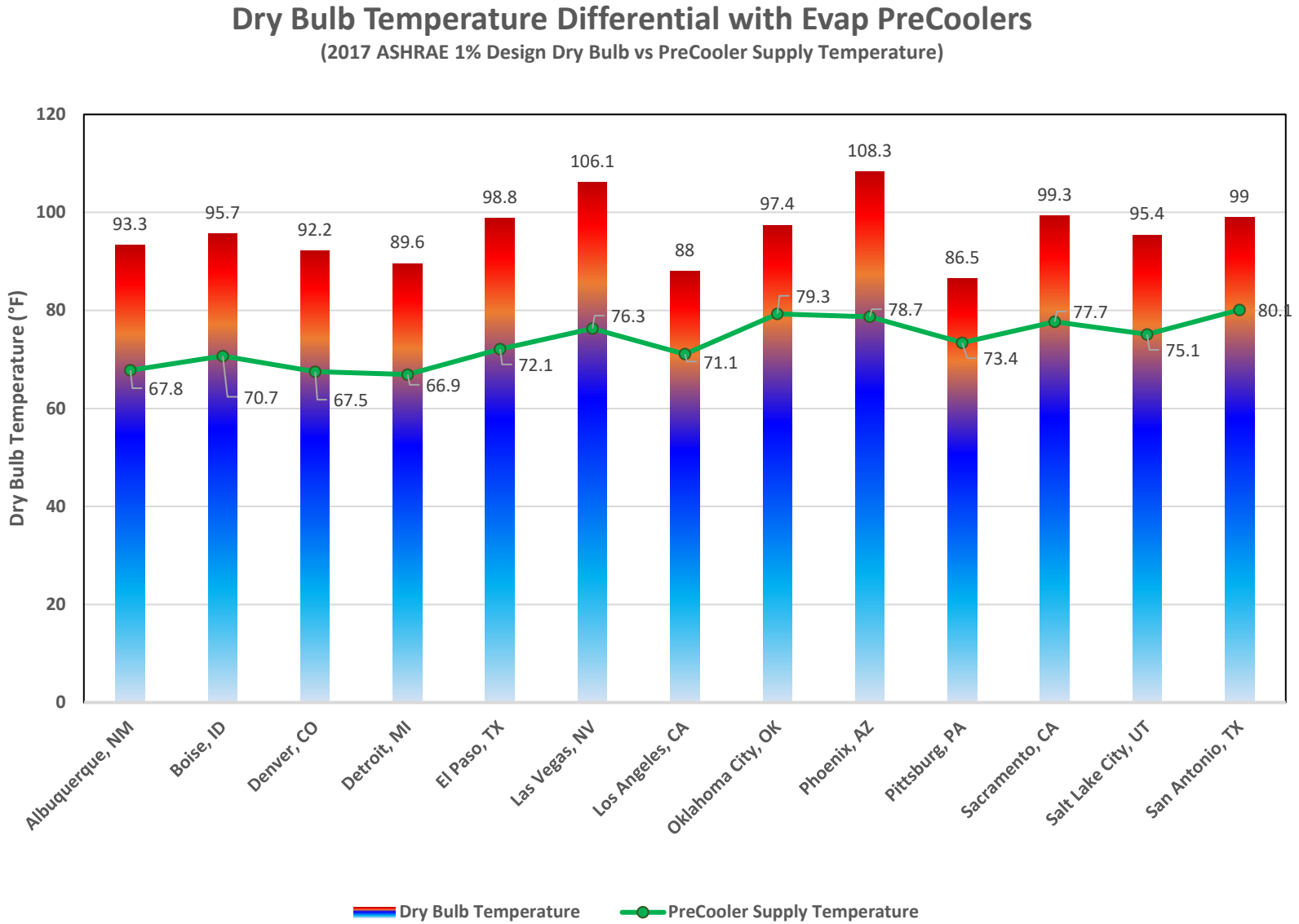
Less Water Costs =

$21,799

Adiabatic precooling retrofits have PreCooler installations
on all major HVAC Manufacturers (Trane, Carrier, York, etc…)

Evaporative PreCooling Performance Data

City, State	°F	°F	ΔT °F
Albuquerque, NM	93.3	67.8	25.5
Boise, ID	95.7	70.7	25
Denver, CO	92.2	67.5	24.7
Detroit, MI	89.6	66.9	22.7
El Paso, TX	98.8	72.1	26.7
Las Vegas, NV	106.1	76.3	29.8
Los Angeles, CA	88	71.1	16.9
Oklahoma City, OK	97.4	79.3	18.1
Phoenix, AZ	108.3	78.7	29.6
Pittsburg, PA	86.5	73.4	13.1
Sacramento, CA	99.3	77.7	21.6
Salt Lake City, UT	95.4	75.1	20.3
San Antonio, TX	99	80.1	18.9



Evaporative PreCooling Performance Data

Viability Study Trane Factory: Pueblo, CO

AHRI Approved Test Facility

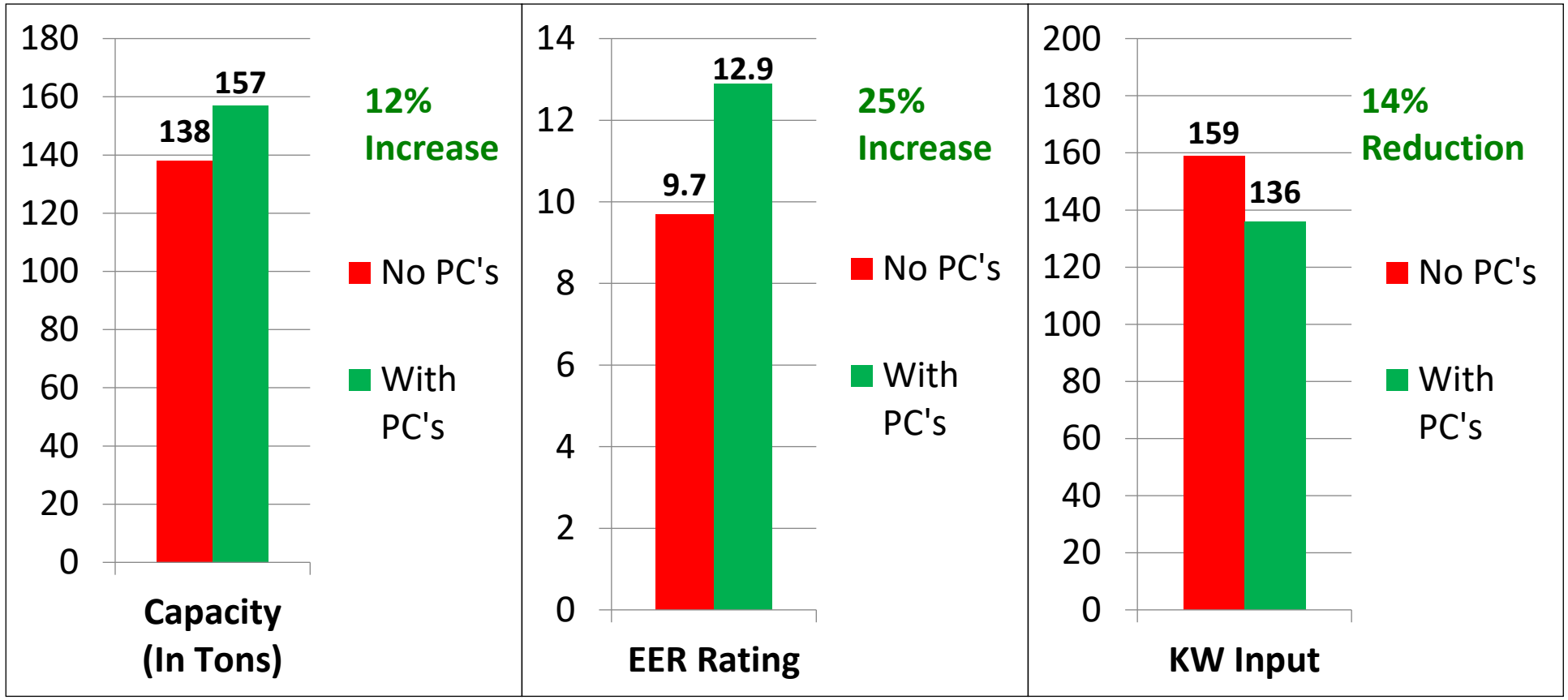
Test Unit: Trane CGAM 140-Std

HydrEVAP **Specs:**

- ✓ 7” Housing
- ✓ 4” Media
- ✓ No Block-Off Panels

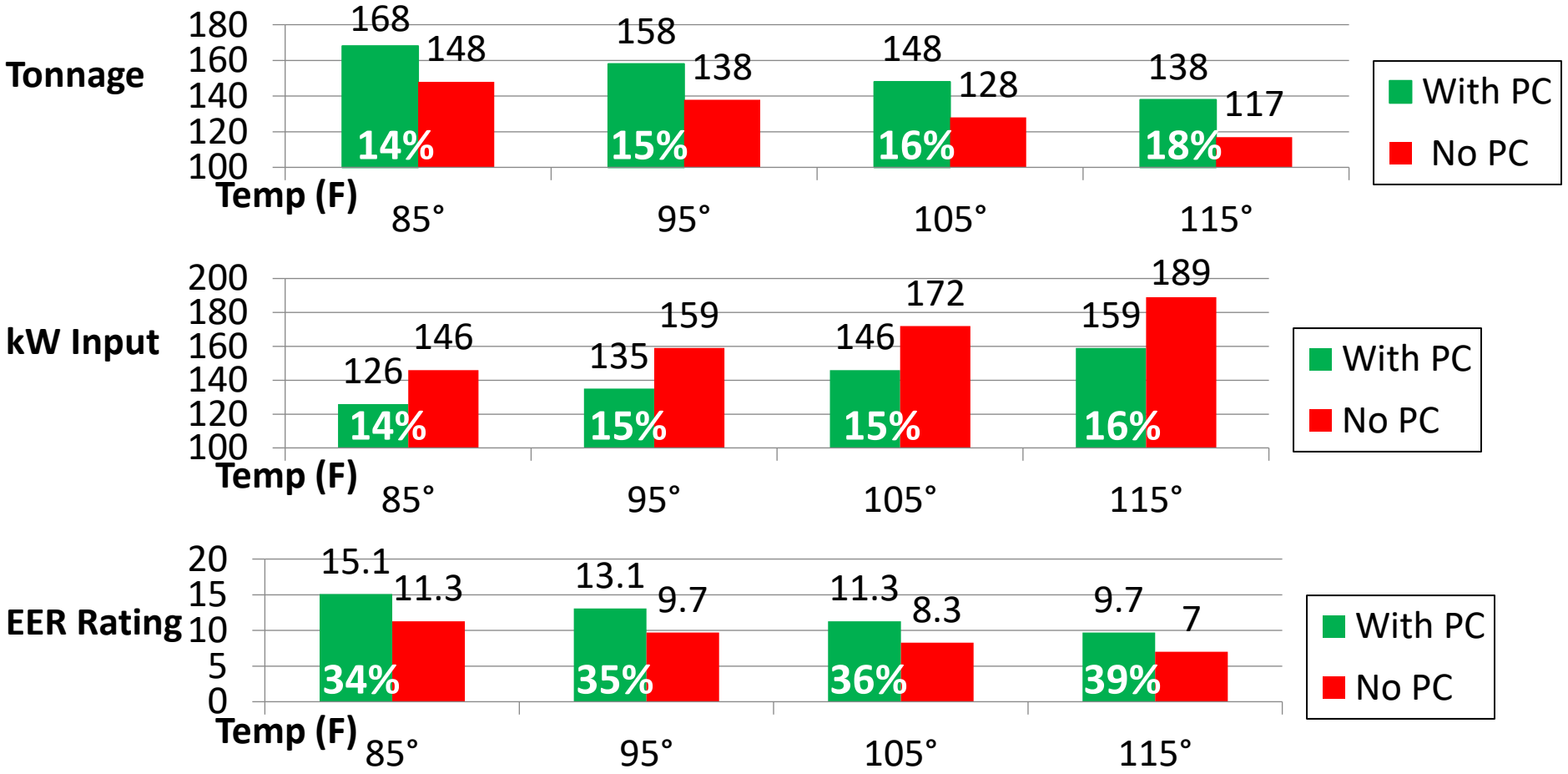
Evaporative PreCooling Performance Data

Test Results – 12%RH



95.0° Dry Bulb 60.0° Wet Bulb 12% RH 44° Evaporator Leaving Temperature

Temperature Specific Data – 12%RH



Evaporative PreCooling Performance Data

Trane Factory: Pueblo, CO

"We were able to confirm benefit of the product…and we concluded that this is a viable product for the arid portions of the US, and we would like to promote it at that region."

-Todd Duncan
Product Manager Scroll & Screw Chillers
Trane

HydrEVAP
Evaporative PreCoolers

Performance Data Provided by Client

Date: **6/22 – 6/29/2012**

Location: **Highlands Ranch, Colorado**

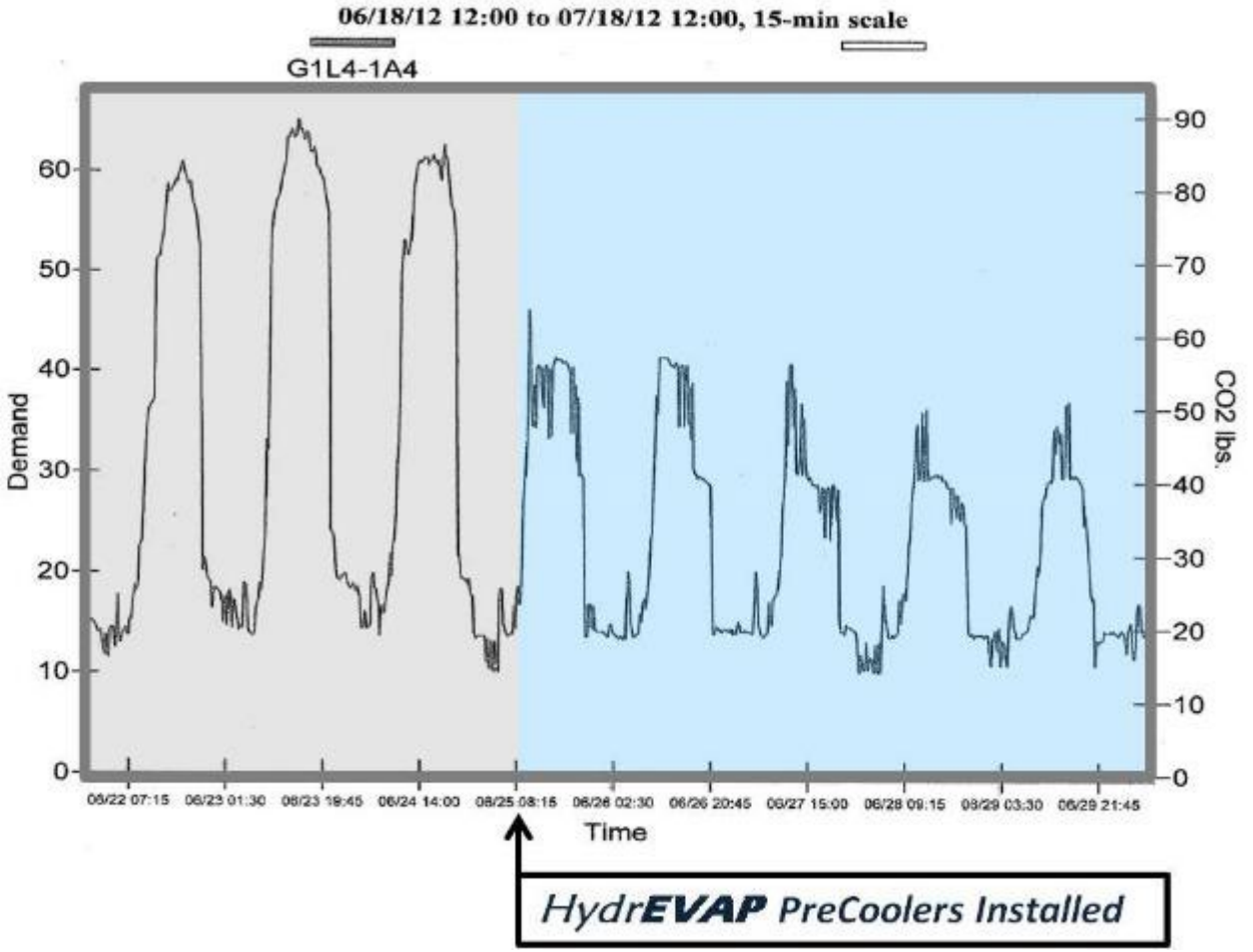
Client: **Douglas County**

Ave. Temp: **93° F**

Ave Humidity: **23% RH**

Unit: **Trane Intellipak (40 Ton Unit)**

On average that is nearly a 40% savings in kWh!



ATEC/Indirex
HaveACoolDay.com
HydrEVAP
Evaporative PreCoolers

Performance Data - HydrEVAP Evaporative PreCoolers

TRANE Building Services KESTRELView™

Wednesday, July 15, 2020
2:23:47 PM PDT

Chiller Service Report
Without PreCoolers

Chiller Status

Chiller

Operating Mode	Unit is Running		BAS Current Limit Setpoint	120.0	% RLA
Front Panel Auto/Stop	Auto		Comm3 Current Limit Setpoint	120.0	% RLA
Outdoor Air Temperature	104.2	°F	Comm3 Ice Termination Setpoint	32.0	°F
External Auto/Stop	Auto		Chiller Top Level Operating Mode	Running	
External Emergency Stop	Auto		Chiller Sub Operating Mode		
Active Chilled Water Setpoint	52.0	°F	Chiller Sub Operating Mode		
Active Current Limit Setpoint	120.0	% RLA	Chiller Sub Operating Mode		
External Current Limit Setpoint	60.0	% RLA	Chiller Sub Operating Mode		
External Chilled Water Setpoint	51.2	°F	Chiller Sub Operating Mode		
Evaporator Entering Water Temperature	58.5	°F	Chiller Sub Operating Mode		
Evaporator Leaving Water Temperature	52.1	°F	BAS Communication	Established	
Chilled Water Flow Switch	Flow		Chilled Water Pump Relay	On	
BAS Chilled Water Setpoint	44.0	°F	Evaporator Water Flow Switch Status (Unfiltered)	Flow	

TRANE Building Services KESTRELView™

Wednesday, July 15, 2020
2:40:30 PM PDT

Chiller Service Report
With PreCoolers

Chiller Status

Chiller

Operating Mode	Unit is Running		BAS Current Limit Setpoint	120.0	% RLA
Front Panel Auto/Stop	Auto		Comm3 Current Limit Setpoint	120.0	% RLA
Outdoor Air Temperature	78.3	°F	Comm3 Ice Termination Setpoint	32.0	°F
External Auto/Stop	Auto		Chiller Top Level Operating Mode	Running	
External Emergency Stop	Auto		Chiller Sub Operating Mode		
Active Chilled Water Setpoint	52.0	°F	Chiller Sub Operating Mode		
Active Current Limit Setpoint	120.0	% RLA	Chiller Sub Operating Mode		
External Current Limit Setpoint	60.0	% RLA	Chiller Sub Operating Mode		
External Chilled Water Setpoint	51.5	°F	Chiller Sub Operating Mode		
Evaporator Entering Water Temperature	57.7	°F	Chiller Sub Operating Mode		
Evaporator Leaving Water Temperature	51.4	°F	BAS Communication	Established	
Chilled Water Flow Switch	Flow		Chilled Water Pump Relay	On	
BAS Chilled Water Setpoint	44.0	°F	Evaporator Water Flow Switch Status (Unfiltered)	Flow	

Performance Data - HydrEVAP Evaporative PreCoolers

Without PreCoolers

Circuit 1

Circuit 1 Sub Mode			Air Flow	85.7	%
Circuit 1 Sub Mode			Inverter Speed	0.0	% FullSpeed
Circuit 1 Sub Mode			Condenser Refrigerant Pressure	266.8	psi gauge
Circuit 1 Sub Mode			Saturated Condenser Refrigerant Temperature	151.0	°F calculated
Circuit 1 Sub Mode			Differential Refrigerant Pressure	222.7	psid
Circuit 1 Sub Mode			Evaporator Refrigerant Pressure	43.7	psi gauge
Circuit 1 Top Level Operating Mode	Running		Saturated Evaporator Refrigerant Temperature	48.3	°F calculated
External Hardwired Lockout	Not Locked Out		EXV Position	38.5	% Open
Front Panel Lockout	Not Locked Out		Evaporator Refrigerant Liquid Level	-0.1	in

Circuit 2

External Hardwired Lockout	Not Locked Out		EXV Position	100.0	% Open
Front Panel Lockout	Not Locked Out		Evaporator Refrigerant Liquid Level	-0.3	in
Air Flow	100.0	%	Circuit 2 Top Level Operating Mode	Running	
Inverter Speed	100.0	% FullSpeed	Circuit 2 Sub Mode		
Condenser Refrigerant Pressure	177.1	psi gauge	Circuit 2 Sub Mode		
Saturated Condenser Refrigerant Temperature	122.2	°F calculated	Circuit 2 Sub Mode		
Differential Refrigerant Pressure	132.5	psid	Circuit 2 Sub Mode		
Evaporator Refrigerant Pressure	44.8	psi gauge	Circuit 2 Sub Mode		
Saturated Evaporator Refrigerant Temperature	49.3	°F calculated	Circuit 2 Sub Mode		

With PreCoolers

Circuit 1

Circuit 1 Sub Mode			Air Flow	85.7	%
Circuit 1 Sub Mode			Inverter Speed	0.0	% FullSpeed
Circuit 1 Sub Mode			Condenser Refrigerant Pressure	170.8	psi gauge
Circuit 1 Sub Mode			Saturated Condenser Refrigerant Temperature	119.8	°F calculated
Circuit 1 Sub Mode			Differential Refrigerant Pressure	128.0	psid
Circuit 1 Sub Mode			Evaporator Refrigerant Pressure	42.8	psi gauge
Circuit 1 Top Level Operating Mode	Running		Saturated Evaporator Refrigerant Temperature	47.4	°F calculated
External Hardwired Lockout	Not Locked Out		EXV Position	44.2	% Open
Front Panel Lockout	Not Locked Out		Evaporator Refrigerant Liquid Level	-0.2	in

Circuit 2

External Hardwired Lockout	Not Locked Out		EXV Position	83.0	% Open
Front Panel Lockout	Not Locked Out		Evaporator Refrigerant Liquid Level	-0.0	in
Air Flow	100.0	%	Circuit 2 Top Level Operating Mode	Running	
Inverter Speed	100.0	% FullSpeed	Circuit 2 Sub Mode		
Condenser Refrigerant Pressure	114.2	psi gauge	Circuit 2 Sub Mode		
Saturated Condenser Refrigerant Temperature	95.1	°F calculated	Circuit 2 Sub Mode		
Differential Refrigerant Pressure	68.7	psid	Circuit 2 Sub Mode		
Evaporator Refrigerant Pressure	45.1	psi gauge	Circuit 2 Sub Mode		
Saturated Evaporator Refrigerant Temperature	49.6	°F calculated	Circuit 2 Sub Mode		

Performance Data - HydrEVAP Evaporative PreCoolers

Compressor 1A Without PreCoolers

Run Hours	11187:29	hrs:mins	Intermediate Oil Pressure	248.6	psi gauge
Starts	1,929		Female Step Loader	Load	
Phase A-B Voltage	462	volts	High Pressure Cutout Switch	Good	
Average Line Current	97.1	% RLA	Compressor 1A Operating Mode	Running	
Line 1 Current	193.0	amps	Compressor 1A Top Level Operating Mode	Running	
Line 2 Current	200.0	amps	Compressor 1A Sub Mode		
Line 3 Current	188.0	amps	Compressor 1A Sub Mode		
Line 1 Current	96.6	% RLA	Compressor 1A Sub Mode		
Line 2 Current	100.0	% RLA	Compressor 1A Sub Mode		
Line 3 Current	94.3	% RLA	Compressor 1A Sub Mode		
Maximum Line Current	100.0	% RLA	Compressor 1A Sub Mode		
Supply Oil Temperature	189.6	°F			

Compressor 1B

Run Hours	11252:47	hrs:mins	Intermediate Oil Pressure	248.0	psi gauge
Starts	1,923		Female Step Loader	Load	
Average Line Current	82.5	% RLA	High Pressure Cutout Switch	Good	
Line 1 Current	163.0	amps	Compressor 1B Operating Mode	Running	
Line 2 Current	171.0	amps	Compressor 1B Top Level Operating Mode	Running	
Line 3 Current	161.0	amps	Compressor 1B Sub Mode		
Line 1 Current	81.6	% RLA	Compressor 1B Sub Mode		
Line 2 Current	85.5	% RLA	Compressor 1B Sub Mode		
Line 3 Current	80.6	% RLA	Compressor 1B Sub Mode		
Maximum Line Current	85.1	% RLA	Compressor 1B Sub Mode		
Supply Oil Temperature	189.5	°F	Compressor 1B Sub Mode		

Compressor 1A With PreCoolers

Run Hours	11187:40	hrs:mins	Intermediate Oil Pressure	159.8	psi gauge
Starts	1,929		Female Step Loader	Load	
Phase A-B Voltage	465	volts	High Pressure Cutout Switch	Good	
Average Line Current	60.7	% RLA	Compressor 1A Operating Mode	Running	
Line 1 Current	120.0	amps	Compressor 1A Top Level Operating Mode	Running	
Line 2 Current	125.0	amps	Compressor 1A Sub Mode		
Line 3 Current	118.0	amps	Compressor 1A Sub Mode		
Line 1 Current	59.9	% RLA	Compressor 1A Sub Mode		
Line 2 Current	63.0	% RLA	Compressor 1A Sub Mode		
Line 3 Current	59.1	% RLA	Compressor 1A Sub Mode		
Maximum Line Current	63.1	% RLA	Compressor 1A Sub Mode		
Supply Oil Temperature	146.1	°F			

Compressor 1B

Run Hours	11252:58	hrs:mins	Intermediate Oil Pressure	160.0	psi gauge
Starts	1,923		Female Step Loader	Load	
Average Line Current	61.0	% RLA	High Pressure Cutout Switch	Good	
Line 1 Current	120.0	amps	Compressor 1B Operating Mode	Running	
Line 2 Current	126.0	amps	Compressor 1B Top Level Operating Mode	Running	
Line 3 Current	119.0	amps	Compressor 1B Sub Mode		
Line 1 Current	60.1	% RLA	Compressor 1B Sub Mode		
Line 2 Current	63.3	% RLA	Compressor 1B Sub Mode		
Line 3 Current	59.8	% RLA	Compressor 1B Sub Mode		
Maximum Line Current	63.3	% RLA	Compressor 1B Sub Mode		
Supply Oil Temperature	146.1	°F	Compressor 1B Sub Mode		

Performance Data - HydrEVAP Evaporative PreCoolers

Compressor 2A Without PreCoolers

Run Hours	11316:07	hrs:mins	Intermediate Oil Pressure	166.3	psi gauge
Starts	1,916		Female Step Loader	Unload	
Average Line Current	55.2	% RLA	High Pressure Cutout Switch	Good	
Line 1 Current	107.0	amps	Compressor 2A Operating Mode	Running	
Line 2 Current	115.0	amps	Compressor 2A Top Level Operating Mode	Running	
Line 3 Current	107.0	amps	Compressor 2A Sub Mode		
Line 1 Current	53.5	% RLA	Compressor 2A Sub Mode		
Line 2 Current	57.7	% RLA	Compressor 2A Sub Mode		
Line 3 Current	53.5	% RLA	Compressor 2A Sub Mode		
Maximum Line Current	58.1	% RLA	Compressor 2A Sub Mode		
Supply Oil Temperature	159.8	°F	Compressor 2A Sub Mode		

Compressor 2A With PreCoolers

Run Hours	11316:17	hrs:mins	Intermediate Oil Pressure	46.1	psi gauge
Starts	1,916		Female Step Loader	Unload	
Average Line Current	0.0	% RLA	High Pressure Cutout Switch	Good	
Line 1 Current	0.0	amps	Compressor 2A Operating Mode	Stopped	
Line 2 Current	0.0	amps	Compressor 2A Top Level Operating Mode	Auto	
Line 3 Current	0.0	amps	Compressor 2A Sub Mode		
Line 1 Current	0.0	% RLA	Compressor 2A Sub Mode		
Line 2 Current	0.0	% RLA	Compressor 2A Sub Mode		
Line 3 Current	0.0	% RLA	Compressor 2A Sub Mode		
Maximum Line Current	0.0	% RLA	Compressor 2A Sub Mode		
Supply Oil Temperature	122.9	°F	Compressor 2A Sub Mode		

Compressor 2B

Run Hours	11206:49	hrs:mins	Intermediate Oil Pressure	164.6	psi gauge
Starts	1,926		Female Step Loader	Load	
Average Line Current	75.1	% RLA	High Pressure Cutout Switch	Good	
Line 1 Current	148.0	amps	Compressor 2B Operating Mode	Running	
Line 2 Current	155.0	amps	Compressor 2B Top Level Operating Mode	Running	
Line 3 Current	145.0	amps	Compressor 2B Sub Mode		
Line 1 Current	74.4	% RLA	Compressor 2B Sub Mode		
Line 2 Current	78.0	% RLA	Compressor 2B Sub Mode		
Line 3 Current	72.9	% RLA	Compressor 2B Sub Mode		
Maximum Line Current	78.1	% RLA	Compressor 2B Sub Mode		
Supply Oil Temperature	159.8	°F	Compressor 2B Sub Mode		

Compressor 2B

Run Hours	11207:00	hrs:mins	Intermediate Oil Pressure	106.5	psi gauge
Starts	1,926		Female Step Loader	Load	
Average Line Current	55.6	% RLA	High Pressure Cutout Switch	Good	
Line 1 Current	109.0	amps	Compressor 2B Operating Mode	Running	
Line 2 Current	115.0	amps	Compressor 2B Top Level Operating Mode	Running	
Line 3 Current	108.0	amps	Compressor 2B Sub Mode		
Line 1 Current	54.7	% RLA	Compressor 2B Sub Mode		
Line 2 Current	58.0	% RLA	Compressor 2B Sub Mode		
Line 3 Current	54.1	% RLA	Compressor 2B Sub Mode		
Maximum Line Current	57.9	% RLA	Compressor 2B Sub Mode		
Supply Oil Temperature	126.4	°F	Compressor 2B Sub Mode		

Performance Data - HydrEVAP Evaporative PreCoolers

TRANE Building Services KESTRELView™

Wednesday, July 15, 2020
2:23:47 PM PDT

Chiller Service Report
Without PreCoolers

Chiller Status

Chiller

TRANE Building Services KESTRELView™

Wednesday, July 15, 2020
2:40:30 PM PDT

Chiller Service Report
With PreCoolers

Chiller Status

Chiller

Tons: 453.5	**Tons: 537.0**	**Increase of 83.5 Tons**	**+ 18%**
kW: 1,492.4	**kW: 853.5**	**Reduction of 638.9 kW**	**- 43%**
kW/Ton: 3.29	**kW/Ton: 1.58**	**Reduction of 1.7 kW/Ton**	**- 52%**
EER: 3.64	**EER: 7.59**	**Increase of 4 EER**	**+ 109%**

Performance Data - HydrEVAP Evaporative PreCoolers

TRANE Building Services

KESTRELView™

Wednesday, July 15, 2020
2:40:30 PM PDT

Chiller Service Report

With PreCoolers

Chiller Status

Chiller

x 6 units

Increase of 501 Tons! **Like having a 7th Chiller!**

Reduction of 3,833.4 kW! **During peak demand!**

Reach setpoint without running 6 compressors!

ATEC/Indirex
Tel: (303) 816-7075 Fax: (800) 859-5592
Info@haveacoolday.com
Sales Representative: Erik Jeanette
Quotation: **HEQ103017 Arvada West High School Chiller**

HydrEVAP

Contact:	Maggie Anderson
Project:	Avada West High School Chiller
Date:	30-Oct-17
Model:	McQuay AGS275DS
Location:	Arvada, CO

Evaporative PreCooler Equipment Selection Information

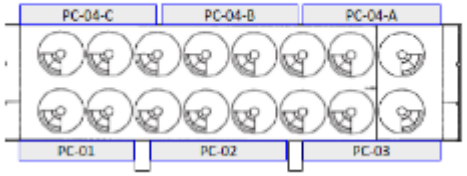
Input Information - Conditions for Evaluation			
Ambient:	**93 (F°)** Dry Bulb	**59 (°F)** Wet Bulb	**13%** Relative Humidity

Unit 1:	AC Unit Performance Data:		
McQuay AGS275DS	**Standard (No PC's)**	**With PreCoolers**	**% Change**
Cooling Capacity (Tons)	268.4 TONS	283 TONS	5%
	Increase in Cooling Capacity of : 14.2		
Energy Consumption (kW Input)	301.3 kW	213 kW	29%
	Reduction in kW of : 88.7		
Energy Efficiency (EER) (Energy Efficiency Rating)	10.2 EER	15.1 EER	48%
	(Increase in Energy Efficiency:) 4.9		

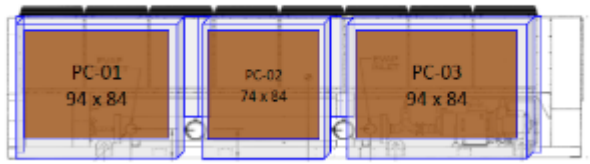
McQuay AGS275DS	Standard (No PC's)	With PreCoolers	Savings
Cost of Energy - Annual	$65,915	$46,503	$19,412
Cost of Energy - Lifetime	$988,723	$697,538	$291,185

McQuay AGS275DS	**Equipment Payback In :**	1.1 Years
Return On Investment	**Lifetime Savings - After PreCooler Cost**	$270,183

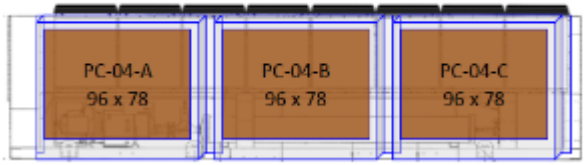
Plan View



Elevation View 1



Elevation View 2



ID#	PreCooler Price Per Chiller	Optional Equipment Per Chiller	Qty	Chiller SubTotal
Unit 1 McQuay AGS275DS	$ 27,744.43	$ 3,757.83	1	$ 31,502.26
	Total Est. Shipping Weight: 535			
	Notes:			
Installation	$ 16,995.00		1	$ 16,995.00
	Notes: Installation does not include providing water source or electrical requirements to chiller vicinity.			
Annual Service	$ 1,395.00		5	$ 6,975.00
	Notes: Spring start-up, Mid-Summer check, Fall shut-down. Replacement pumps included, excludes media replacement.			
Efficiency Works rebate with 50% bonus	$ (41,250.00)		1	$ (41,250.00)
	Standard + Bonus rebate $150/nominal ton			
			PreCooler SubTotal	$ 14,222.26

# of Pallets	2	Crating/Palletizing Charge	$ 250.00
Total Weight	785	Est. Shipping/Handling Charges	$ 1,000.00

Total Project Quote FOB: Loveland, CO	$ 15,472.26
PreCoolers, Shipping, and Optional Equipment	

Estimated Annual Savings:	**$ 19,412.00**
Estimated ROI (In Years/Seasons):	**0.8**
Estimated ROI (In Months):	**3.5**
Estimated Lifetime Savings (15 yrs):	**$ 275,707.74**

Efficiency Works rebates

Evaporative Condensing

Evaporative pre-cooling incentives

Equipment upgrade	Description	Incentive		Limited time incentive	
Evaporative Condensing	Evaporative media or mist to pre-cool air entering the condenser of a rooftop unit (RTU) or air-cooled chiller. In the unlikely event that the evaporative equipment damages a condenser or part of a condenser, and it is less than 15 years old, the manufacturer shall replace the condenser or damaged part of the condenser and pay for the cost of the study to determine the cause of failure.	~~$100~~	per ton	**$150**	per ton

- For a limited time, a 50% bonus is available for cooling rebates. Projects must be completed and submitted for payment by November 15, 2023.
- Preapproval is required for all projects with incentives greater than $10,000
- Incentives are limited to total project cost for projects with incentives less than $50,000

Questions?

Bryan Curtis

Evaporative Solutions

720-933-8606

bcurtis@evaporativesolutions.com

Thank you for participating in Efficiency Works Business

Business@EfficiencyWorks.org
EfficiencyWorks.org

Efficiency Works™

Estes Park | Fort Collins | Longmont | Loveland