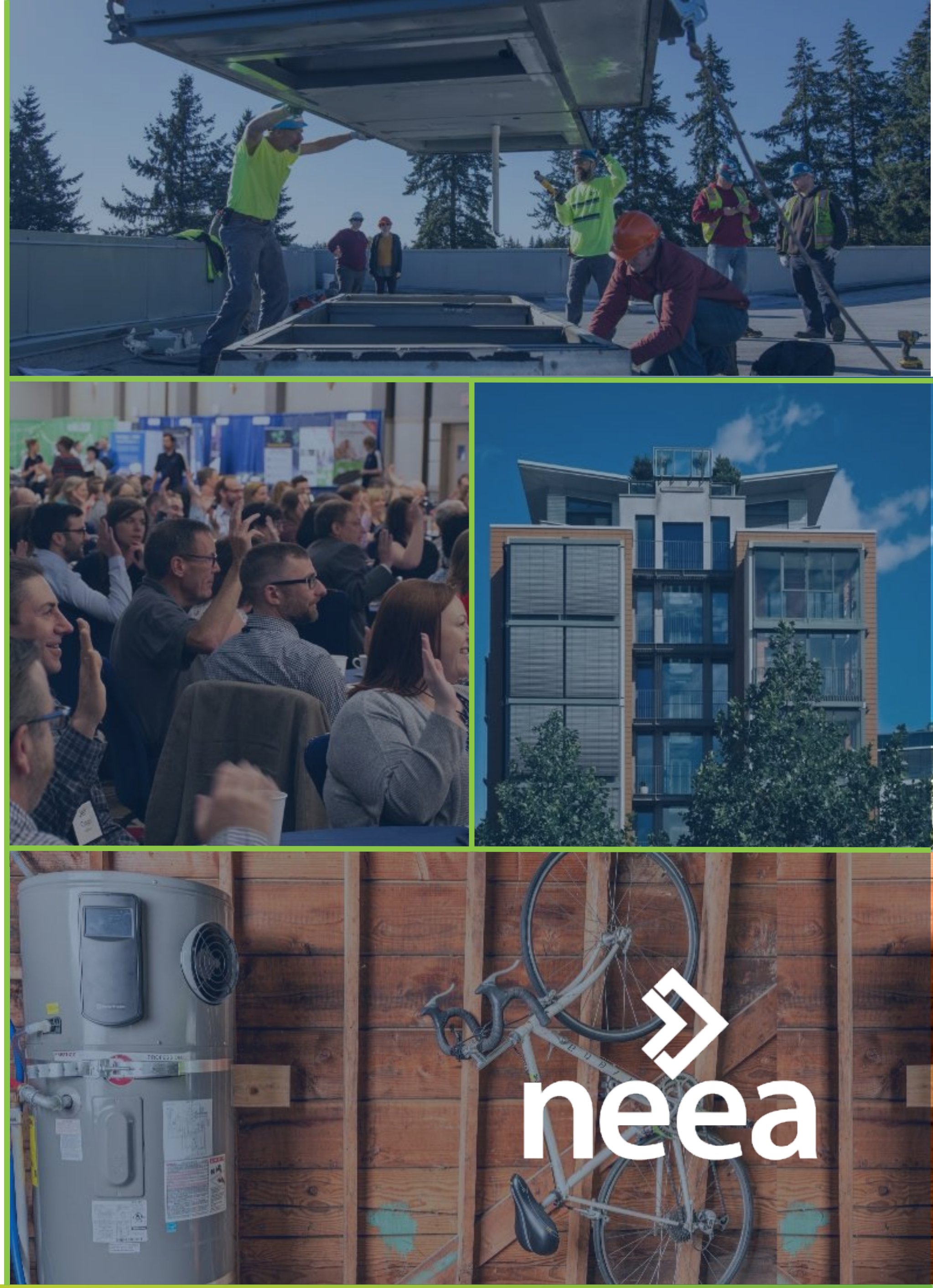
Regional Emerging Technology Advisory Committee (RETAC)

Northwest Energy Efficiency Alliance

Q1 2023 Meeting

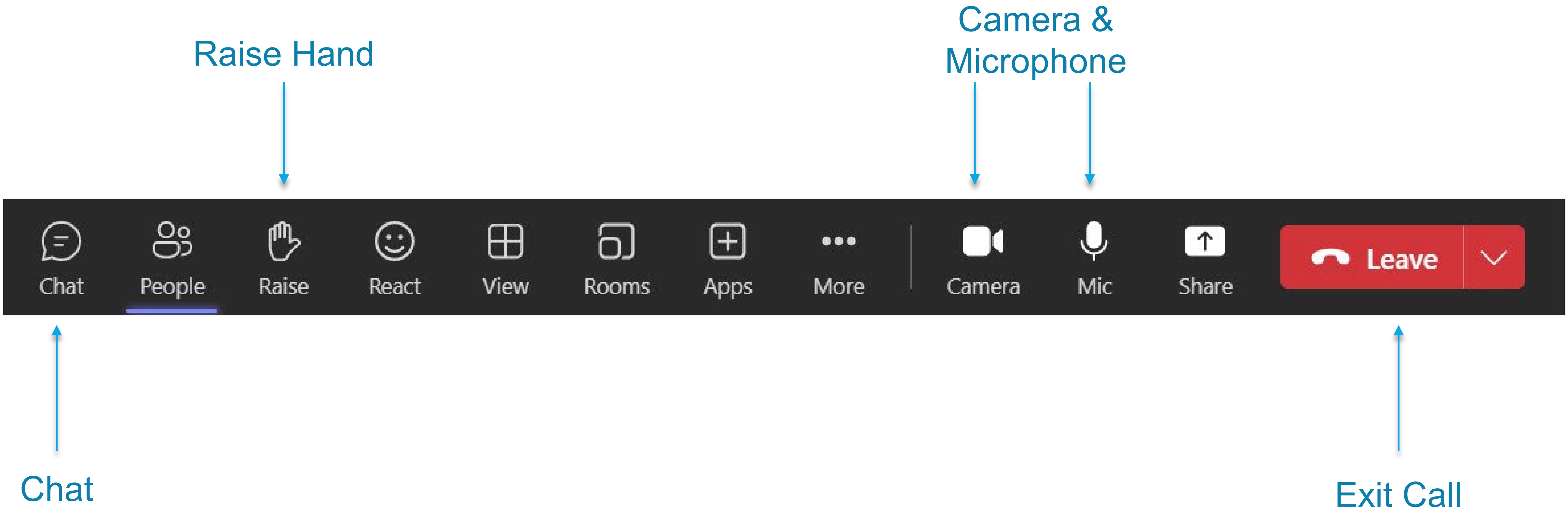
March 30, 2023

9:00am – 11:45am



CLASSIFICATION LEVEL: PUBLIC

Navigating MS Teams Layout



Note: These options may vary, depending on which version you're using.

Name,
Title,
Organization
and …

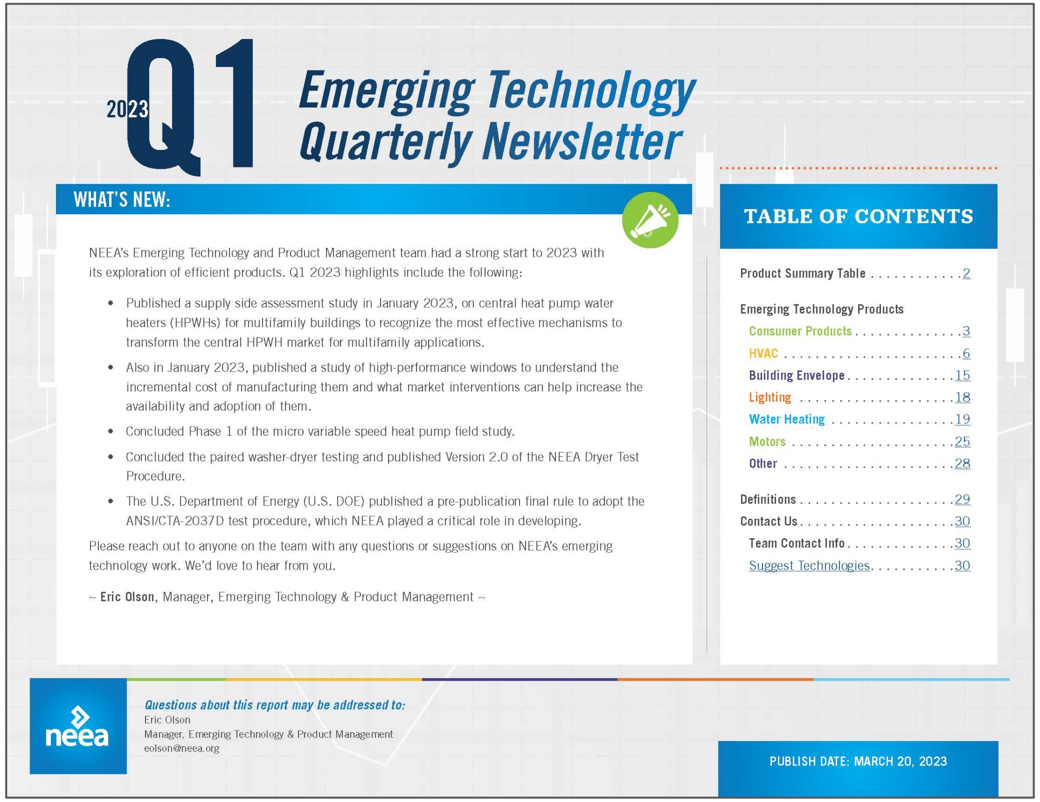
What was one popular song from the year you graduated high school?

Agenda

9:00 am	Welcome, Agenda Review, Announcements, Conferences & Product Council Updates
9:45 am	*New!* Slipstream Emerging Technology Update
10:30 am	*Break (15 min)*
10:45 am	*New!* NEEA Product Council Series
11:30 am	Public Comment, Poll & Adjourn

Announcements

Q1 2023 Emerging Tech Newsletter



2023 Q1 Emerging Technology Quarterly Newsletter

WHAT'S NEW:

NEEA's Emerging Technology and Product Management team had a strong start to 2023 with its exploration of efficient products. Q1 2023 highlights include the following:

- Published a supply side assessment study in January 2023, on central heat pump water heaters (HPWHs) for multifamily buildings to recognize the most effective mechanisms to transform the central HPWH market for multifamily applications.
- Also in January 2023, published a study of high-performance windows to understand the incremental cost of manufacturing them and what market interventions can help increase the availability and adoption of them.
- Concluded Phase 1 of the micro variable speed heat pump field study.
- Concluded the paired washer-dryer testing and published Version 2.0 of the NEEA Dryer Test Procedure.
- The U.S. Department of Energy (U.S. DOE) published a pre-publication final rule to adopt the ANSI/CTA-2037D test procedure, which NEEA played a critical role in developing.

Please reach out to anyone on the team with any questions or suggestions on NEEA's emerging technology work. We'd love to hear from you.

~ Eric Olson, Manager, Emerging Technology & Product Management ~

TABLE OF CONTENTS

neea

Questions about this report may be addressed to:
Eric Olson
Manager, Emerging Technology & Product Management
eolson@neea.org

PUBLISH DATE: MARCH 20, 2023

- Updated schedule
- Selected Q1 Highlights:
  - Version 2.0 NEEA Dryer Test Procedure Released
  - Very High Efficiency DOAS Optimization
  - Micro HP Field Study
  - HPW Incremental Manufacturing Cost Study
  - LLLC Data Collection
  - AHRI 1430 Electric Water Heater Connectivity Standard

https://neea.org/resources-reports

2023 RETAC Meeting Dates

Q1	Thursday, March 30
Q2	Tuesday, June 27
Q3	Thursday, September 21
Q4	Thursday, December 14

Conferences
Product Councils

Conferences

Past Conferences

- Consumer Electronics Show – January 2023
- CEE Winter Meeting – January 2023
- Midwest Energy Solutions Conference – January 2023
- ASHRAE / AHR Conference – February 2023
- TMAF – Energy Solutions Center – March 2023
- Hydraulic Institute Annual Conference – February 2023
- ACEEE Hot Water & Hot Air Forum – March 2023
- LEDucation – March 2023
- NALMCO Spring Conference – March 2023

Upcoming Conferences

- Better Buildings, Better Plants Summit – April 2023
- Building Technology Office Peer Review – April 2023
- Efficiency Exchange – May 2023
- Getting to Zero Forum – May 2023
- IEA Heat Pump Conference – May 2023
- LightFair 2023 – May 2023
- CEE Summer Session – June 2023

 |

Q1 2023 Product Council Presentations

Presenter	Topic	Date Scheduled	Webinar Recording
University of Oregon	Integrated Design Lab Series	1/31/23	Northwest Energy Efficiency Alliance (NEEA) | Integrated Design Lab…
University of Idaho	Integrated Design Lab Series	2/7/23	Northwest Energy Efficiency Alliance (NEEA) | Integrated Design Lab…
Washington State University	Integrated Design Lab Series	2/14/23	Northwest Energy Efficiency Alliance (NEEA) | Integrated Design Lab…
University of Washington	Integrated Design Lab Series	3/7/23	Northwest Energy Efficiency Alliance (NEEA) | Integrated Design Lab…
Northeast Energy Efficiency Partnership (NEEP)	Cold Climate Air Source Heat Pump Product List Refresher & Update	3/14/23	Northwest Energy Efficiency Alliance (NEEA) | NEEP Cold Climate Air…
New Buildings Institute (NBI)	Central Heat Pump Water Heaters for Multifamily Supply Side Assessment & Workshop	3/28/23	Materials available online March 31, 2023 → Northwest Energy Efficiency Alliance (NEEA) | Product Council

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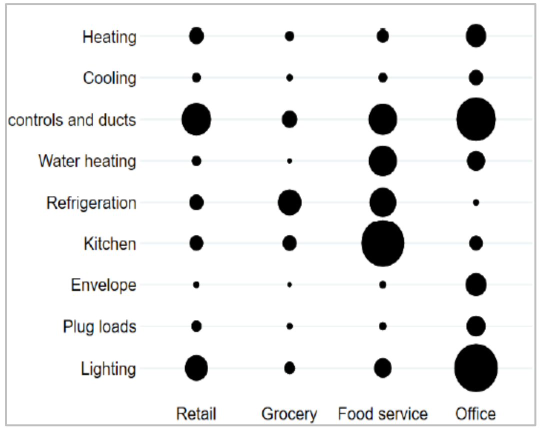
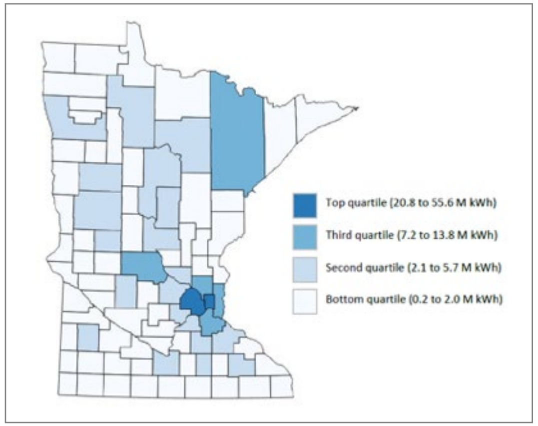
Slipstream Emerging Technology Update

Slipstream Research and Innovation

March 2023





Research | Demonstrate | Pilot | Evaluate

Analytics and Market Research

Energy Modeling

Field Measurement and Research

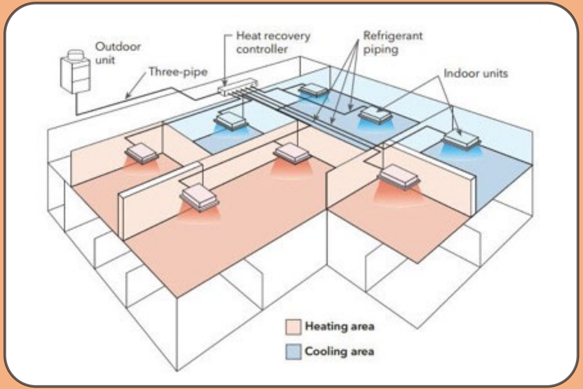
Demonstration Projects

Deployment Pilots

Market Transformation Development / Tech Transfer

New Program / Pilot Design and Development

Advanced Evaluation

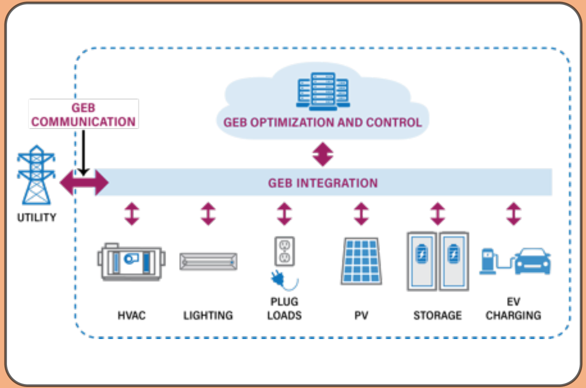


COMMERCIAL ELECTRIFICATION

HEATH AND ENERGY

ADVANCING CODES + BPS

FINANCING INNOVATION



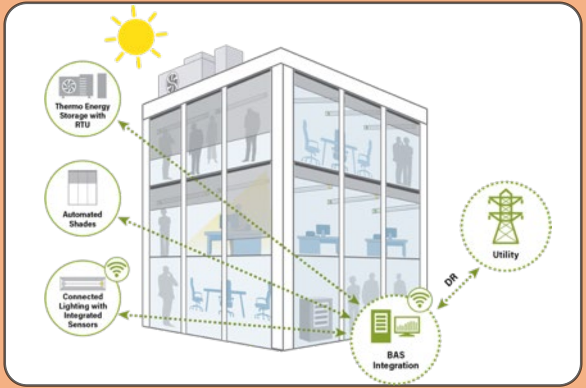
GRID-INTERACTIVE EFFICIENT BUILDINGS

COMMUNITY DECARB + RESILIENCE

Photo of Tierra Linda development courtesy of Gordon Walek

AFFORDABLE HOUSING (INCL. BURDEN)

RESIDENTIAL ELECTRIFICATION



SMARTER BUILDINGS

Ongoing work in emerging tech…

Residential electrification

- ASHPs
- HPWHs
- Full electrification, equity (incl. economics)

Example: 120V Heat Pump Water Heater Pilot

Completed: Midwest Modeling and Cost Analysis

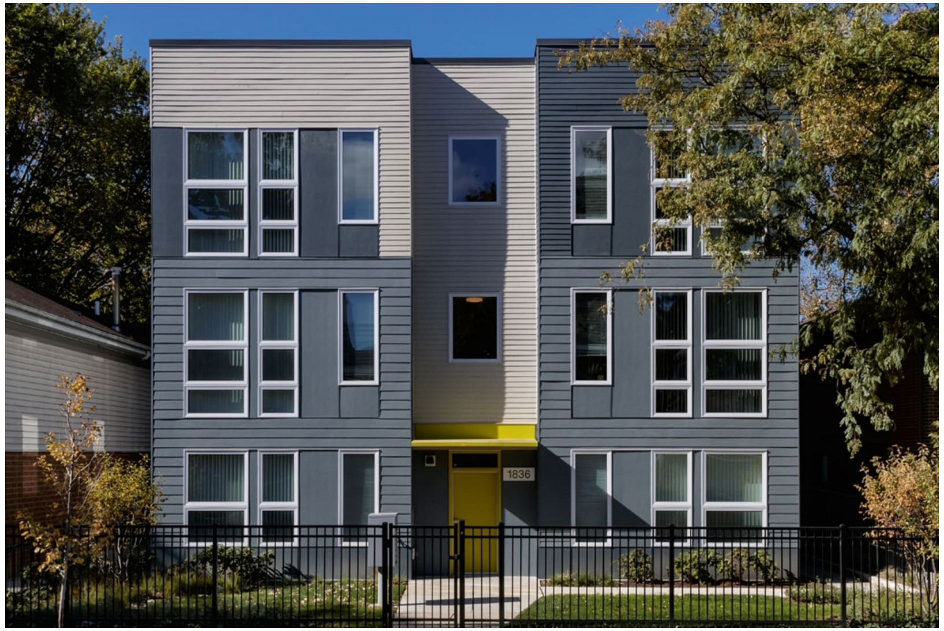
- 120 V HPWH can effectively replace natural gas in lower use homes and avoid panel upgrades
- Targeting and plumber education required to unlock full benefits

Upcoming: Midwest Field Demonstrations

- Multi-state study with 6 to 8 installations per state
- Study field performance to assess costs, efficiency, energy use, peak demand, and performance
- Targeted installation September 2023 with 1 year of monitoring

Rheem Proterra Plug in

Source: www.rheem.com/ProTerra

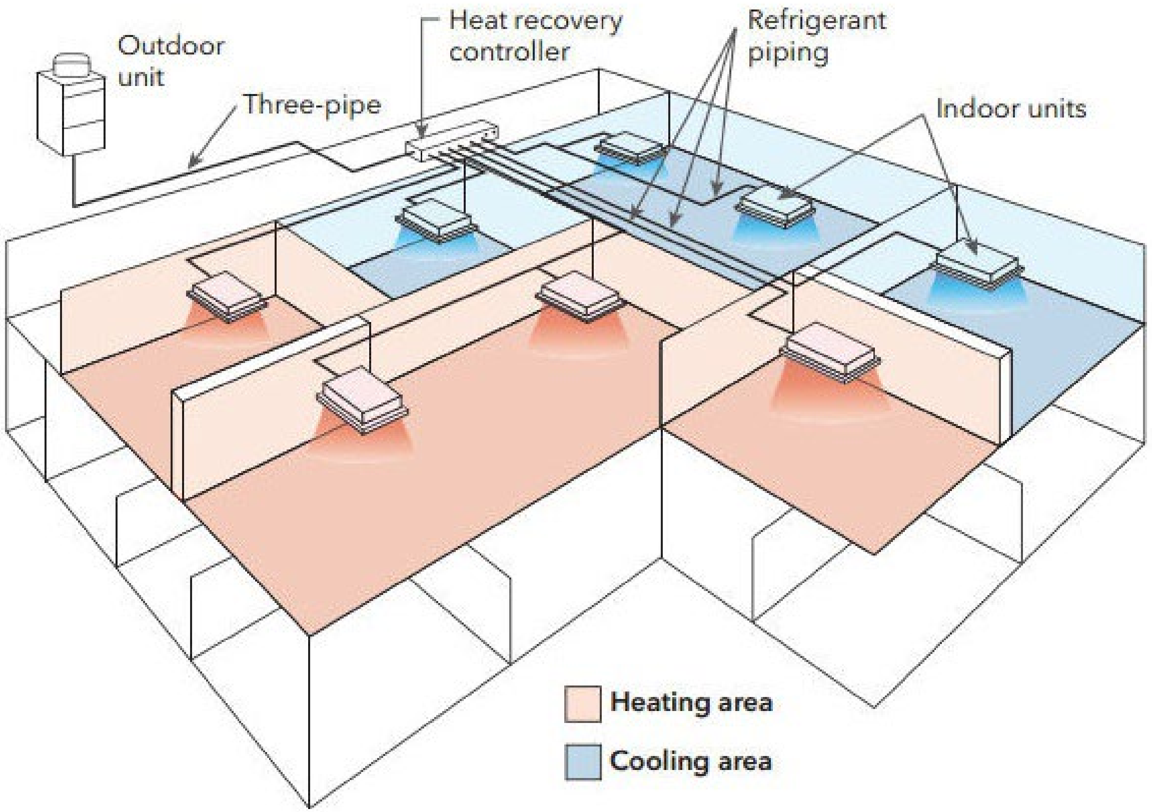


Affordable housing
(and lower energy burden)

- Design/construction (e.g. PHIUS)
- Manufactured homes
- Non-energy impacts

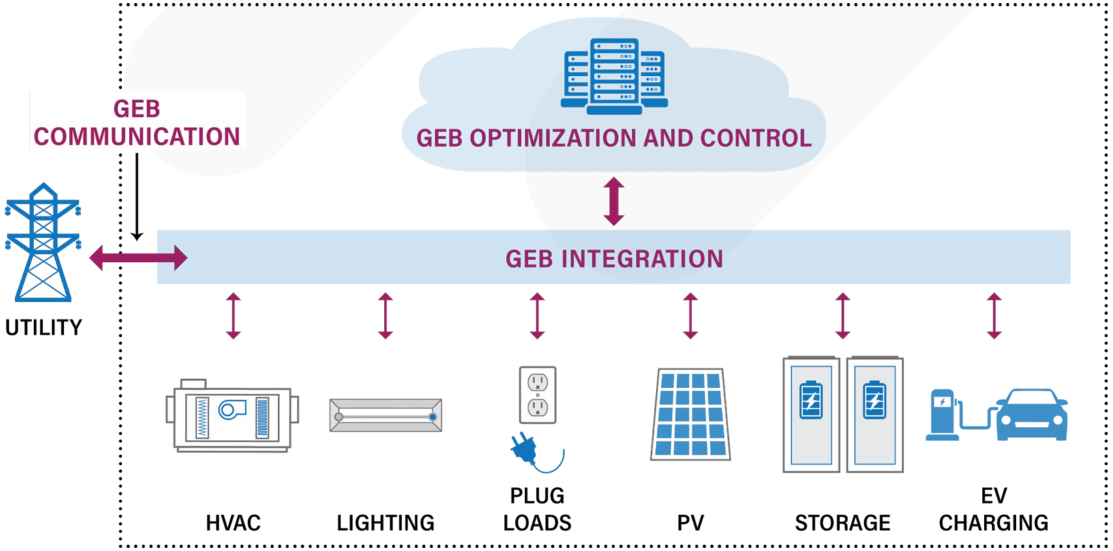
Example: Passive House for Affordable Housing

Commercial Electrification



- Small commercial
  - Similar to residential
- Medium commercial
  - Variable Refrigerant Flow
  - Heat Pump and Dual Fuel RTUs
- Large commercial
  - Central air-to-water heat pumps
  - Strategic electrification

Grid-interactive Efficient Buildings



- Analytics and market research
  - Resiliency
  - DER interconnection policy
- Modeling
  - BTM microgrids
  - Load shift/shed
- Active demonstrations
  - Load management (HVAC, lighting, plugs)
  - RTES
  - EV managed charging
  - Solar+storage management
  - Connected communities
- Future demonstration capabilities
  - OpenADR
  - Aggregation
  - VPP

Smarter Buildings

- Smart building and EMIS training
- Integrate lighting + HVAC + shades
- ASHRAE Guideline 36 controls field demo.
- Automated Fault Detection and Diagnostics (AFDD) - Monitoring-based Cx
- Smart equipment (smart motor, smart valve) demo.

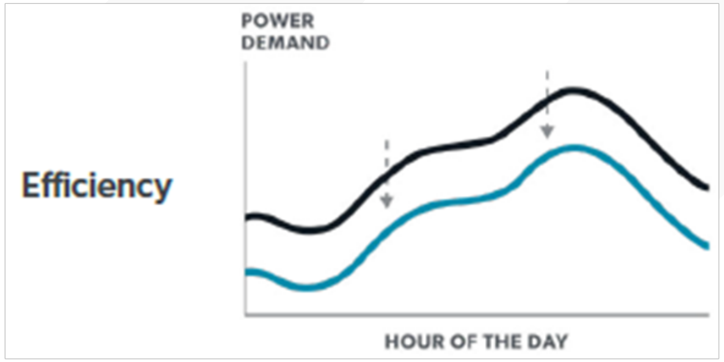
… and smarter homes

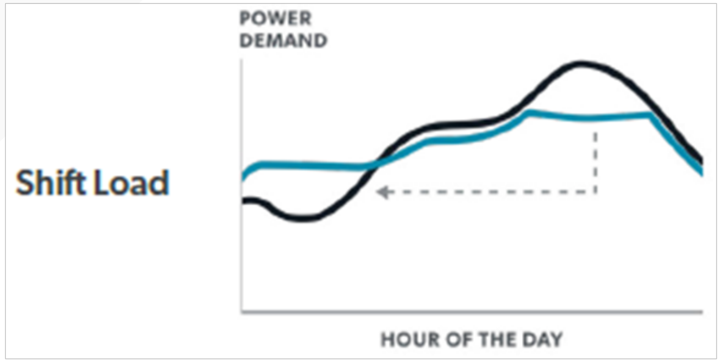
- Smart home device integration and control
- Smart homes pilot
- Smart apps demo. (Open HEMS)

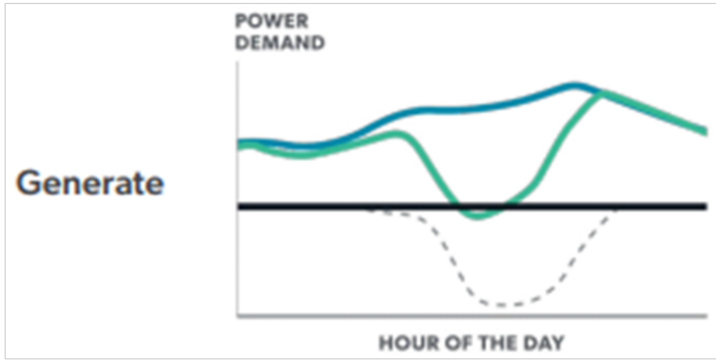
Switched Reluctance Motors Project Summary

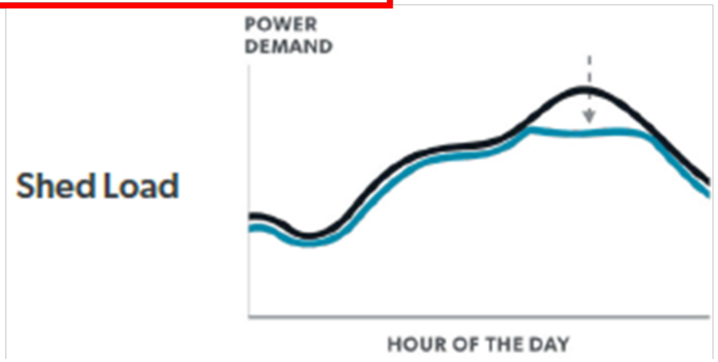
comed
AN EXELON COMPANY
Energy Efficiency

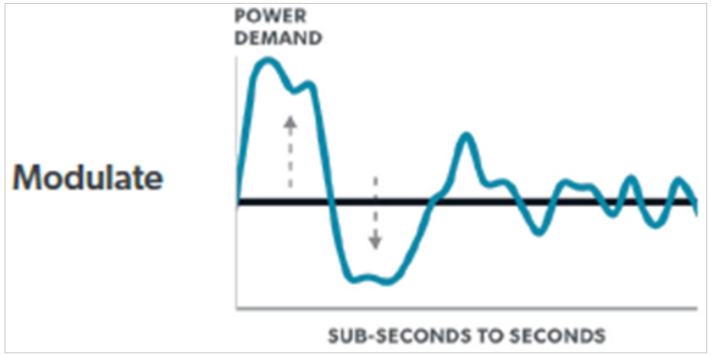
Flexible Loads



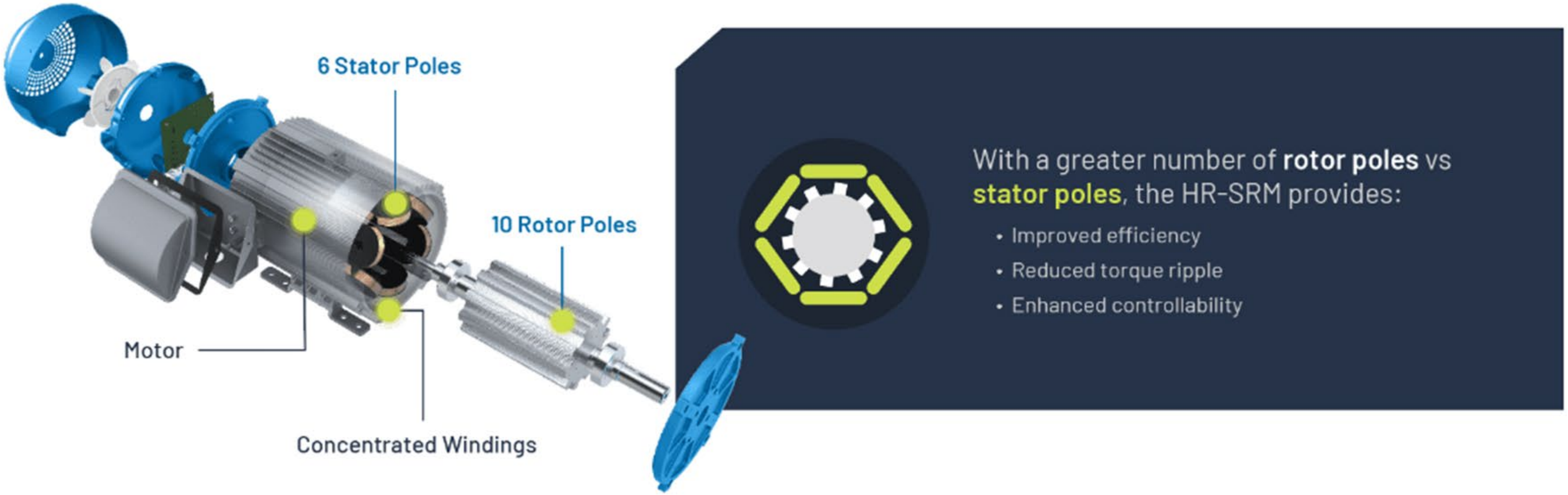






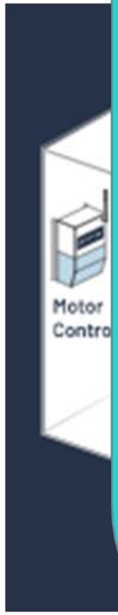


The Motor



Used with permission from Turntide Motors: https://turntide.com/

The Motor System



Used with per

Lesson 1:

Efficiency + Control + Visibility = 61% (±9) annual kWh saved

nt

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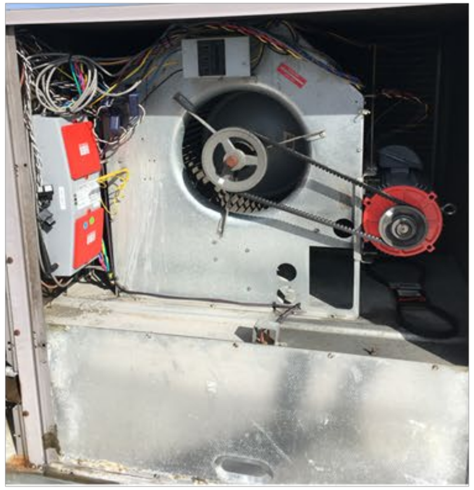
Study Conducted on RTUs near Chicago

RTU

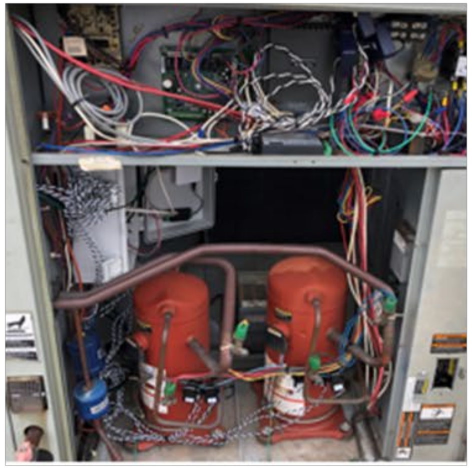
Source: Wikipedia Creative Commons

Fan motor



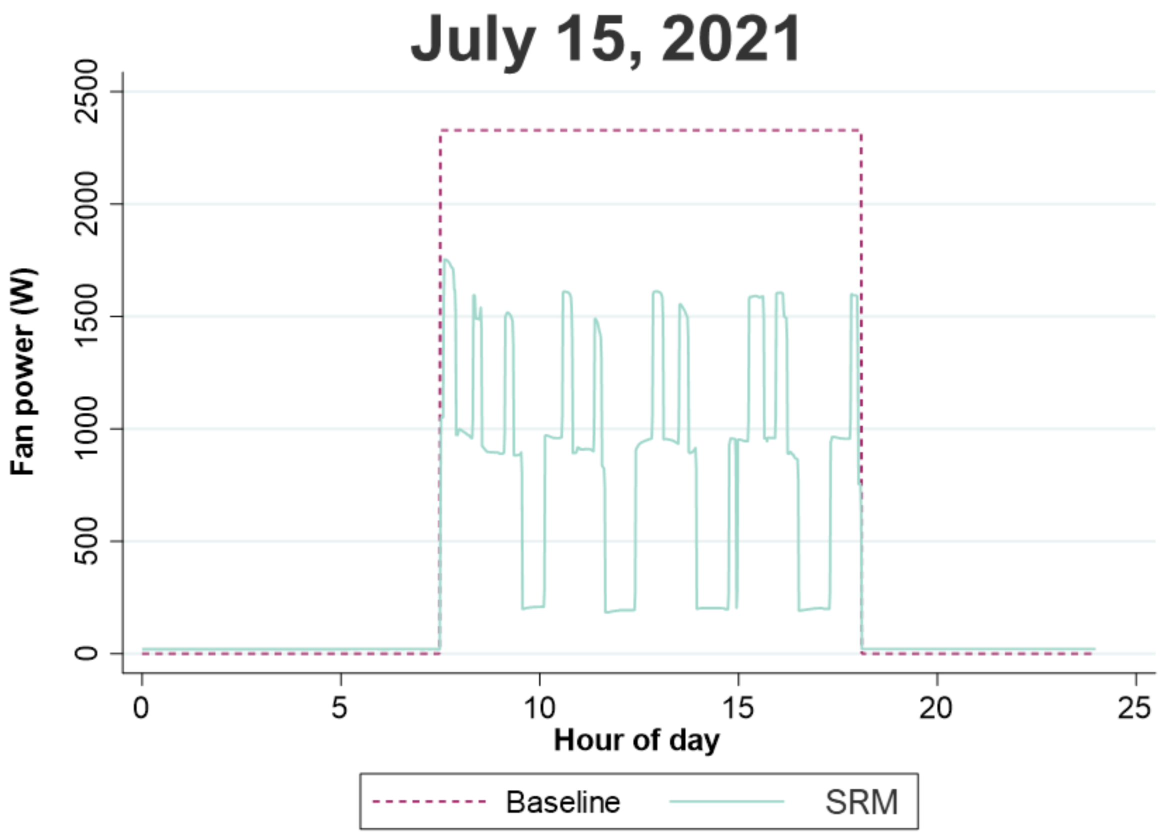
Source: Slipstream

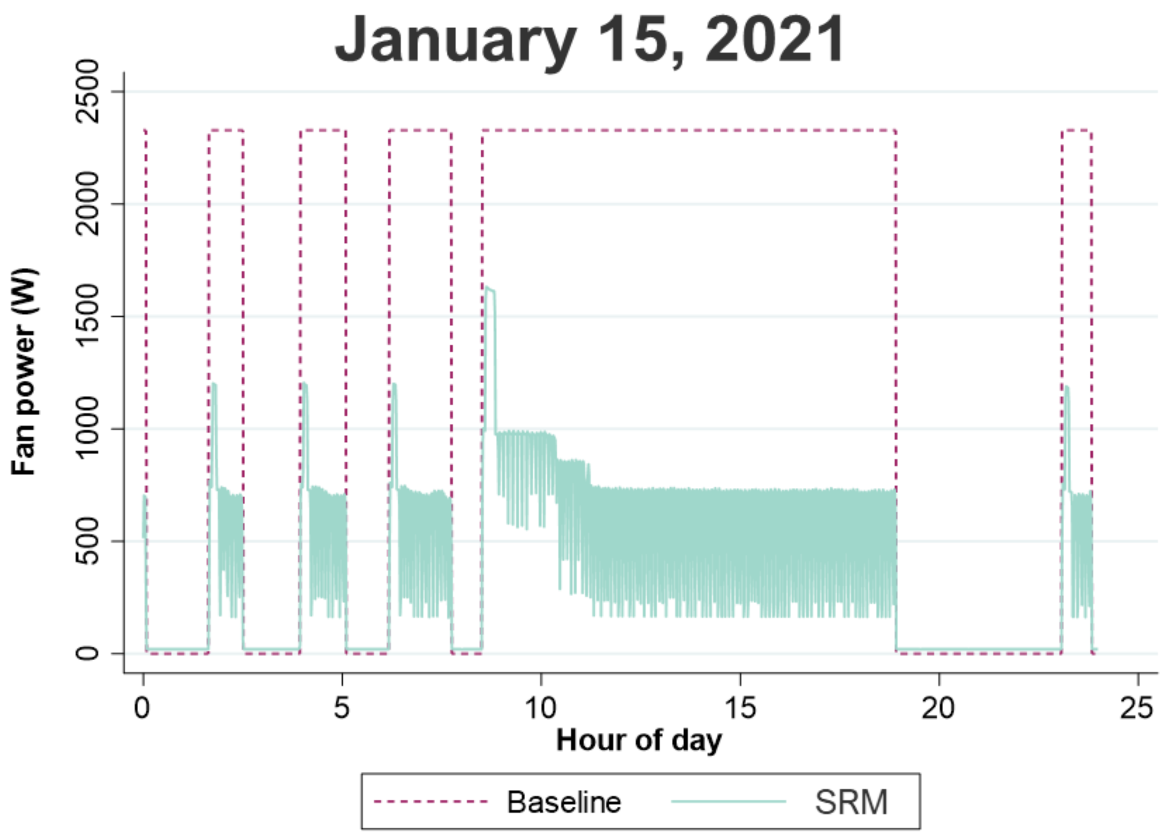
Compressor



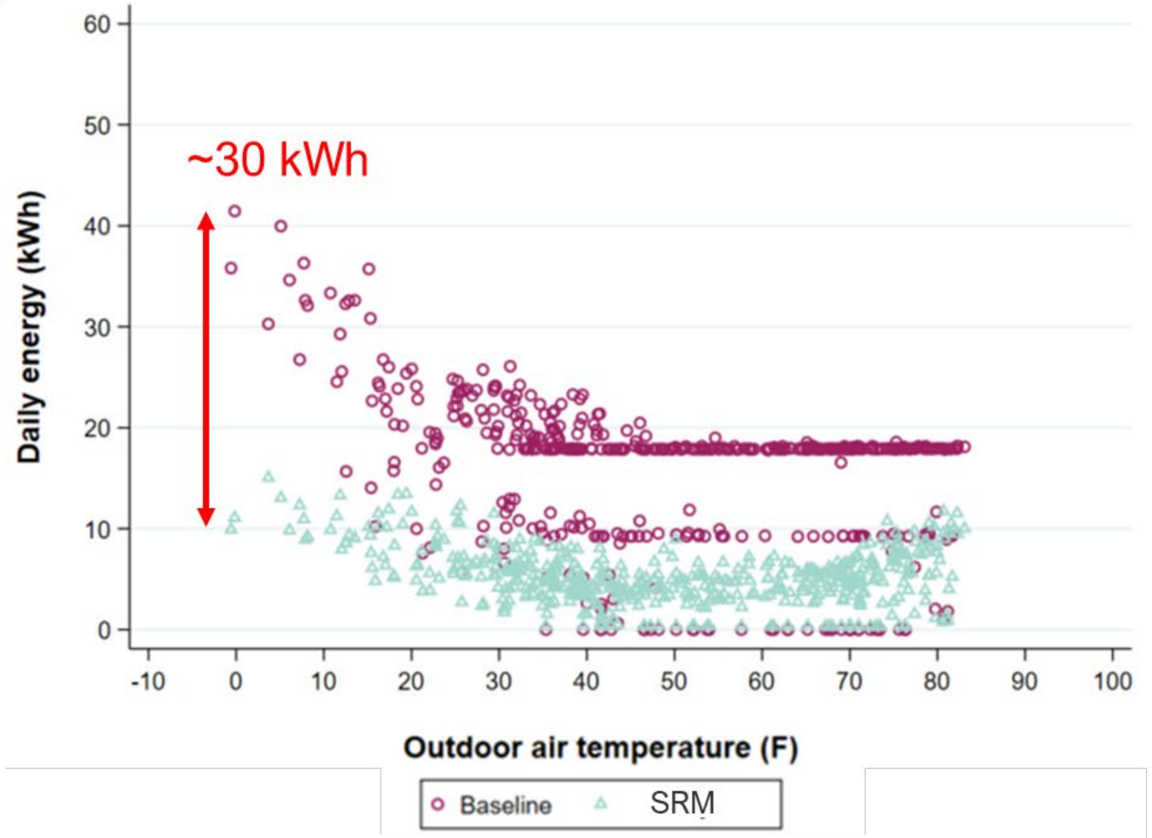
Source: Slipstream

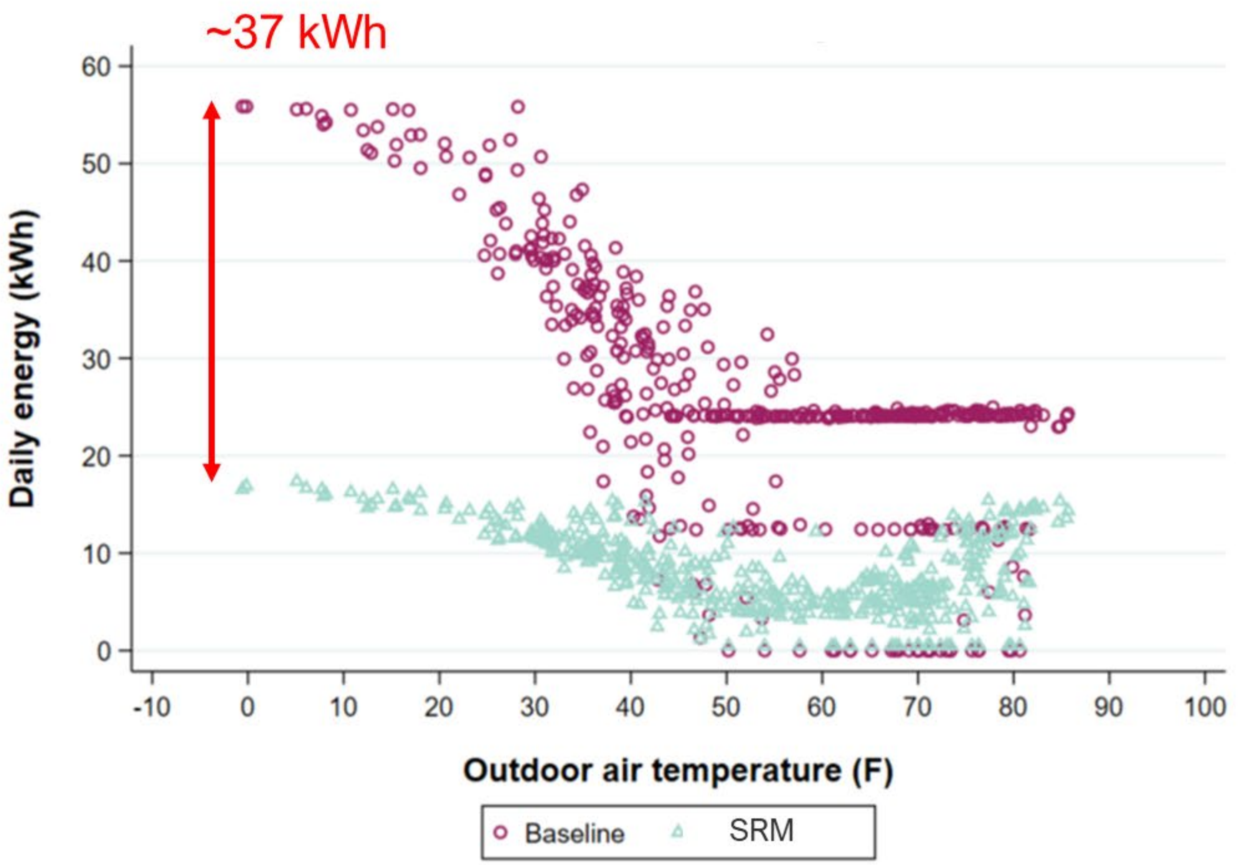
Daily Operation



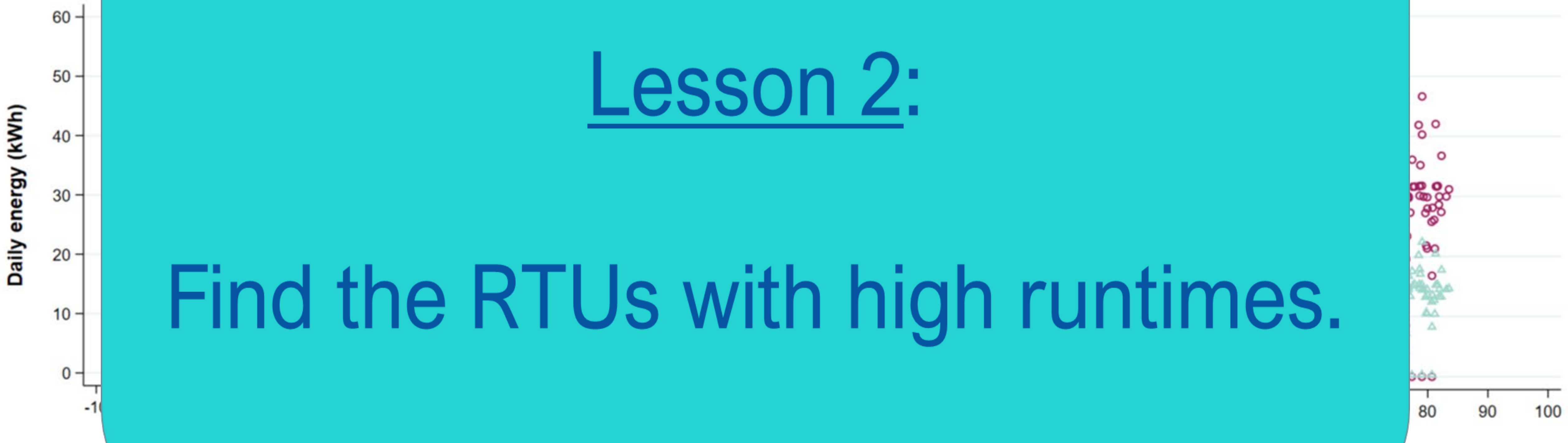


Annual Operation: Site 1





Annual Operation: Site 2



Lesson 2:

Find the RTUs with high runtimes.

Absolute Savings

	Fan				Total RTU	
Site	Baseline usage (kWh)	SRM System usage (kWh)	Annual savings (kWh)	Annual savings (%)	Total usage (kWh)	Total savings (%)
Site 2 RTU 3	2,910	1,510	1,400 (± 110)	48 (± 1)	N/A	N/A
Site 2 RTU 4	4,670	1,880	2,790 (± 410)	60 (± 4)	N/A	N/A
Site 3 RTU 1	7,050	2,900	4,150 (± 5,030)	59 (±68)	N/A	N/A
Site 1 RTU 1	5,949	1,940	4,000 (± 85)	67 (±1)	11,420	35
Site 1 RTU 2	10,180	3,120	7,060 (± 170)	69 (±1)	16,300	43

61% (±9)

39%

Annual Energy Savings Context

Investigator	So. Cal. Edison	So. Cal. Edison	So. Cal. Edison	NREL	Slipstream
Number of Savings Assessments	n=1	n=1	n=1	n=5	n=5
RTU Capacity	10 ton	10 ton	10 ton	10 ton	10-20 ton
Motor Size	3 hp	3 hp	3 hp	-	3, 5, 7.5 hp
Research setting	Laboratory: Induction vs. SRM System	Laboratory: Induction with VFD vs. SRM System	Field test: Induction vs. SRM system	Simulation: Induction vs. SRM System	Field test: Induction vs. SRM System
Fan Energy Savings	50%	11%	57%	32-46% depending on building type	61% (±9) and 39% of total RTU energy

Installation Interviews

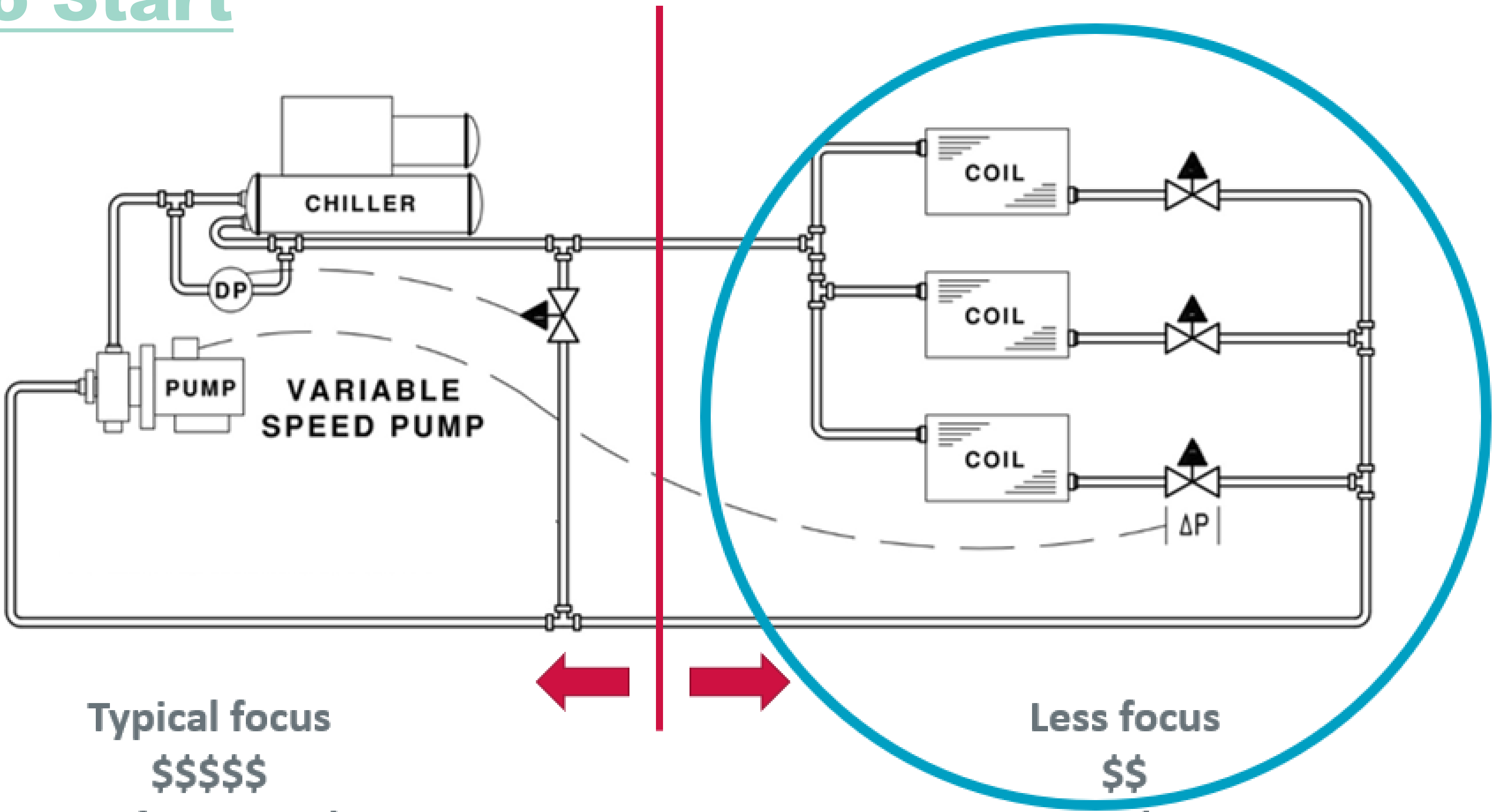
- Installation is different but not more difficult; very comparable.
- No additional qualifications beyond typical HVAC motor retrofit
- 3-to-4 hour training in an online course, most proficient after 1-2 installations.
- Extra labor mostly for motor controller and calibration.
- Data visualizations help remote diagnosis.
- Occupants reported noise when motors ramp up.

Smart Valve
Project Summary

comed[SM]
AN EXELON COMPANY | Energy Efficiency

Smart Valve Approach

Where To Start



Typical focus
$$$$$
Lots of existing data

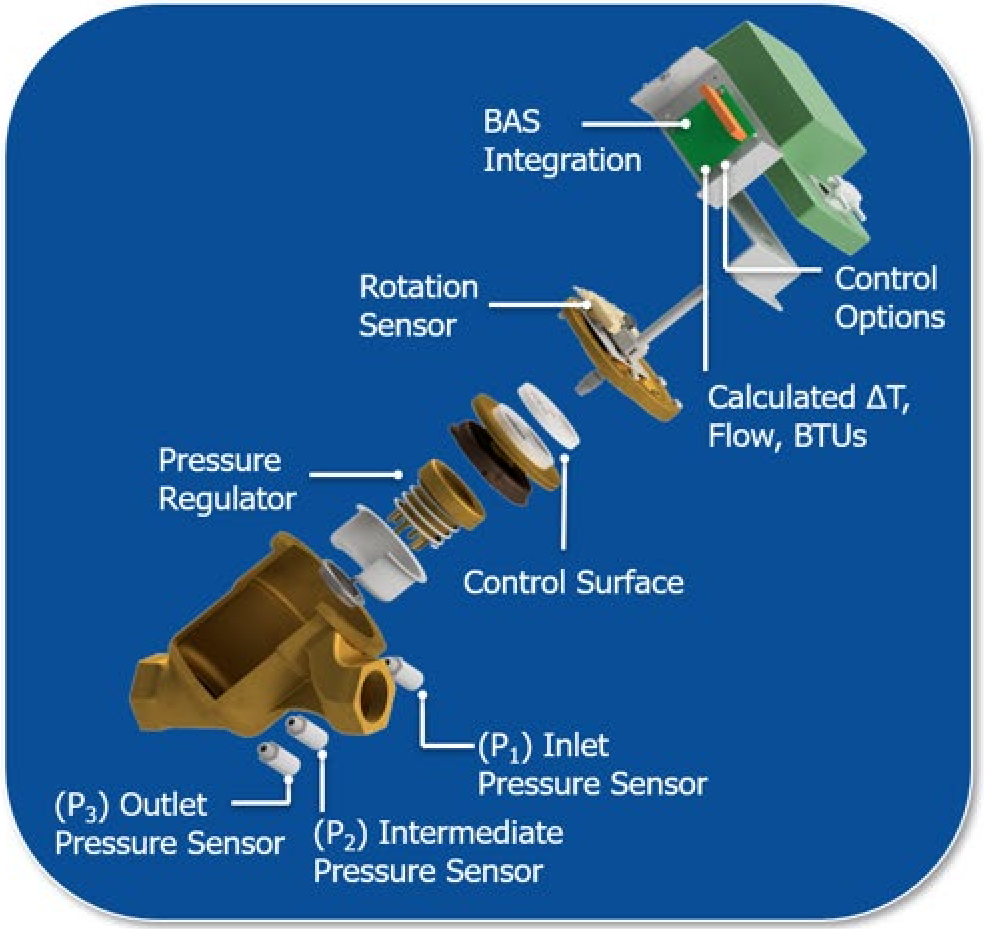
Less focus
$$
Less data

Smart Valve Definition

- Pressure-independent control valves that can accurately and stably control air handling unit supply air temperature via superior variable flow control.
- Additional sensors and cloud-based software platform provide:
  - Real-time intelligence, optimization, energy analytics, and fault detection
- Primary energy savings:
  - Increasing ΔT decreases water flow rate reduces pumping energy.
  - Tuning ΔT and flow rate leads to more precise leaving air temperature at the AHU’s coil. Reduces overcooling saving chiller energy
  - Increasing ΔT increases return water temperature, improving chiller efficiency

Valve Hardware

- Maximum efficiency with high, guaranteed ΔT
- Optimal stability maintaining ± 0.1° coil leaving air temp
- Robust, pressure independent flow control
- 100:1 Control Turndown
- Smart, connected device



Stability

↓

Precision

↓

Efficiency

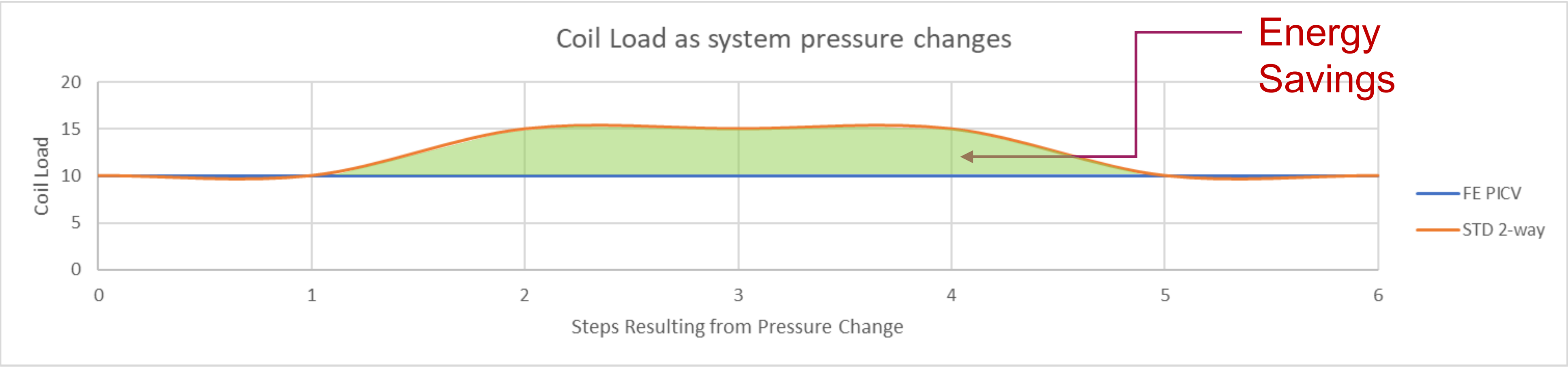
Pressure Independence Energy Savings

Standard 2-way Pressured Dependent Valve

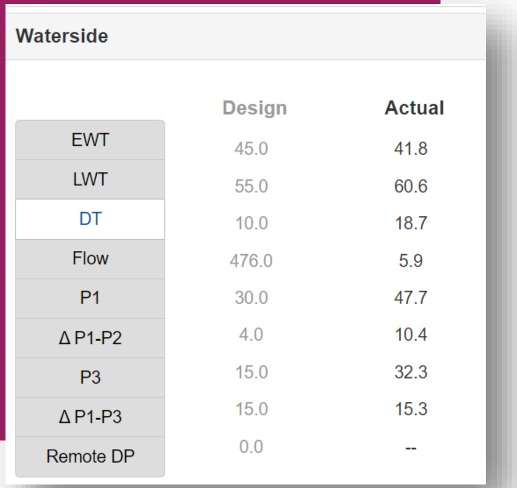
Increased Pressure → Increased Flow Through Cooling Coil → Drop in DAT → PID Loop Signals Change → Chilled Water Valve Closes → DAT Stabilizes

Pressure Independent Valve

Increased Pressure → - → - → - → - → DAT Remains Stabilized



Smart Functionality Energy Savings

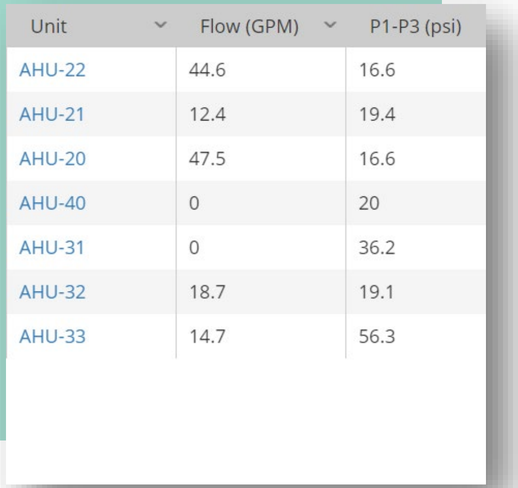


Waterside

	Design	Actual
EWT	45.0	41.8
LWT	55.0	60.6
DT	10.0	18.7
Flow	476.0	5.9
P1	30.0	47.7
Δ P1-P2	4.0	10.4
P3	15.0	32.3
Δ P1-P3	15.0	15.3
Remote DP	0.0	--

Functional Equipment Testing and Commissioning

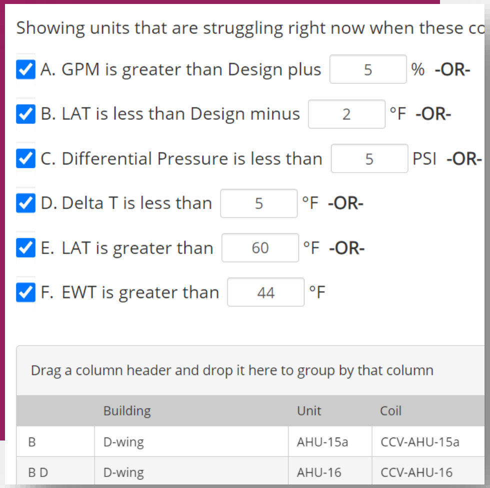
- Quickly verify all sensors communicating
- Immediately begin trending
- Verify BAS communication and response



Unit	Flow (GPM)	P1-P3 (psi)
AHU-22	44.6	16.6
AHU-21	12.4	19.4
AHU-20	47.5	16.6
AHU-40	0	20
AHU-31	0	36.2
AHU-32	18.7	19.1
AHU-33	14.7	56.3

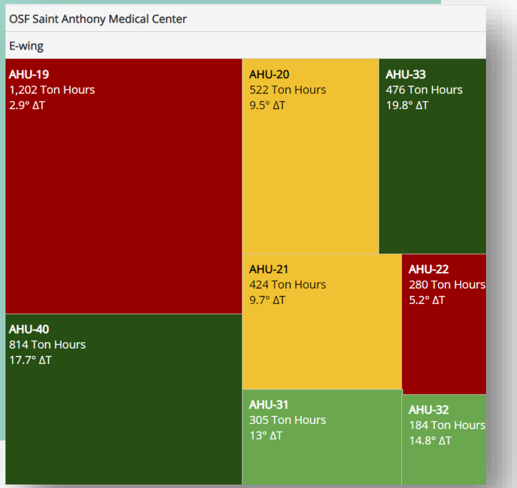
Hydraulic System Optimization

- Do you need building / AHU pumps?
- Can you add pump control?
- Are your setpoints too low? Too high?



Amplified System Review

- Check setpoints
- Check sensor Calibrations
- Check BAS loops
- System piping losses (pressure and temperature)
- Many more…



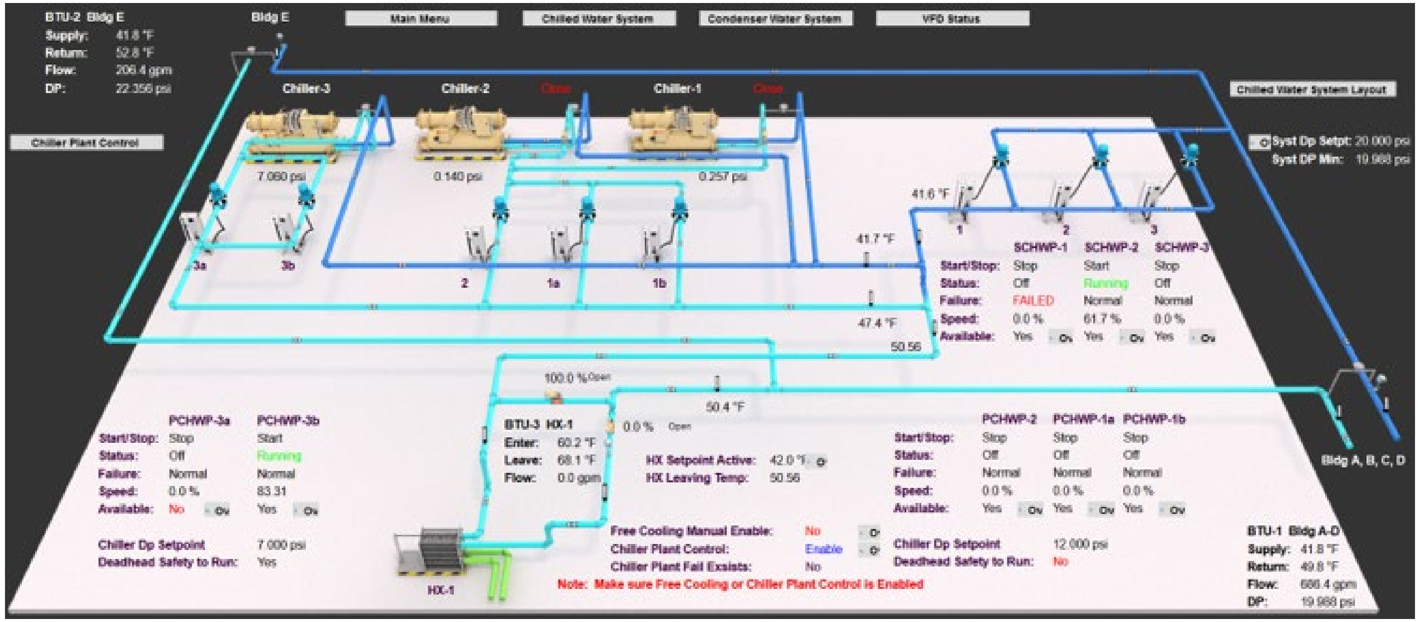
Continuous Value Add

- Monitor performance as the system changes
- Measure change against baselines
- Design future equipment for real trended loads

Hospital Retrofit

Project Drivers

- Low Delta-T, even after significant chiller plant retrofit
- High flow rate on cool days
- Waterside economizer not enabled
- No visibility into flow or pressure in distribution system
- ComEd Emerging Tech support and incentive



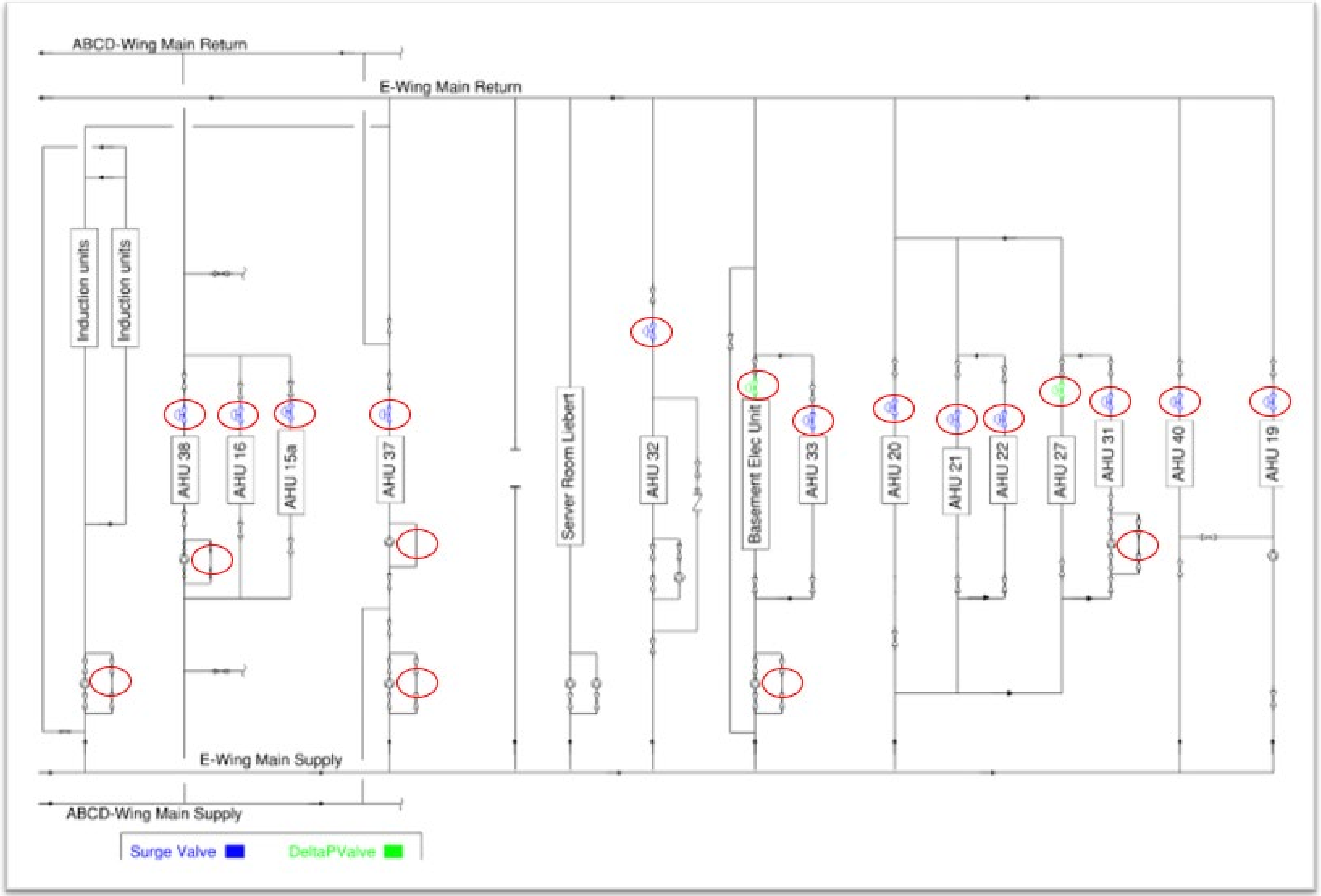
Project Overview

Facility expanded over the years
- Mix of new and old AHUs
- 2-way and 3-way valves
- Multiple booster pumps

New Chiller Plant
- Primary / Secondary Pumping
- x2 1,050 ton chillers
- x1 600 ton chiller

Two chilled water distribution loops
- E Wing (Focus of project): 12 AHUs
- ABCD Wing: 14 AHUs

Project Piping Diagram



E Wing

~40% of load

12 Smart Valves

2 PIC Valves

6 booster pumps removed

M&V Overview

Goal: independently quantify electric energy savings of CHW valve retrofit

Timeframe: May thru November 2020

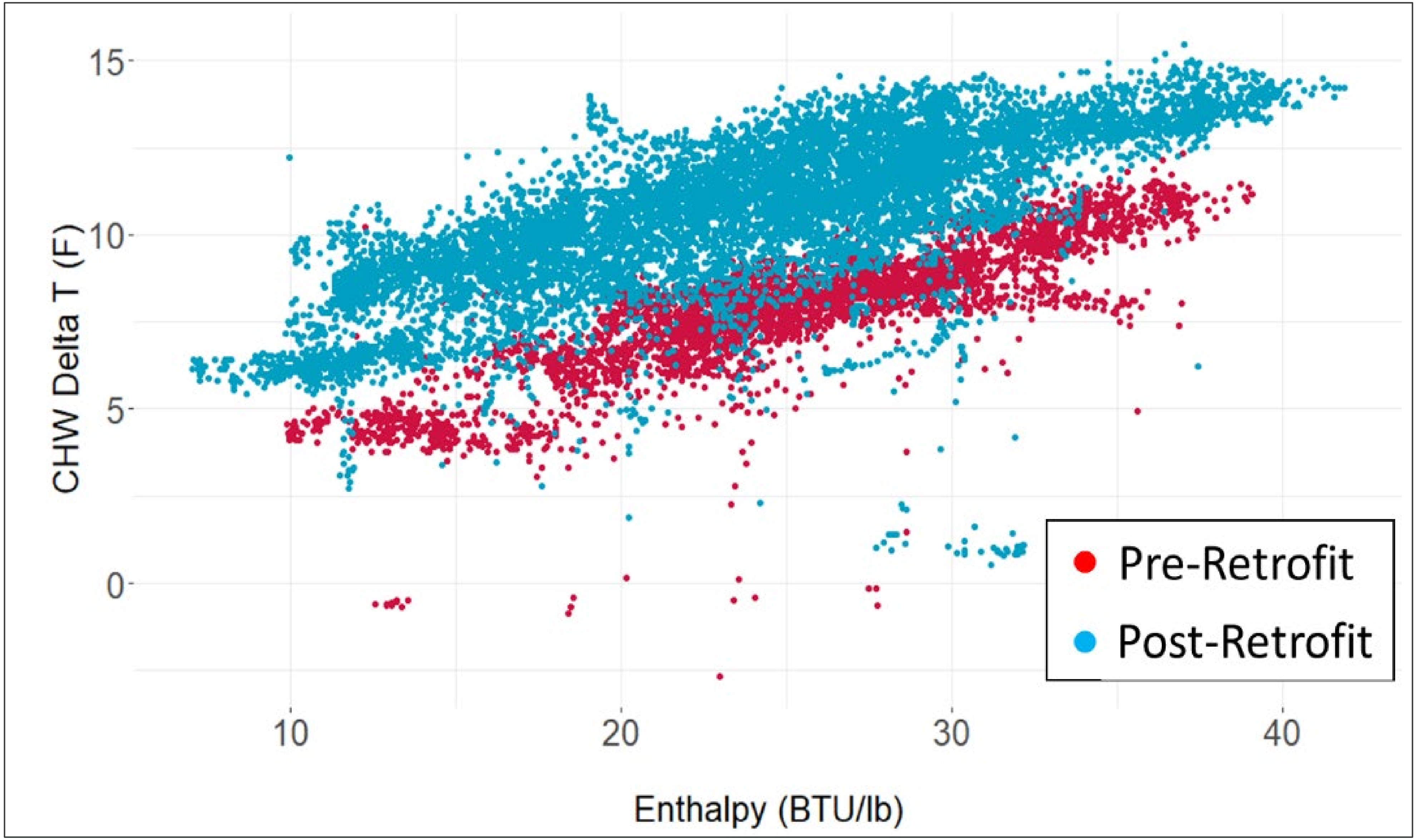
Data acquisition

- From BAS archives and local weather station
- Could not deploy our own measurement equipment due to COVID-related site access restrictions

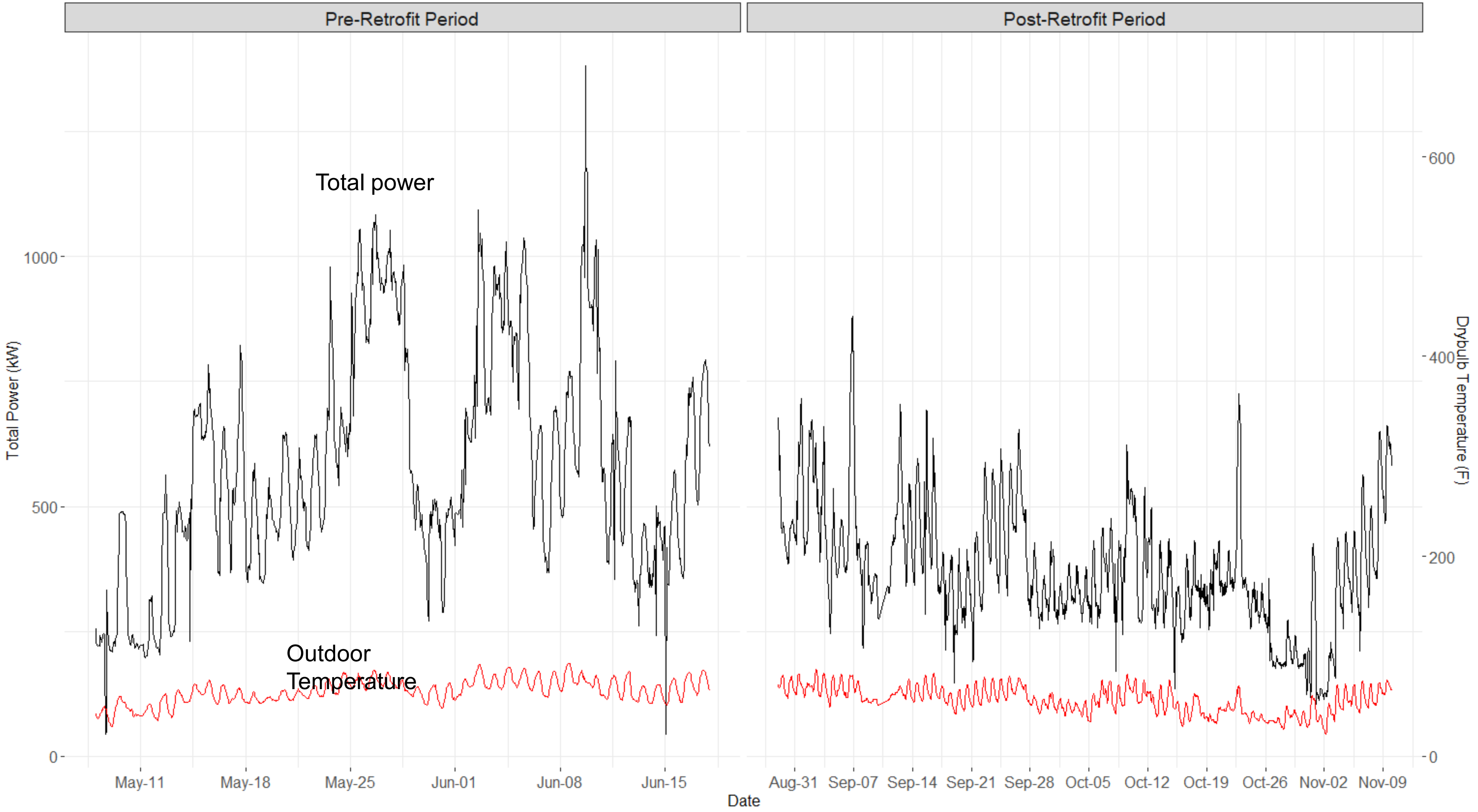
Data: 15 minute interval

- Outdoor conditions: drybulb and wetbulb temperature (gives enthalpy)
- Power: chillers, primary and secondary pumps (only status for booster pumps)
- Temperature: CHW supply and return, CW entering and leaving
- Flow
- Pressure Difference

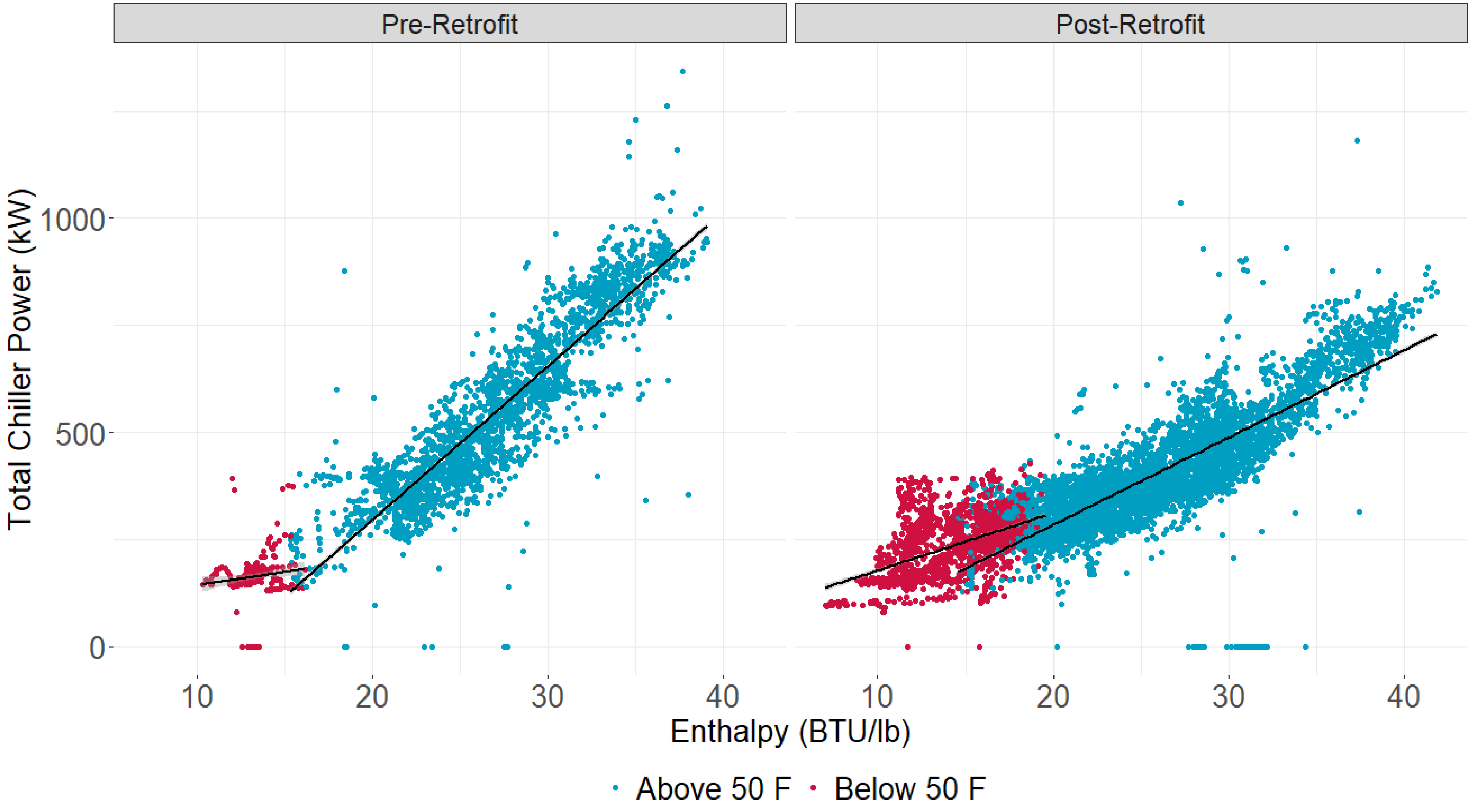
Data – CHW Delta T



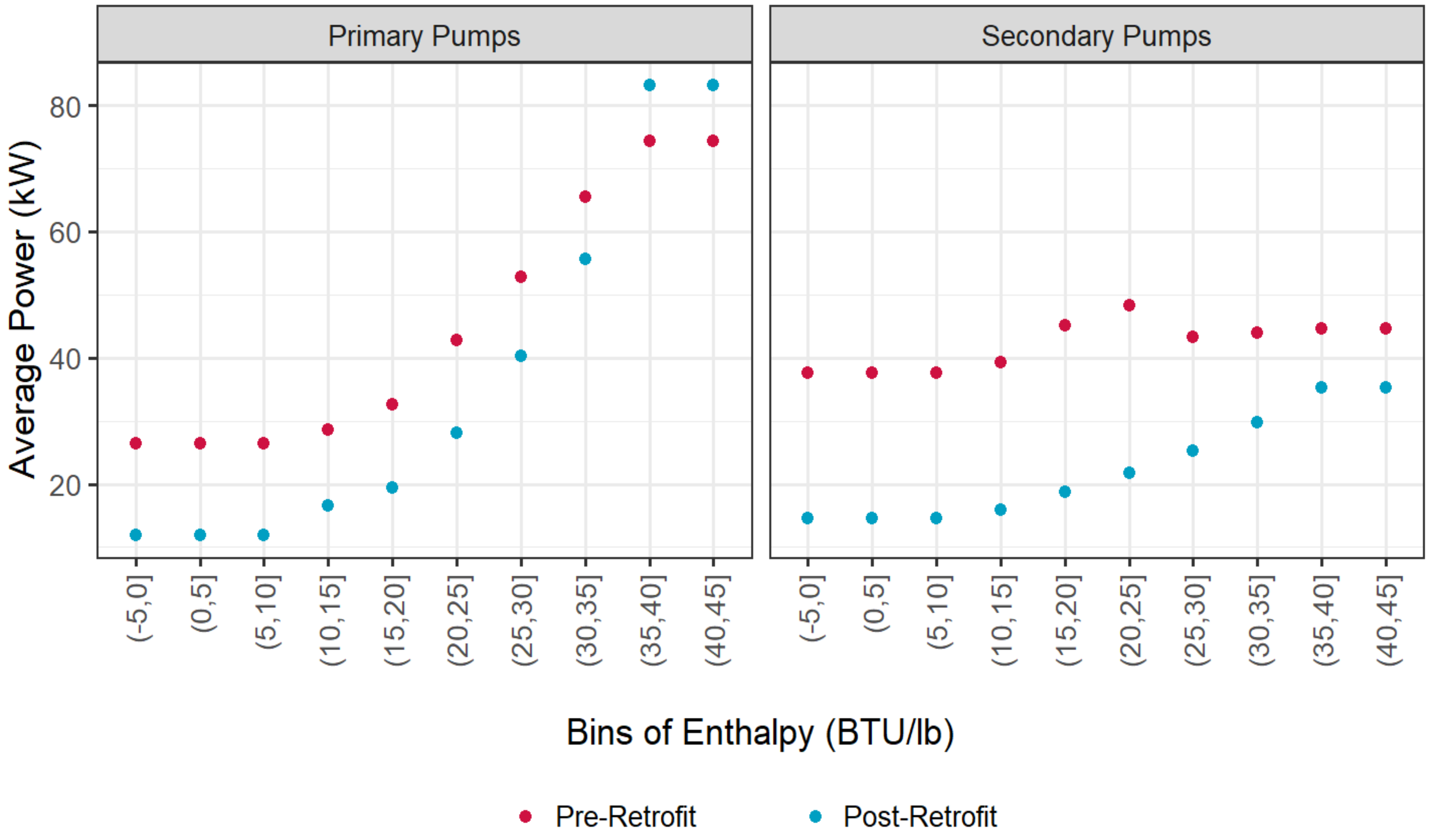
Data – Total Chiller Plant Power



Chiller Power



Primary and Secondary Pumps

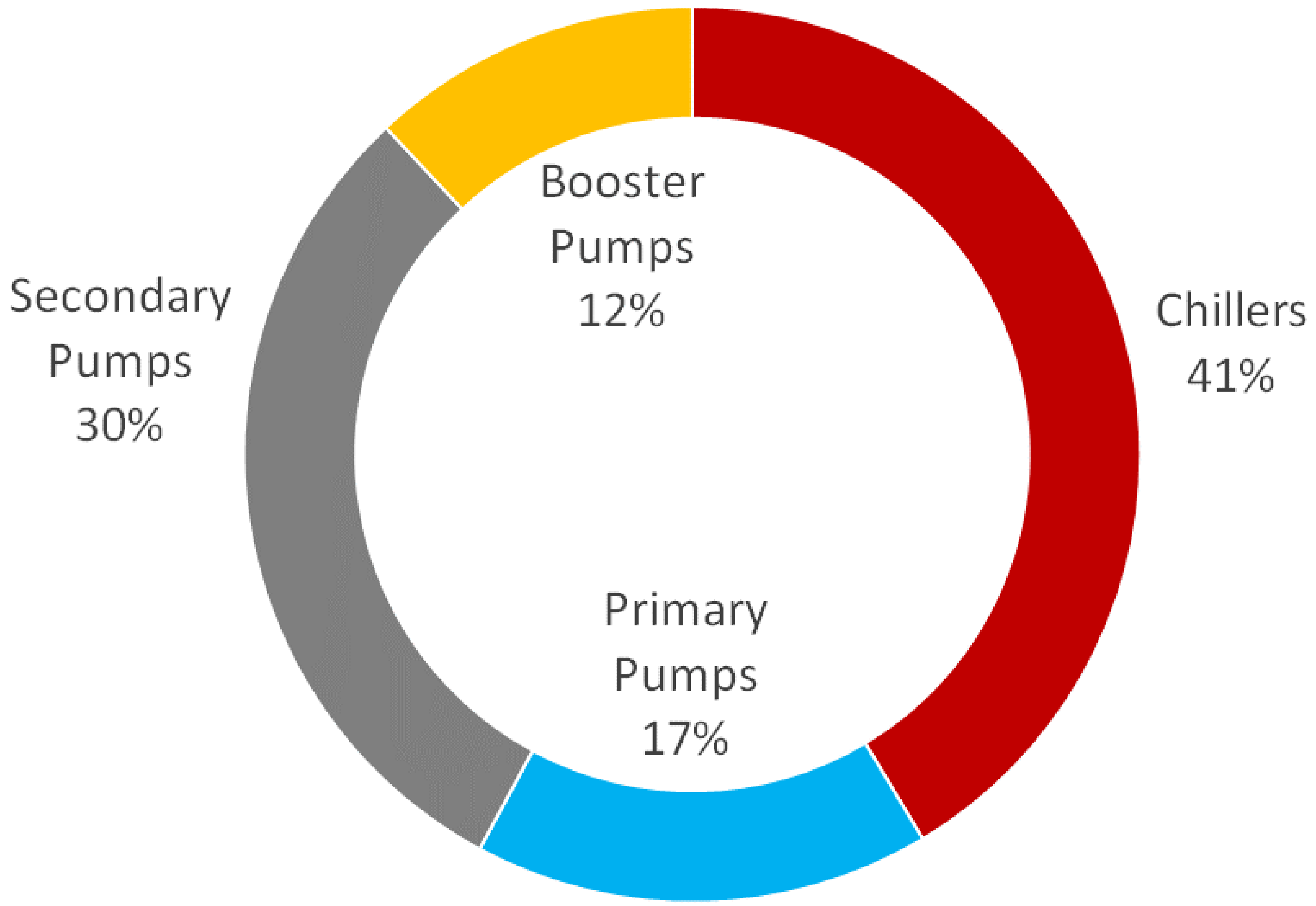


Results – Summary

	Energy Savings (kWh)	Percent Savings of Component Baseline
Chillers	234,427	9%
Primary Pumps	93,167	30%
Secondary Pumps	170,672	52%
Tertiary Pumps	67,834	93%
Total	566,099	16%

- **Saved approximately 16% of the chilled water system energy**
  - **Reminder: Project only addressed the E-Wing.**
- **At $0.08/kWh, this translates to approximately $50,000 annual utility bill savings**

Results – Equipment Proportion



Majority of savings was from chillers and secondary pumps

Program Implementation

Incentive offering

- Custom pathway most likely
  - Site-specific parameters determine savings impact
    - Peak cooling load
    - Equivalent full load hours
    - Efficiency of chiller and CHW pumps
    - CHW pump design flow
    - CHW pump total design head

- Potential prescriptive pathway for constrained scenario:
  - Existing chilled water plant without adsorption chillers
  - Primary-only or primary-secondary pumping arrangements with variable speed pumps
  - Pressure dependent CHW valves

Identifying opportunities

- Low Delta T Syndrome
  - When CHW DT is well below design
- Cooling-intensive facilities
  - Large buildings, year-round cooling, significant dehumidification requirements
  - Older facilities with less efficient air- or water-cooled chillers
  - Older, inefficient pumps, especially with primary/secondary pumping
  - Variable speed CHW systems
- Healthcare, higher education with associated laboratories

Outreach

- Long sales cycle: 6+ months
- Who to engage
  - Chief facility engineer
  - IT staff
  - Financial decision makers
- Sales messaging
  - Position smart valves as a controls retrofit not a valve retrofit
  - Improved control and data on system performance
  - Streamline facility operations

Measurement & verification

- Hourly data required for measuring savings:
  - Chiller electric power (kW)
  - Chilled water pump power (kW)
  - Outdoor air enthalpy (Btu/lb)
- Wide range of daily temperatures pre and post retrofit
  - 8-12 months M&V period
- Weekday versus weekend occupancy
- Low versus high enthalpy conditions

Savings potential

- 5 projects per year
- 12-21% chiller and CHW pump savings per site
- 0.2-1.5 kWh per square feet
- 230,000 kWh typical savings in hospitals and education with labs
- 1 million kWh/year savings
- Measure life is approximately 15 years
- Simple Payback 5+ years

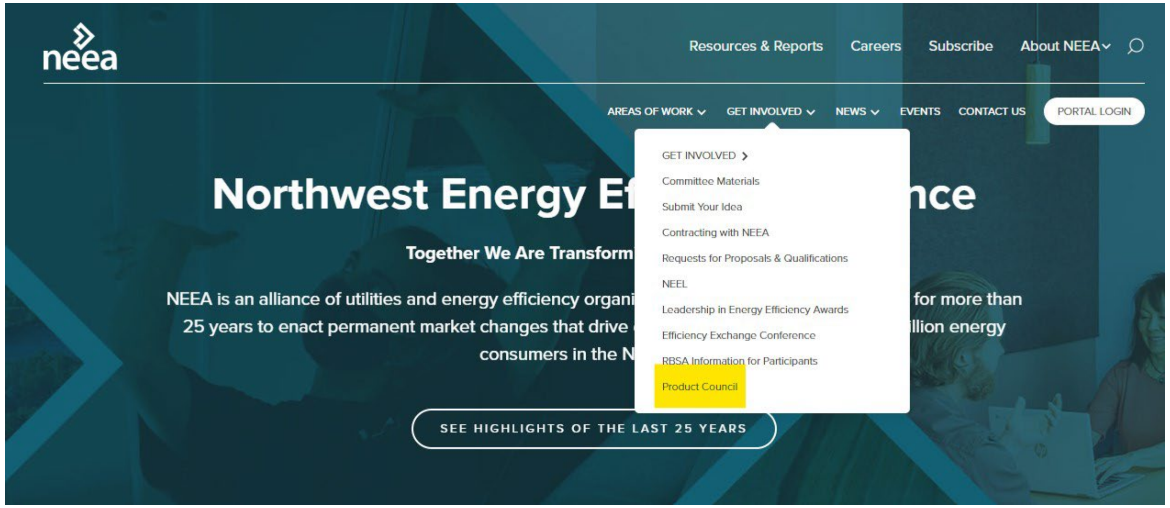
Break

Agenda

9:00 am	Welcome, Agenda Review, Announcements, Conferences & Product Council Updates
9:45 am	*New!* Slipstream Emerging Technology Update
10:30 am	*Break (15 min)*
10:45 am	*New!* NEEA Product Council Series
11:30 am	Public Comment, Poll & Adjourn

Product Council

Product Council on neea.org



FILTER

QUANTM Electric Pumps and Energy Savings

At the December 6, 2022 Product Council Meeting, Graco, Inc., reviewed the newly released QUANTM electric pump, which is designed to be a drop-in replacement for air-operated double-diaphragms (AODD) pumps. QUANTM is a double-diaphragm pump that is powered by an electric drive, instead of the traditional compressed air source used by traditional air-operated diaphragm pumps. This session, presented by Jeff Shaffer from Graco, sought to bring awareness and understanding of the technology that powers QUANTM, as well as to create understanding around operation and energy savings benefits.

Year: 2022 Month: December Document Type: Slides Program/Technology: Electric Motors & Pumps

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Slipstream Sketchbox: Simplified and Streamlined Building Energy Modeling

The November 15, 2022 Product Council Meeting detailed information on Sketchbox, a web-based user interface for energy modeling, designed to take the guesswork out of energy performance and help users find

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Upcoming Product Council Events

31 JANUARY
Product Council Integrated Design Lab Series: University of Oregon
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07 FEBRUARY
Product Council Integrated Design Lab Series: University of Idaho
READ MORE ›

14 FEBRUARY
Product Council Integrated Design Lab Series: Washington State University
READ MORE ›

07 MARCH
Product Council Integrated Design Lab Series: University of Washington
READ MORE ›

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What topics would you like to see this year?

How do I request a session?

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CLOSING

- ❑ ***Public Comments/Q&A***
- ❑ ***Poll Questions***

How did we do this quarter?

1. What's one thing you appreciated about this meeting?
2. What would you like to see at a future meeting?
3. What's got you curious right now in the realm of energy efficiency?
4. What is your preference on in-person vs. virtual meetings moving forward?
    - Hybrid/In-Person (NEEA, Portland – Q2)
    - Online/Virtual (MS Teams)
    - No preference – open to either option!

If the poll didn't work for you, please let us know in the chat box what the problem was: if you used the app or browser, and the error message you got, if any.

Thank You!!