Nano-Engineered Materials:

Driving Energy Savings for Campus Sustainability and Asset Reliability

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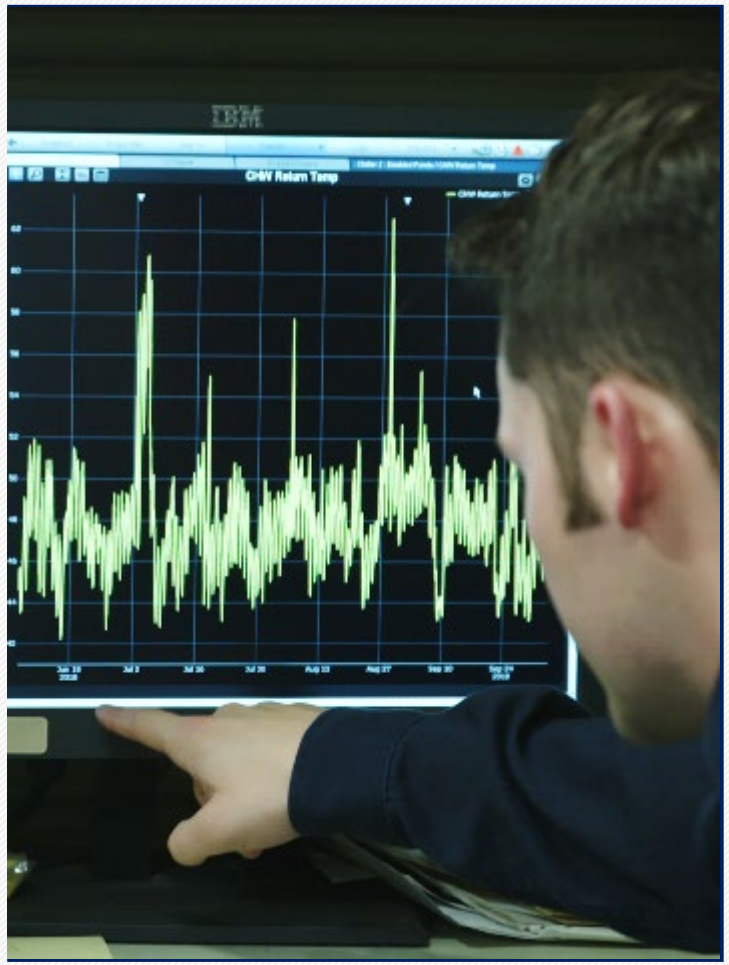
CampusEnergy2020
THE POWER TO CHANGE
FEBRUARY 10-14 ▲ SHERATON DENVER DOWNTOWN ▲ DENVER, CO

INTERPHASE MATERIALS

Our Solution

The AAA Engineering Process



Project Overview

A “Big Ten” Institution

When: August 2019

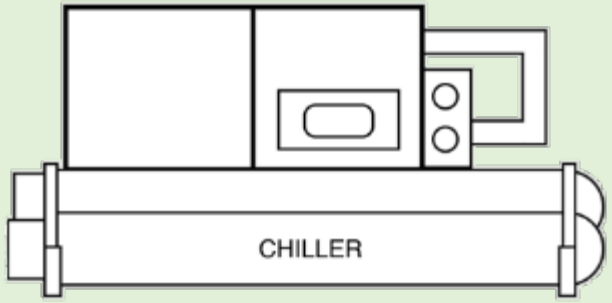
Assets: 1 Chiller

2 PFHXs

Purpose: Evaluate the AAA Process against existing practices and other technologies

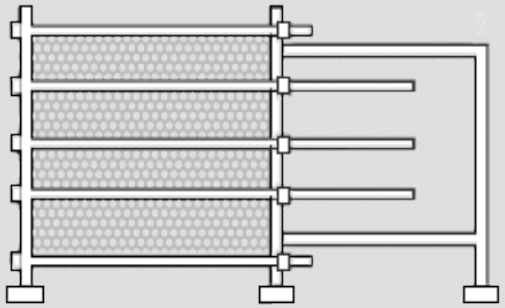
Project Challenge

Boost **Production**



- Improve performance across varying load conditions
- Test various technical options to:
  - Improve chiller efficiency
  - Reduce kW draw per load
  - Improve and maintain system cleanliness

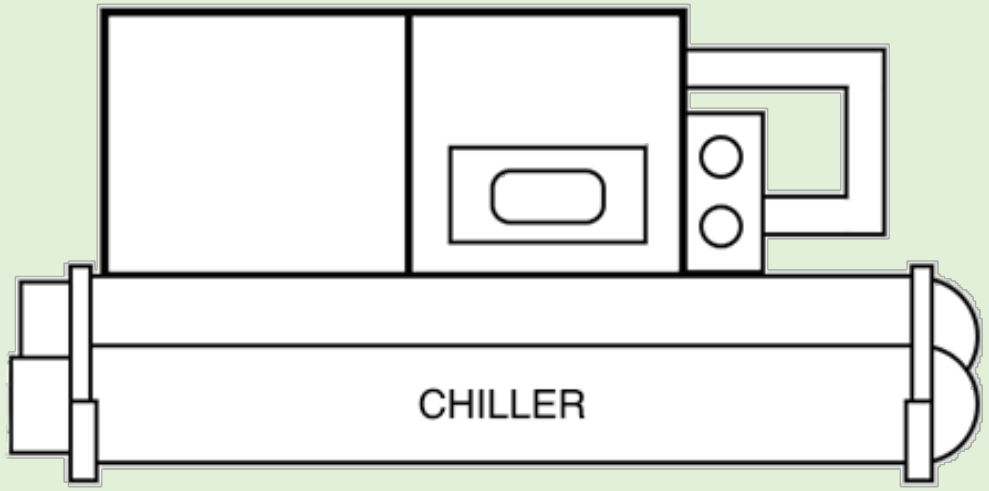
Enhance **Distribution**



- Improve performance on pristine system
- Test various technical options to:
  - Improve heat transfer across flows
  - Reduce approach temperature
  - Improve and maintain system cleanliness

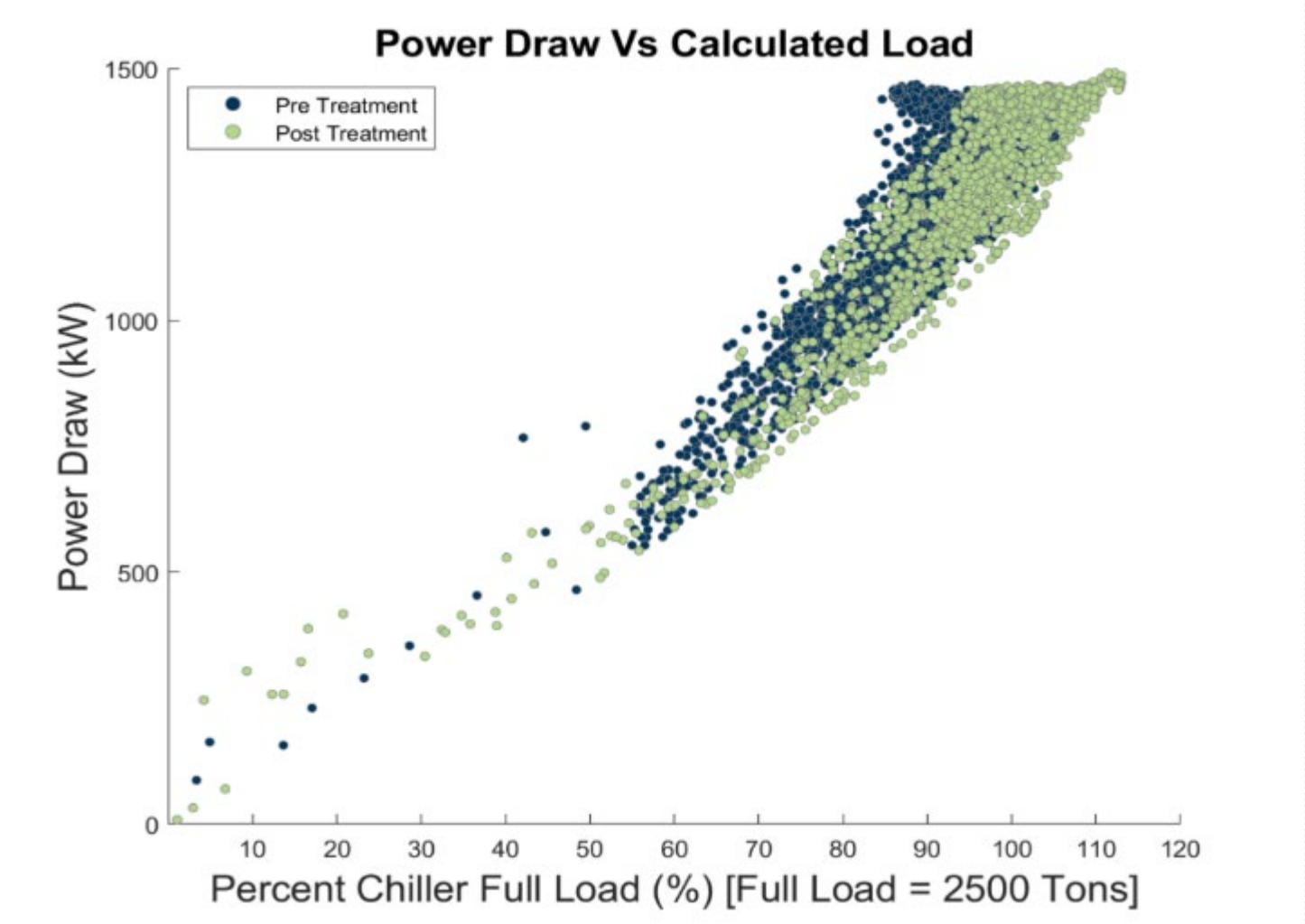
Chiller Project Design

Boost **Production**



- Success parameters:
  - Condenser Effectiveness
  - kW Draw
- 2,500 tons of cooling
- Operates over 100% capacity in summer

Power Draw



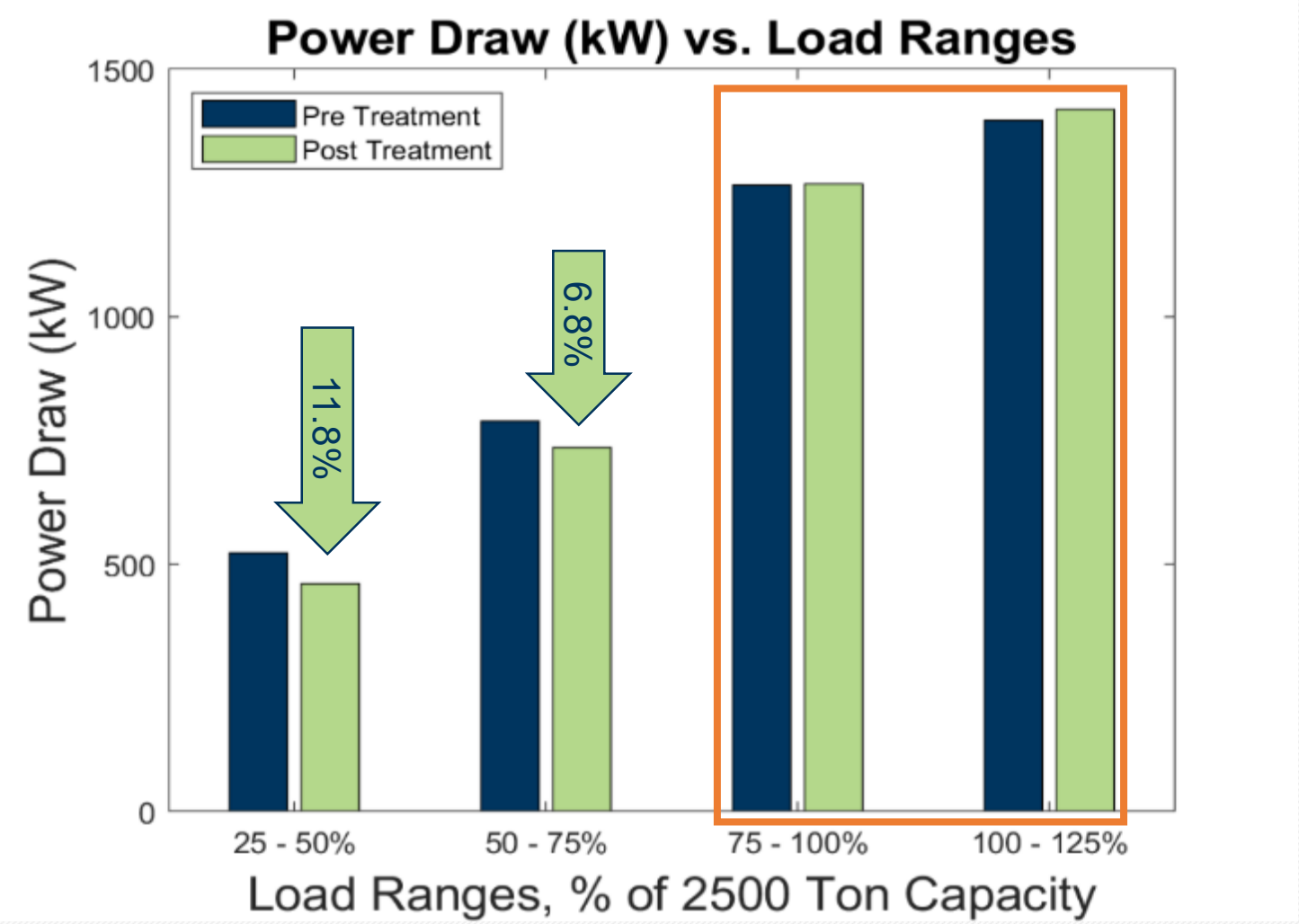
9.3%
Avg. Improvement in Power Draw

Power Draw Reduction
Mid-Range Loads

11.8%
25-50% Load Ranges

6.8%
50-75% Load Ranges

Power Draw



9.3%

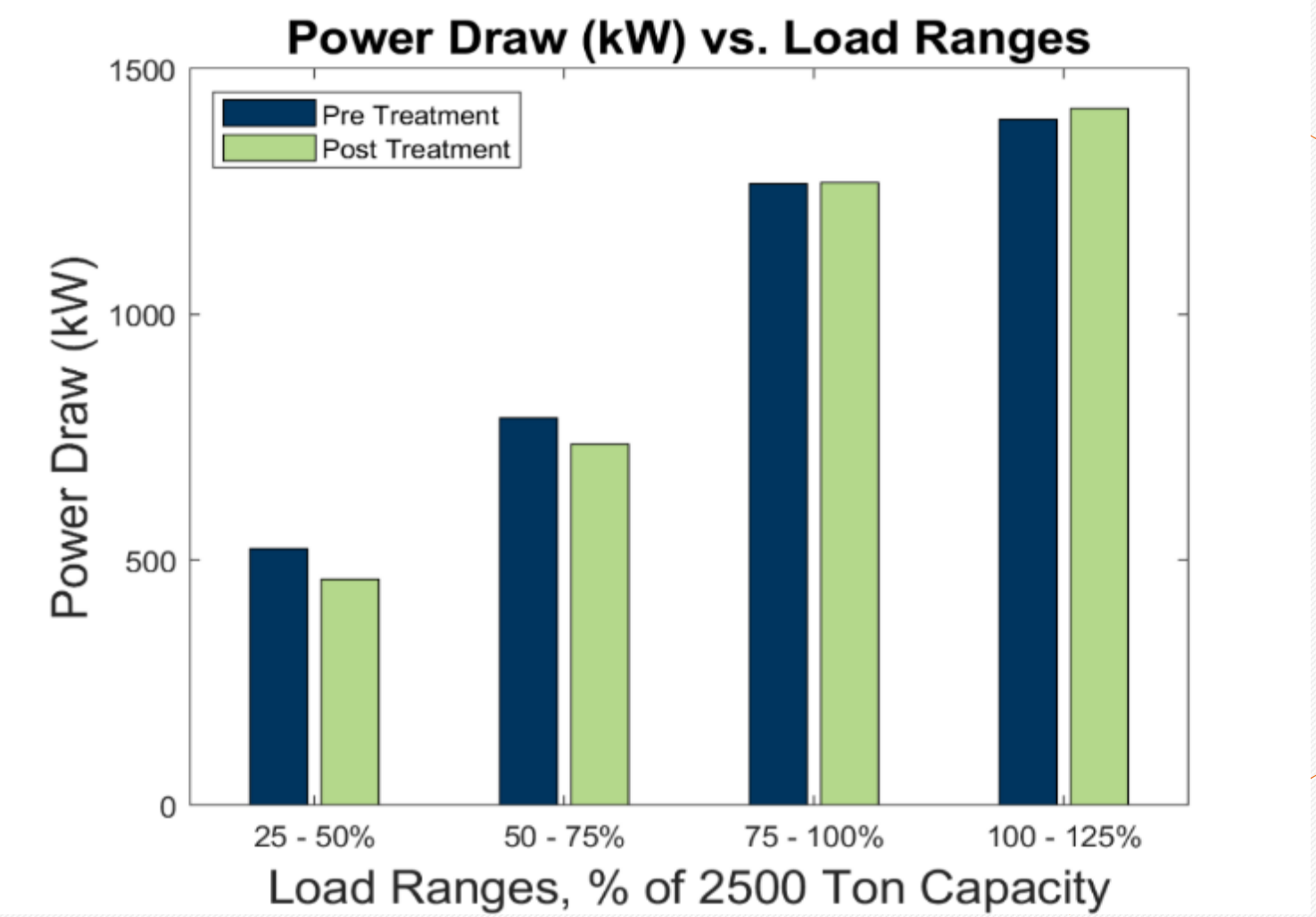
Avg. Improvement in Power Draw

Power Draw Reduction

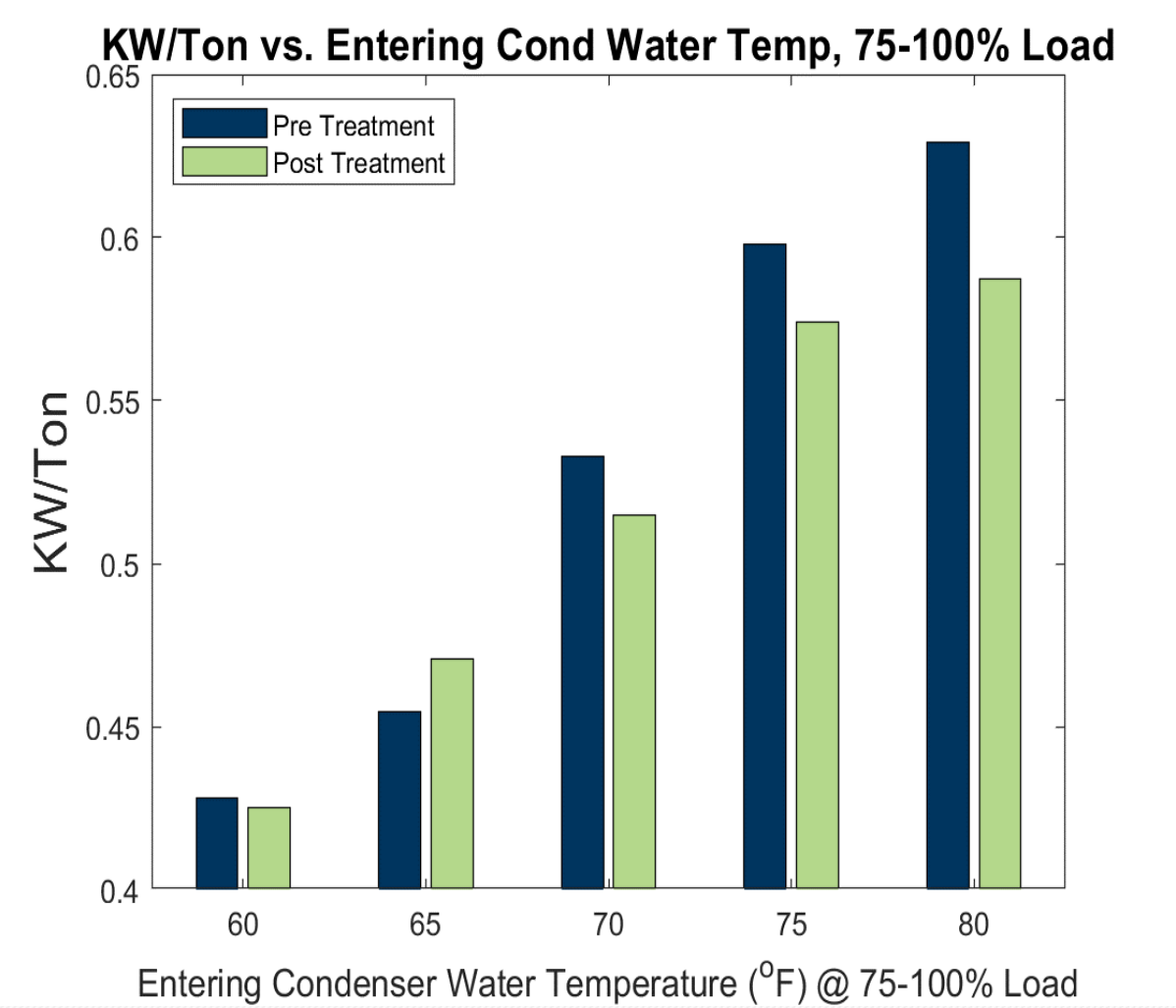
Mid-Range Loads

11.8%	**6.8%**
25-50% Load Ranges	50-75% Load Ranges

Power Draw & Condenser Water



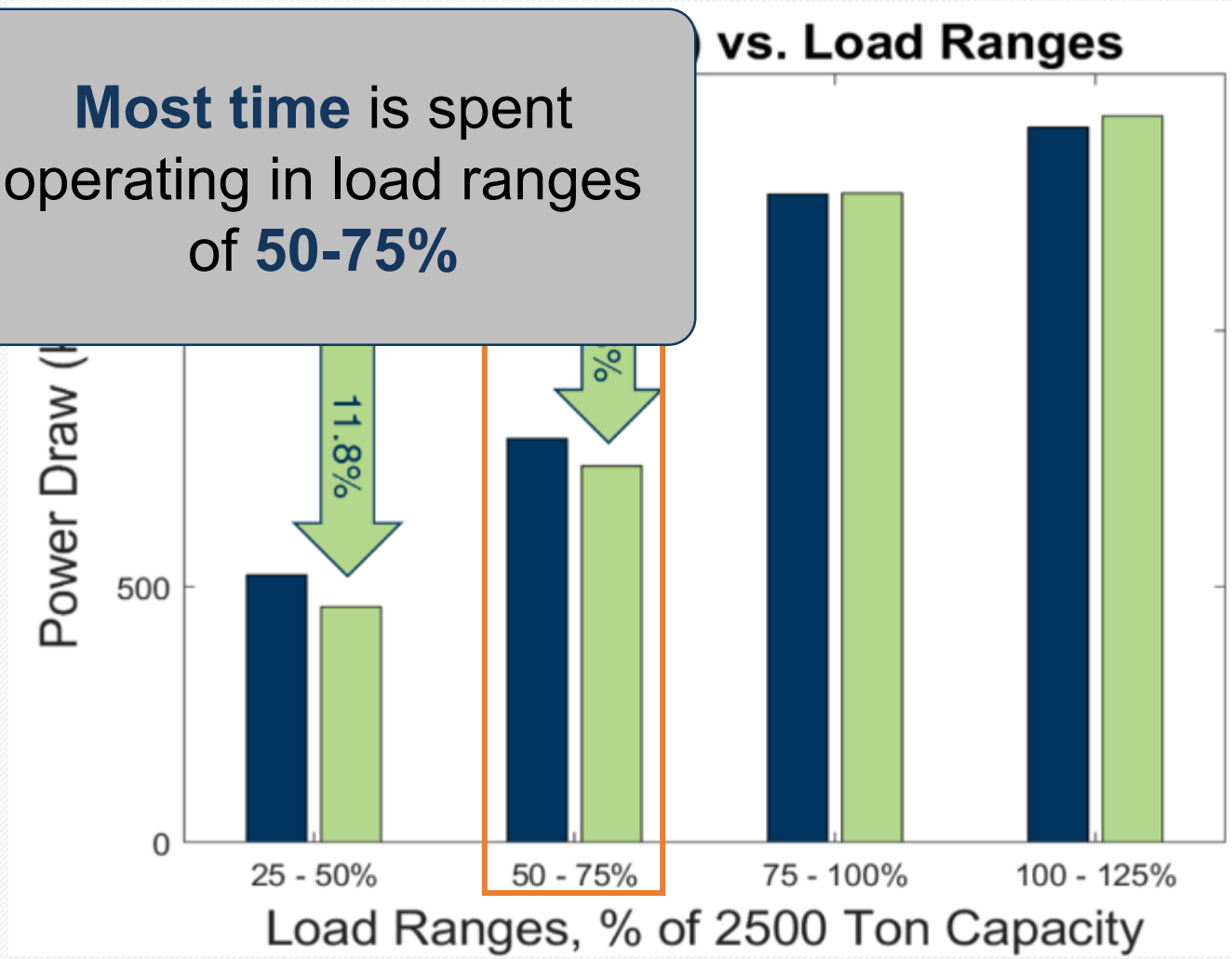
Power Draw & Condenser Water

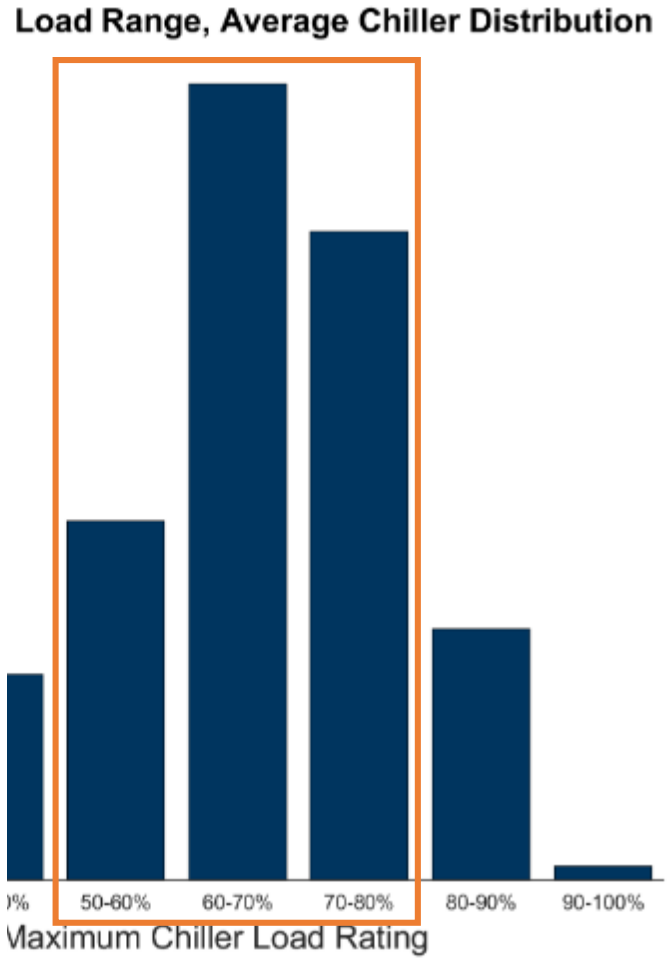


75 – 100% Load Temperature	65ºF	70ºF	75ºF	80ºF
kW/ton Pre-Treated	0.4548	0.5328	0.5980	0.6291
kW/ton Post-Treated	0.4707	0.5150	0.5741	0.5872
Difference (%)	3.48	3.34	4.00	6.67
Post Treatment Data Points	173	227	460	115

Load & Operating Hours

Most time is spent operating in load ranges of **50-75%**





Savings & ROI

Chiller Size (tons)	Energy Savings per year (kWh)	Cost Savings per year	Payback (Months)
1000	142,415	$14,241	5
1200	170,900	$17,090	4
2000	284,831	$28,483	3

Assumptions:	1,400 ton avg. chiller size $0.10 kWh energy cost

Avg. Payback per Chiller:

4 months

Faster payback in larger systems

Estimated Savings per Chiller:

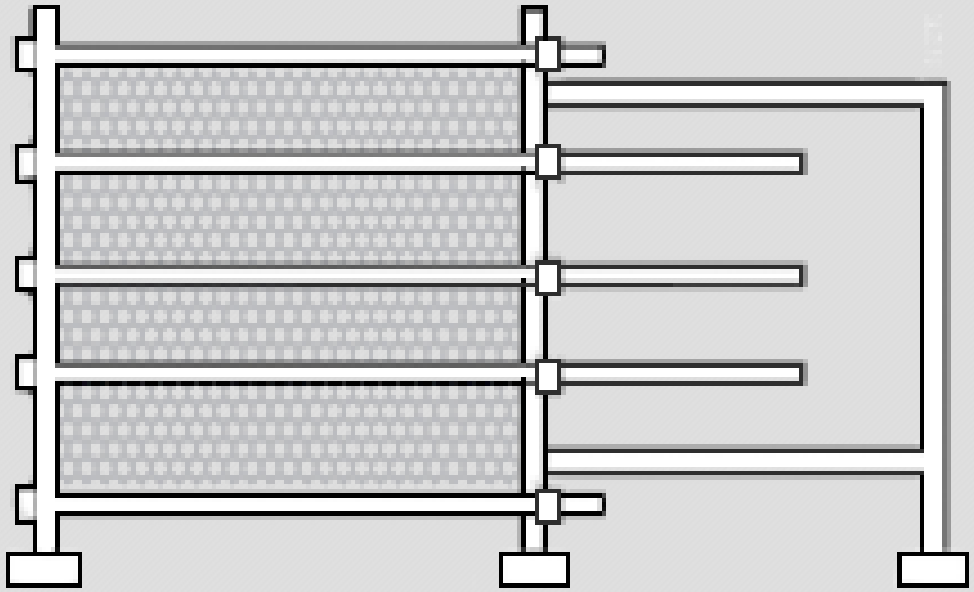
$20,000

Greater savings with larger chillers

PFHX Project Design

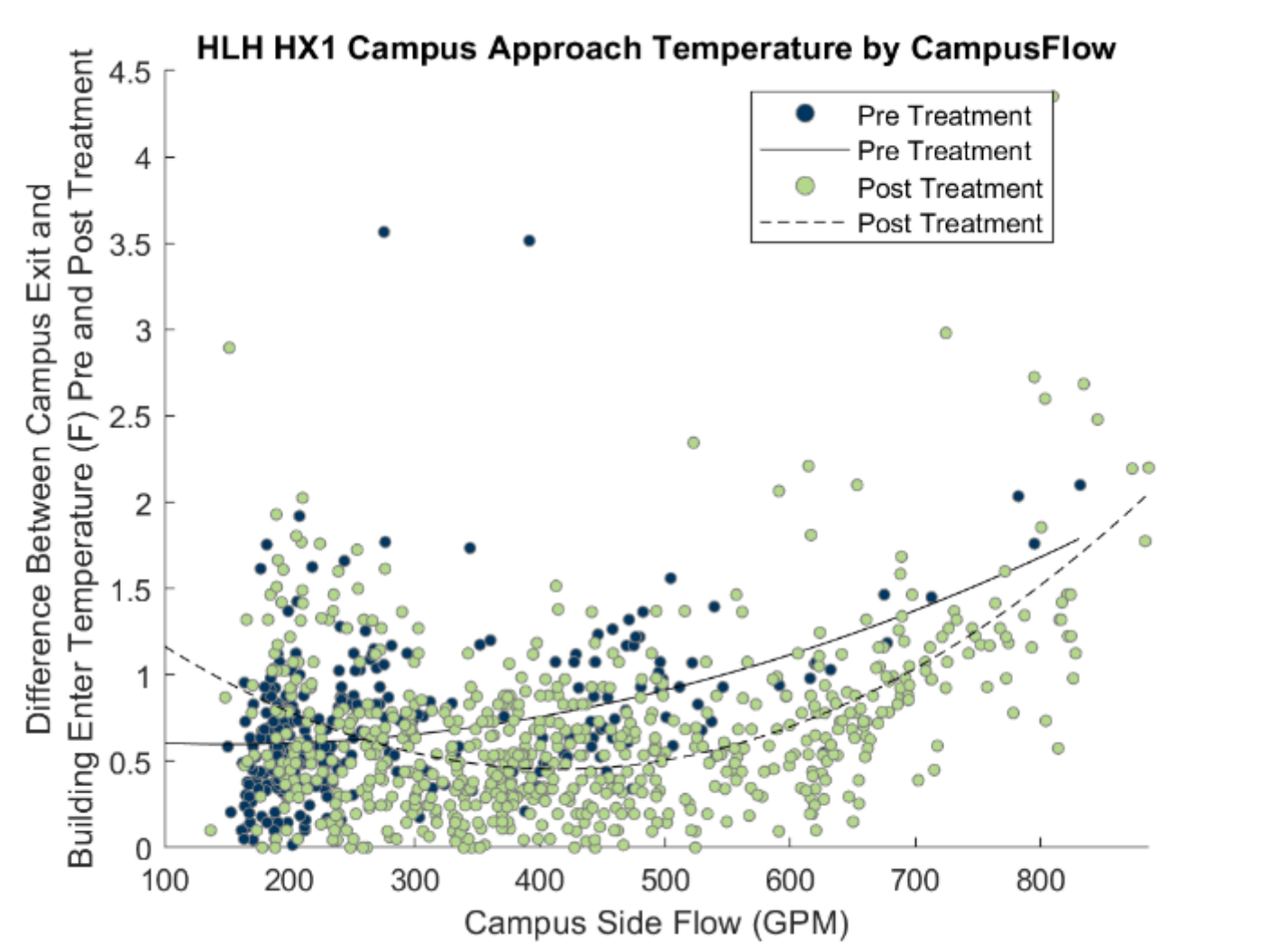
- Success parameters:
  - Approach temperature
  - Effectiveness
  - UA * Flow
- 320 gal. volume
- Focus on improvements to already pristine system

Enhance **Distribution**



Decrease Approach Temperature for Better Campus to Building Supplies

Approach Temperature



34.7%

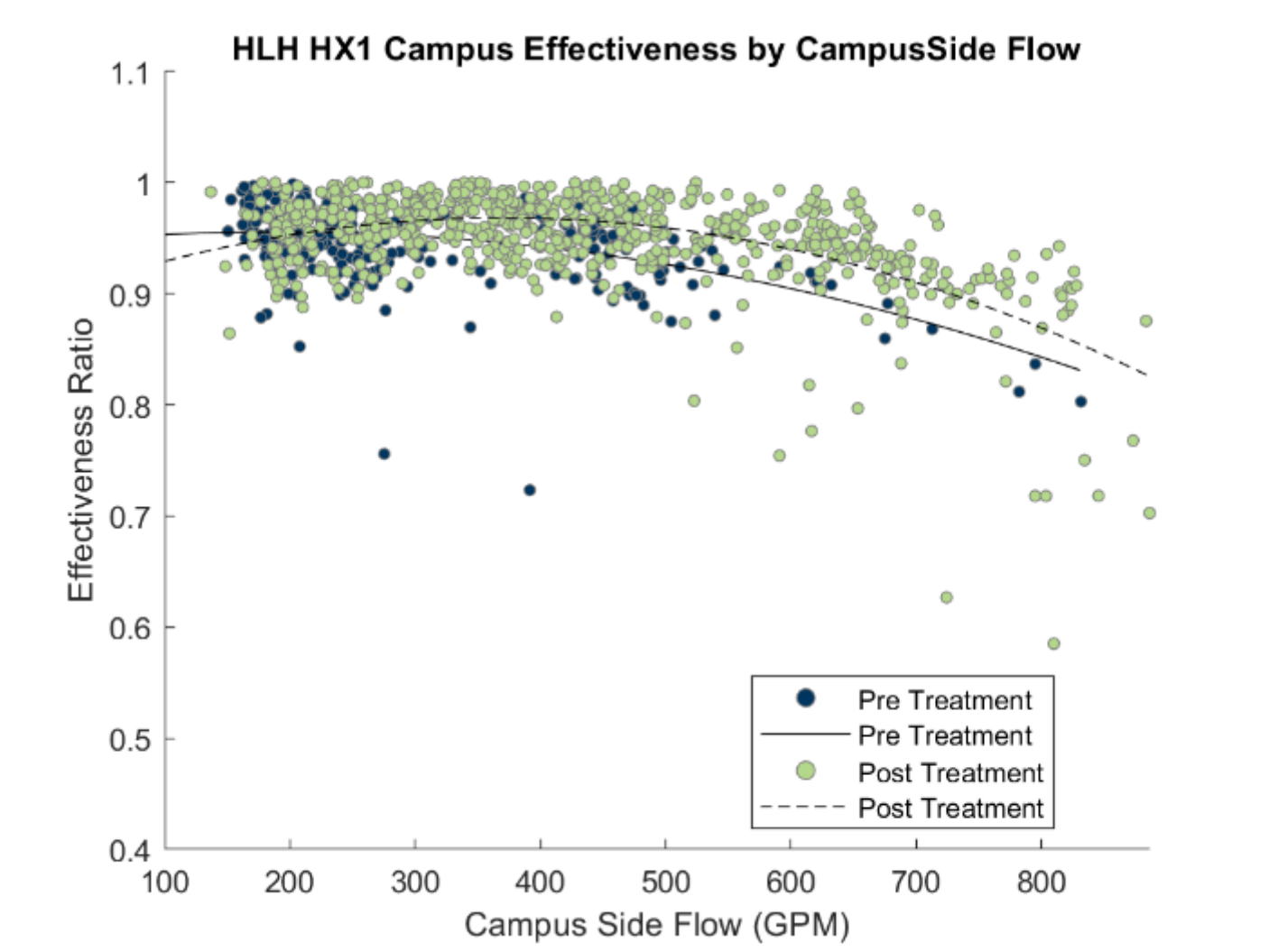
Decrease in Approach Temp.

Avg. Approach Temp.

300-600 GPM

0.78 ºF	**0.51 ºF**
Before	After

Effectiveness



2.3%

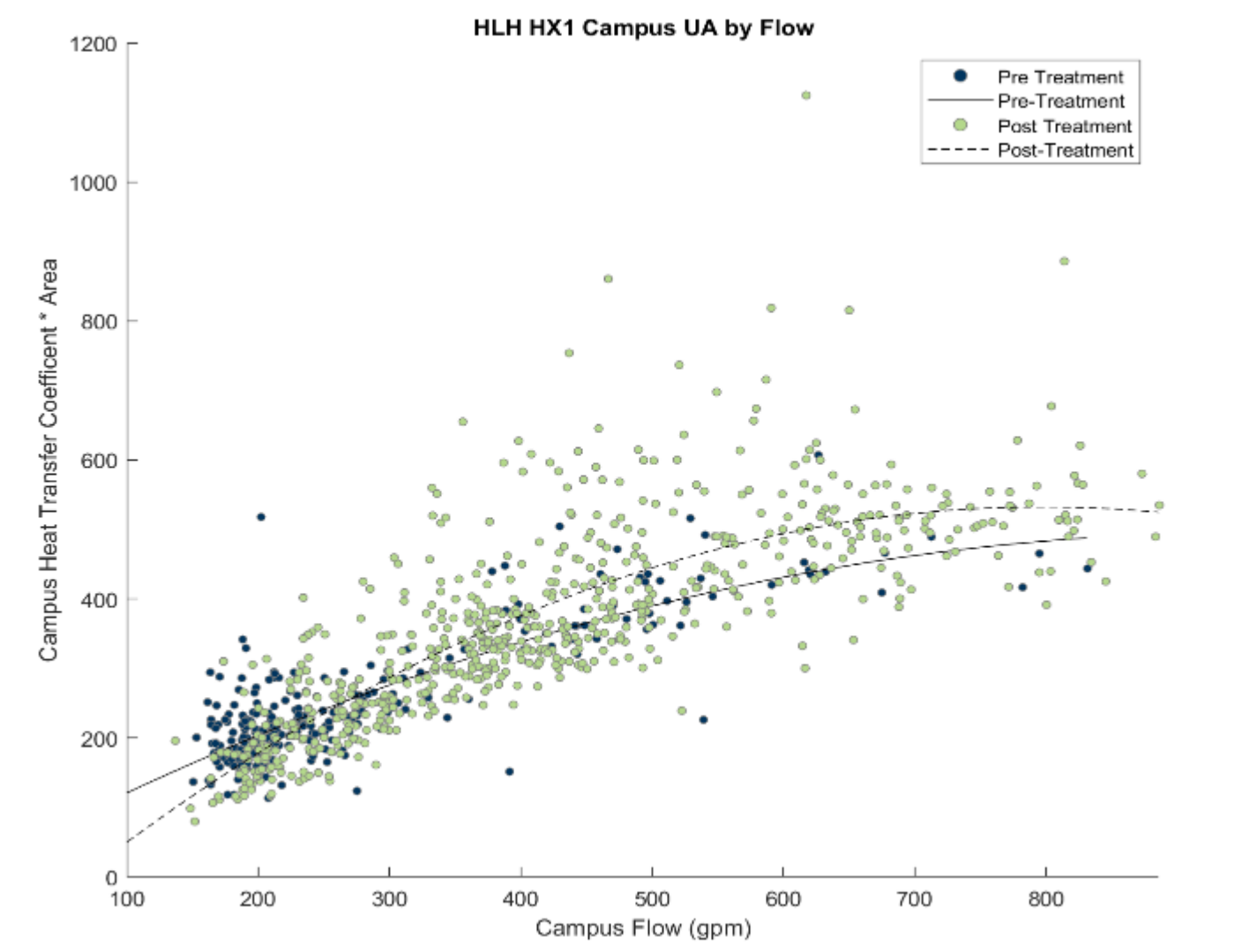
Increase in Average Effectiveness

Avg. Effectiveness

300-600 GPM

0.9397	**0.9610**
Before	After

UA*Flow



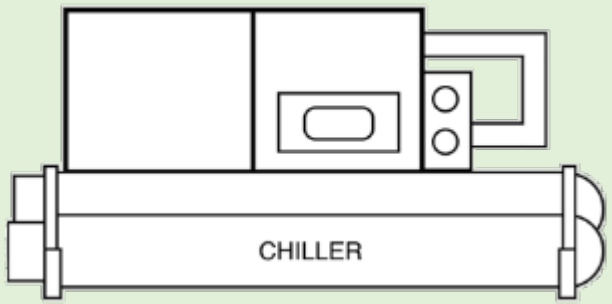
10.2%
Increase in HTC * Area

Avg. UA
300-600 GPM

0.3566	**0.3931**
Before	After

Project Impact & Lessons Learned

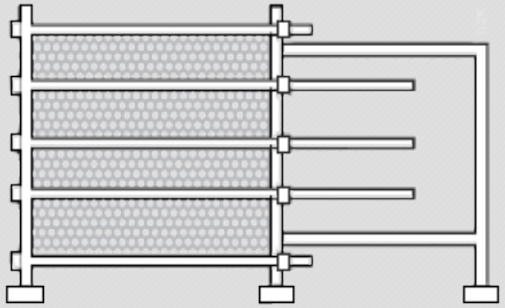
Boost **Production**



- Motor power draw lowered by **6.8 – 11.8%**
- Improve performance at challenging loads and temps

- *Estimated* **$20,000** average savings per chiller

Enhance **Distribution**



- Lower approach temp by **34.7%** to boost heat transfer
- A **10.2%** improvement to HTC * Area
- Improve effectiveness by **2.3%**

Questions?

Thank You!

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