EUI Reduction in Healthcare Buildings through HVAC Upgrades

Marina Shatalova

April 16th 2026 WSSHE Spring Symposium

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Today's Speakers

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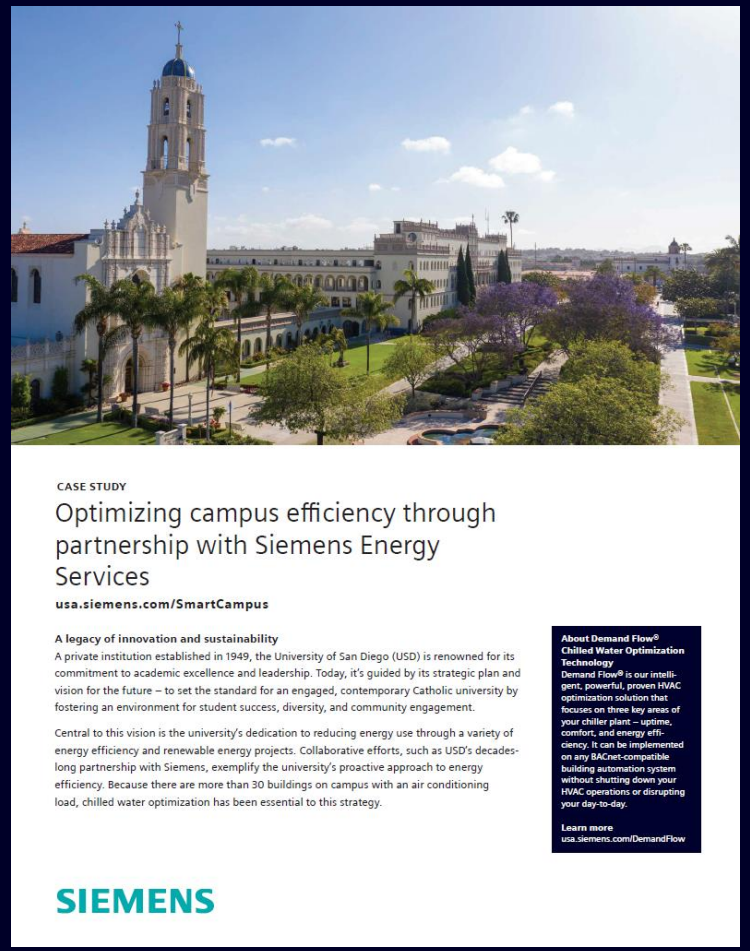

CASE STUDY

Optimizing campus efficiency through partnership with Siemens Energy Services

usa.siemens.com/SmartCampus

A legacy of innovation and sustainability

A private institution established in 1949, the University of San Diego (USD) is renowned for its commitment to academic excellence and leadership. Today, it's guided by its strategic plan and vision for the future – to set the standard for an engaged, contemporary Catholic university by fostering an environment for student success, diversity, and community engagement.

Central to this vision is the university's dedication to reducing energy use through a variety of energy efficiency and renewable energy projects. Collaborative efforts, such as USD's decades-long partnership with Siemens, exemplify the university's proactive approach to energy efficiency. Because there are more than 30 buildings on campus with an air conditioning load, chilled water optimization has been essential to this strategy.

About Demand Flow® Chilled Water Optimization Technology

Demand Flow® is our intelligent, powerful, proven HVAC optimization solution that focuses on three key areas of your chiller plant – uptime, comfort, and energy efficiency. It can be implemented on any BACnet-compatible building automation system without shutting down your HVAC operations or disrupting your day-to-day.

Learn more
usa.siemens.com/DemandFlow

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Agenda

1. Clean Building Act and EUI Goals
2. Solutions for Energy Reduction
3. Achieving and Maintaining
4. Questions

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Building Performance Standards - What are they?

The 3 Ps that Make a BPS

Prescriptive pathways set by jurisdictions with defined energy and emissions targets

Prolonged policies spanning 10+ years, with stricter interim requirements over time

Payments for compliance often reaching millions of dollars per property for owners

How they Develop

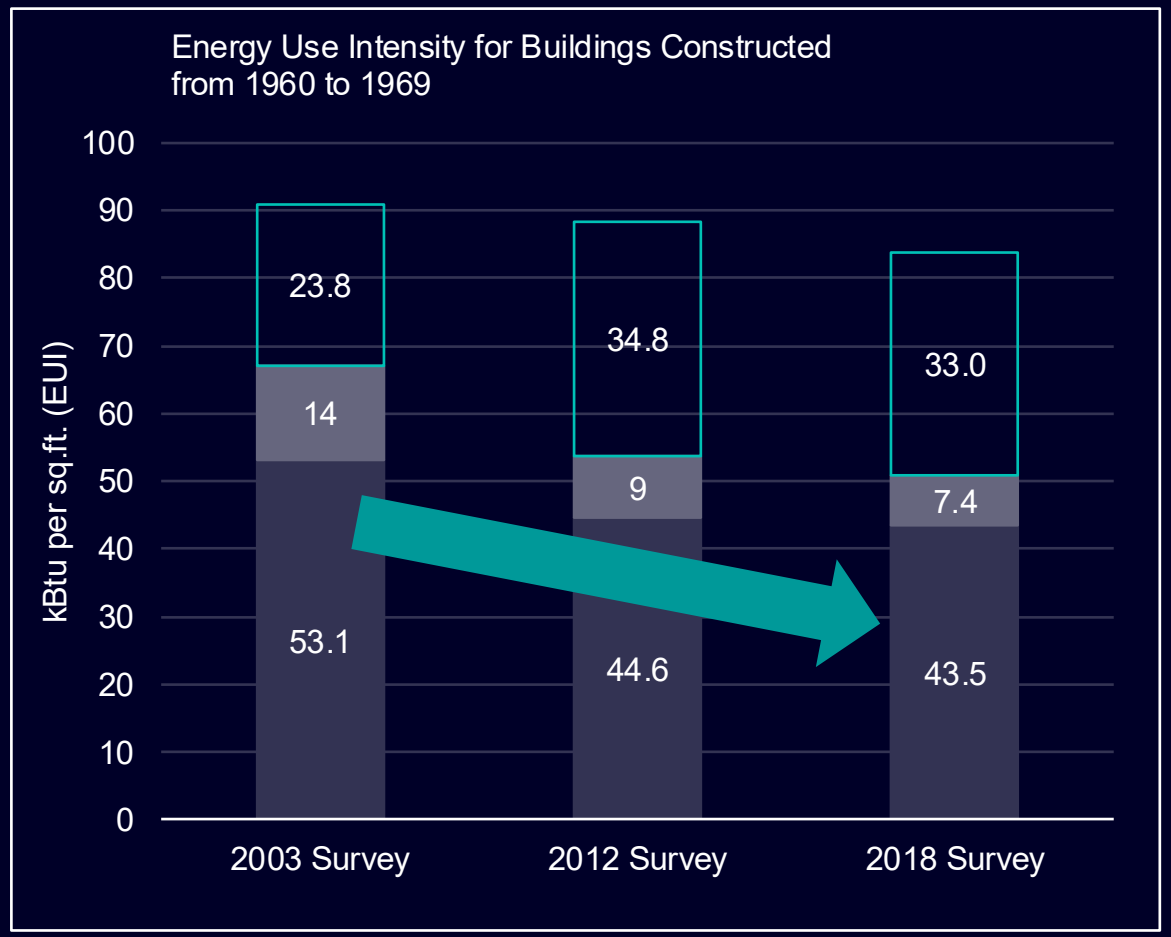
Benchmarking

Washington Clean Buildings Act
Introduced in 2019 through HB 1257
Applicable to non-residential buildings 50,000 sq. ft. in size.
In 2022 expanded to buildings over 20,000 sqft including the multifamily housing.

Compliance

Tier 1 compliance depends on sqft but starts June 1, 2026 to meet performance metrics
Tier 2 compliance date for benchmarking starts on June 1, 2027

Older Buildings Improve Through Retrofits and Modernizations



Source: US Energy Information Administration, Commercial Building Energy Consumption Survey

Modernization projects in older building stock have reduced energy consumption in HVAC and lighting systems

- LED retrofits
- Equipment retrofits
- System retrofits
- Pneumatic → DDC upgrades

$$\text{EUI} = \frac{\text{Total Annual Energy Consumption (kBTU)}}{\text{Gross Floor Area (sq ft)}}$$

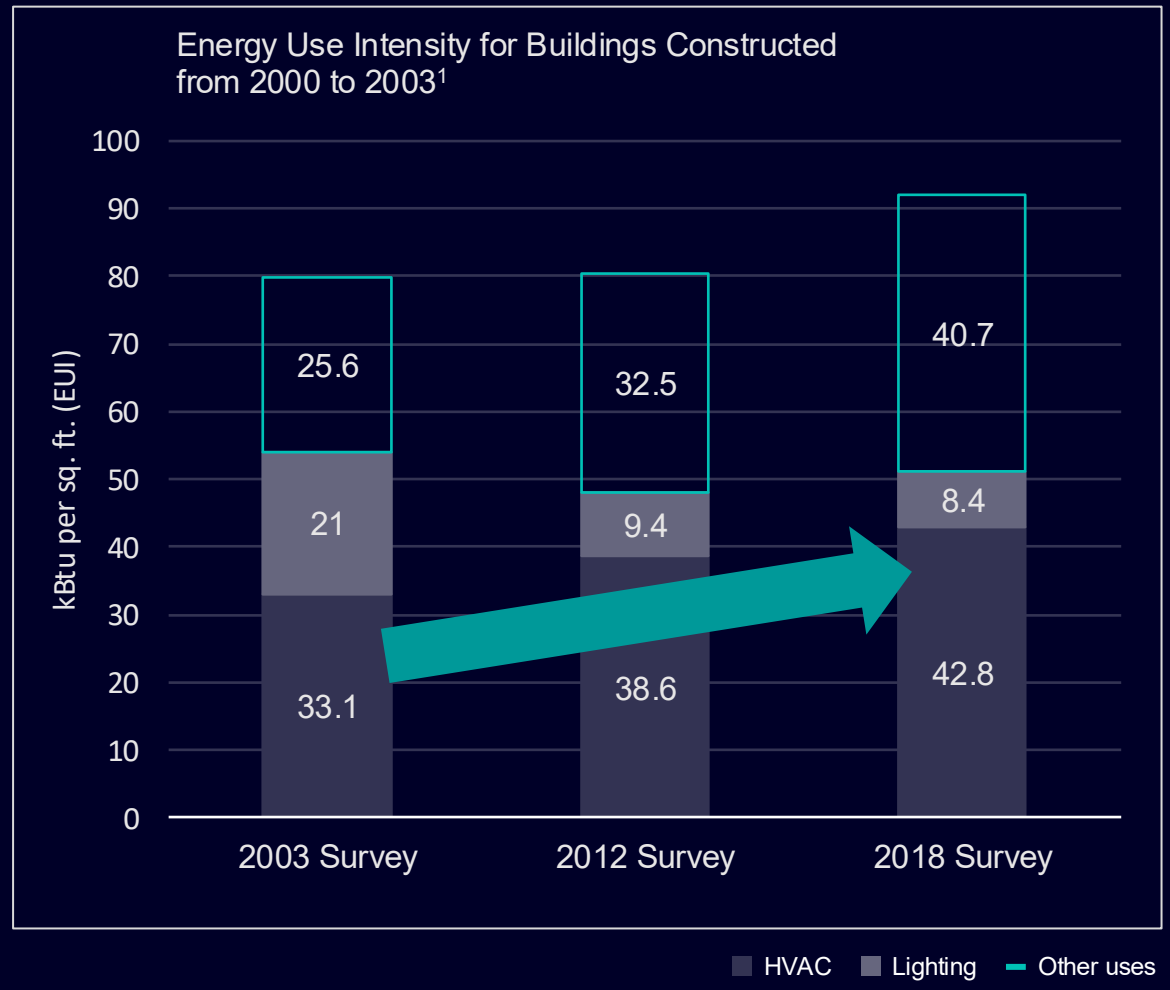
Newer Buildings Degrade Because We Cannot Maintain Performance

New buildings designed to modern energy codes (ASHRAE 90.1, LEED, etc.) achieve high levels of day-one efficiency through efficiency design and operations

HVAC performance is not maintained over time

- Poor commissioning and documentation
- Employee turnover and staff reductions
- Operator overrides

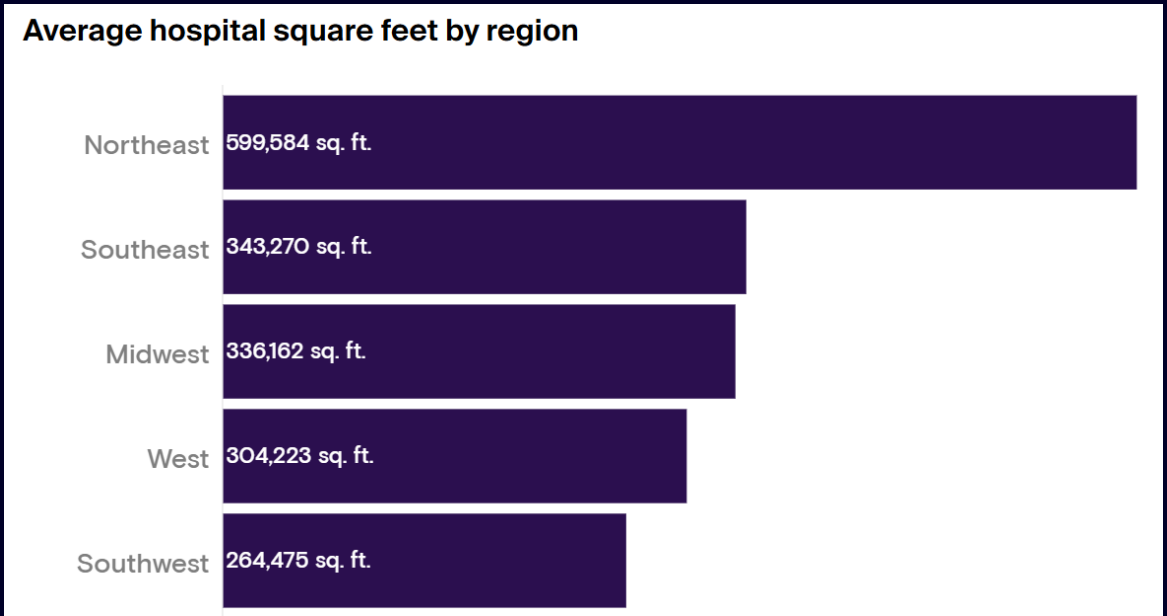
How do we maintain the performance of optimized energy systems, whether they are designed by us or by others?



1 2018 Survey modified cohort to include buildings constructed from 2000 to 2009

Where does Healthcare fall here?

Most hospital campuses fall under Tier 1



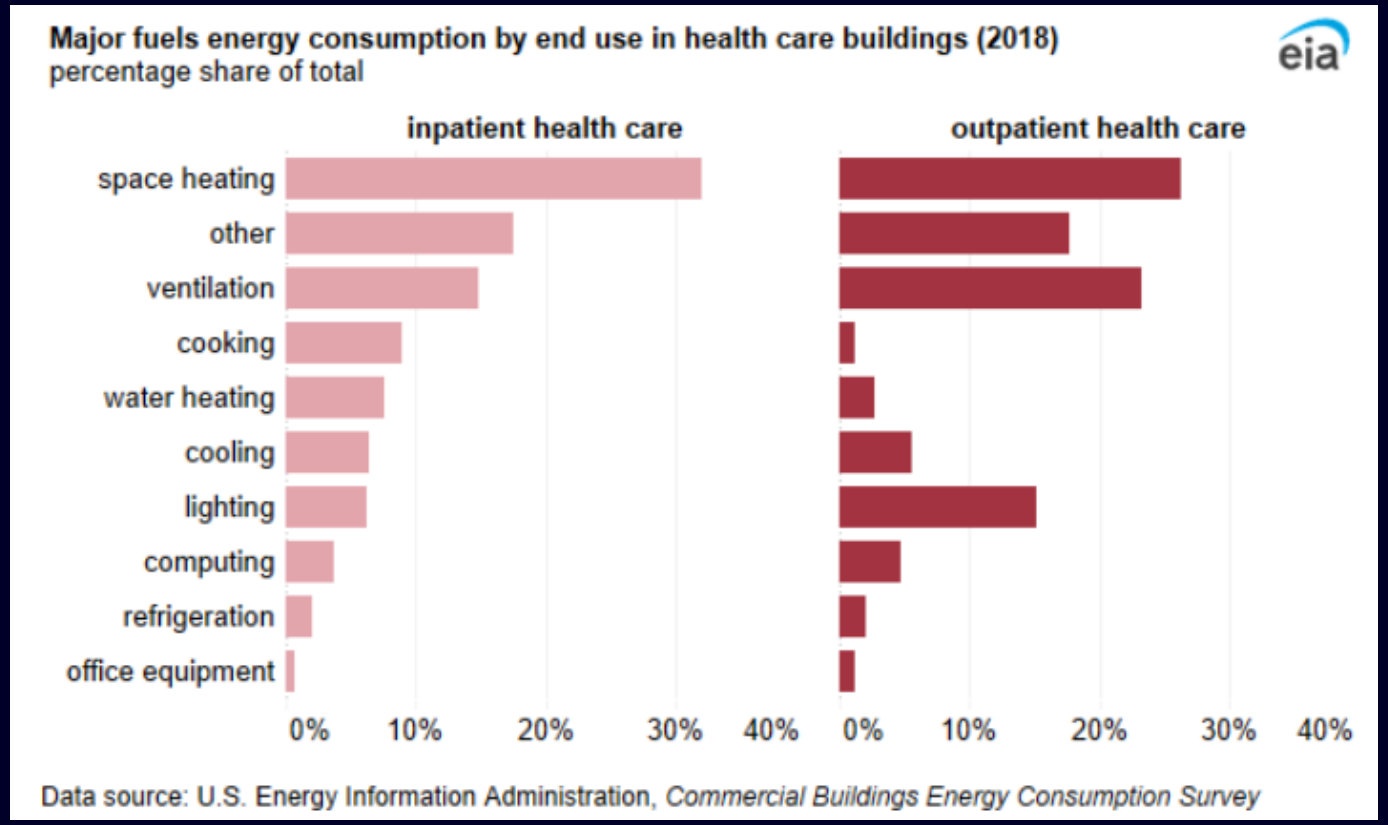
Tier 1 covered buildings reporting schedule:

- **June 1, 2026** – More than 220,000 sq. ft.
- **June 1, 2027** – More than 90,000 sq. ft. but less than 220,001 sq. ft.
- **June 1, 2028** – More than 50,000 sq. ft. but less than 90,001 sq. ft.

Sector	Facility Type	Zone 4C EUI Target	Zone 5B EUI target
Healthcare	Ambulatory surgical center	90	96
Healthcare	Hospital (general medical and surgical)	215	215
Healthcare	Outpatient rehabilitation / physical therapy	90	96
Healthcare	Residential care facility	78	82
Healthcare	Senior care community	78	82
Healthcare	Urgent care / clinic / other outpatient	90	96
Healthcare	Other — specialty hospital	196	196

Sources: Definitive Healthcare, “Average U.S. Hospital Square Footage” (2025), Washington State Clean Buildings Performance Standard

Utility Usage in the Health Care Buildings



Over 45% of energy usage in the United States is due to HVAC systems in both inpatient and outpatient health care

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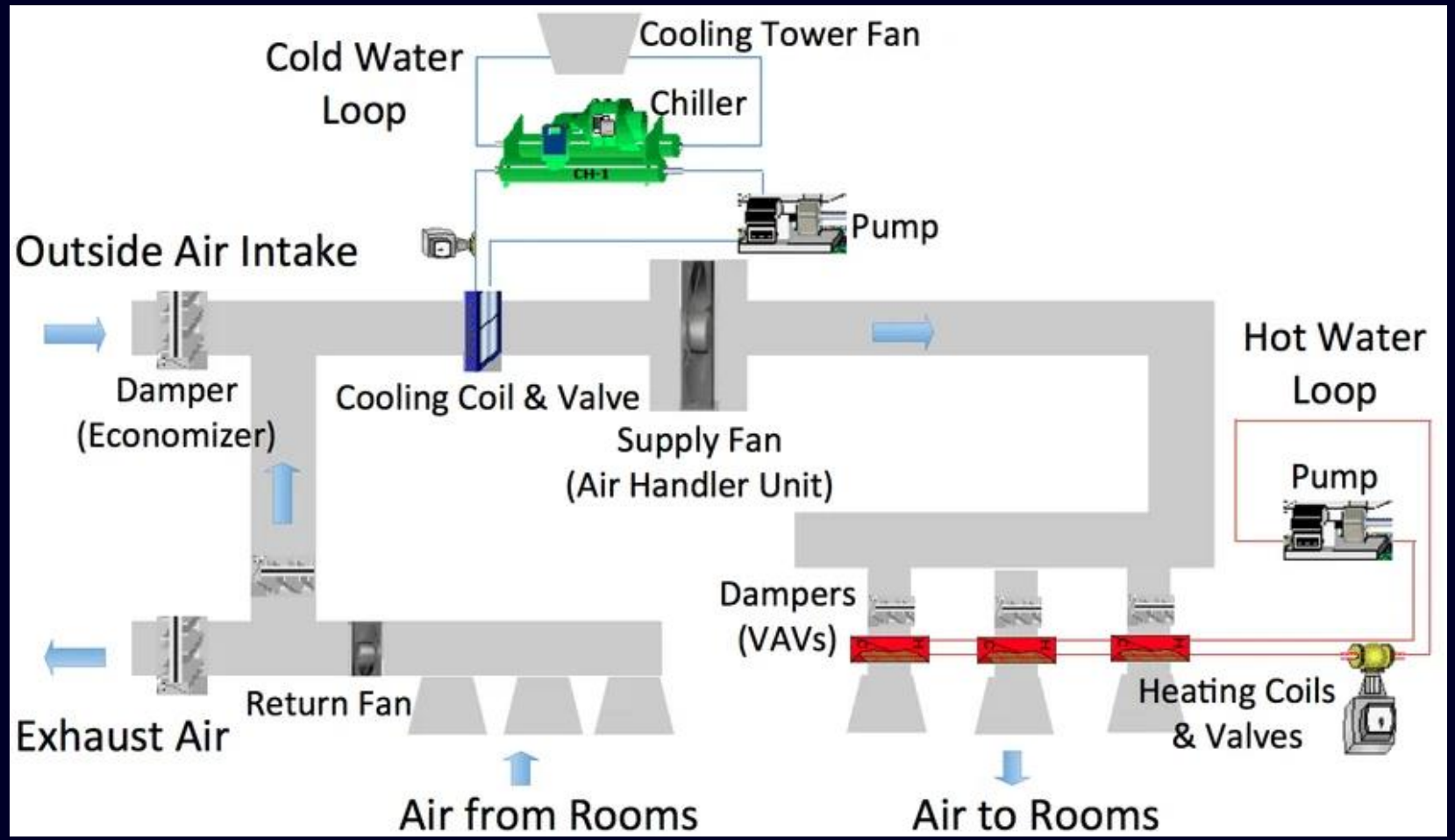
HVAC Breakdown



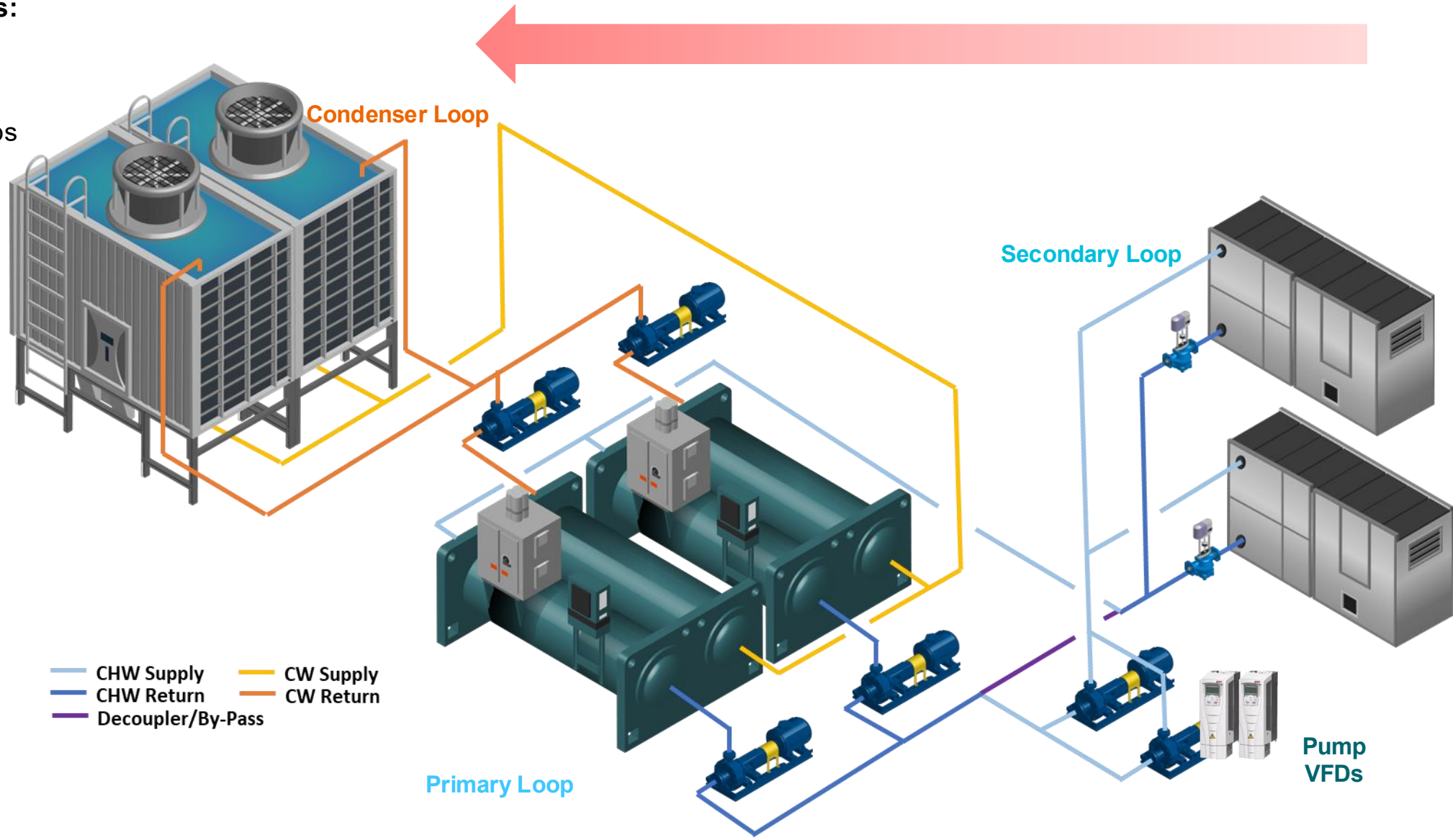
Two Main goals:

- **Reduce Ventilation rate to reduce the motor energy**
- **Reduce simultaneous heating and cooling**

Chilled Water System Design

Chilled Water Subsystems:

- ❑ Chillers
- ❑ Chilled Water Pumps
- ❑ Condenser Water Pumps
- ❑ Cooling Towers
- ❑ Loads (AHU's)



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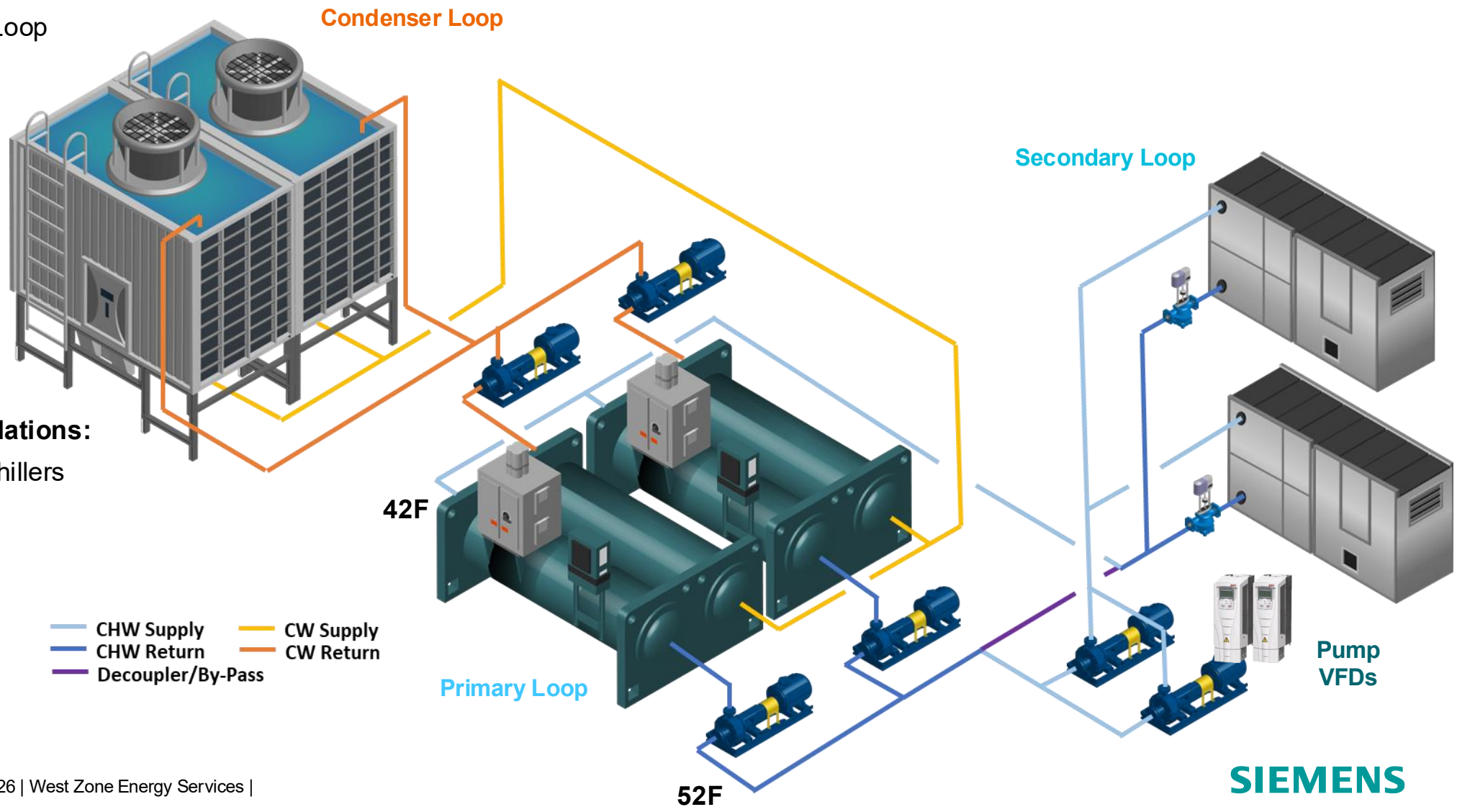
Chilled Water System Design

Heat Transfer from Building Air, to Outside (via Cooling Tower)

Previous Generation Installations:

- Constant Flow thru Chillers
- Primary – Secondary Loop
- 10 F Delta T Design



Current Generation Installations:

- ✓ Variable flow through Chillers
- ✓ Variable Primary
- ✓ Wider Delta T, 14-16 F
- ✓ Heat Recover Chillers
- ✓ Heat Pump

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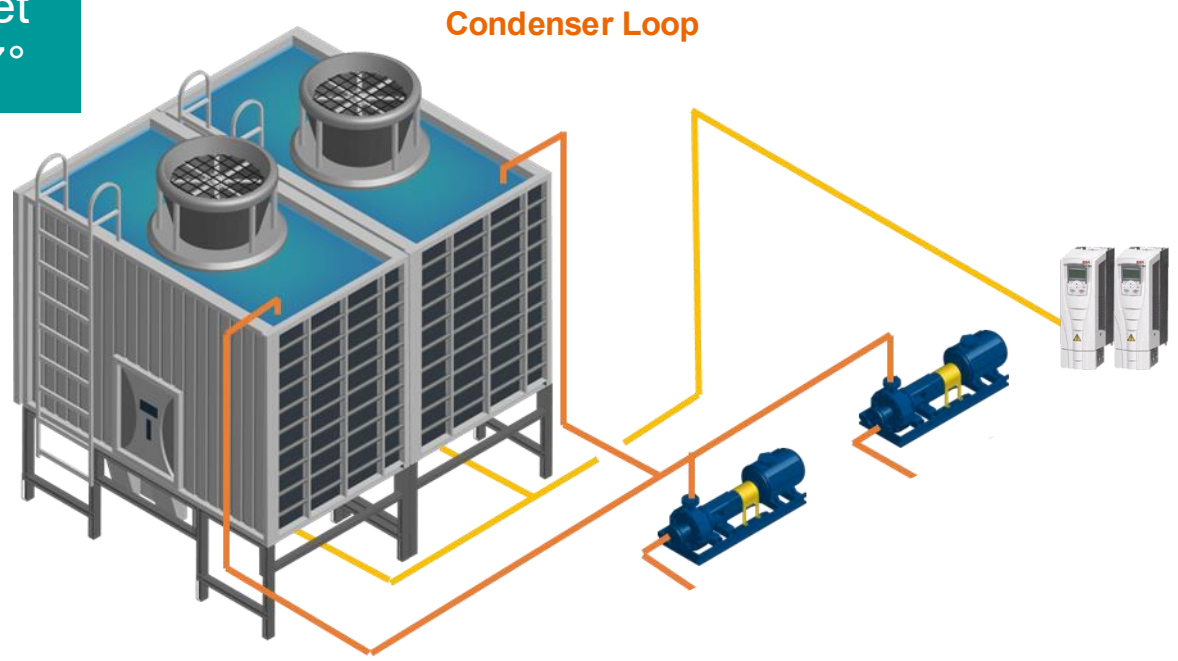
Condenser Side Improvements

Condenser Setpoint reset Wet bulb + 7°



Get VFDs on the pumps, take advantage of the affinity laws

Regular cleaning of the tower grates and proper chemical treatment

CHW Supply
CHW Return
Decoupler/By-Pass
CW Supply
CW Return

The Affinity Laws regarding speed

flow $\frac{gpm_{old}}{gpm_{new}} \approx \frac{rpm_{old}}{rpm_{new}}$

~~head~~ pressure $\frac{head_{old}}{head_{new}} \approx \left(\frac{rpm_{old}}{rpm_{new}}\right)^2$

power $\frac{kW_{old}}{kW_{new}}$ or $\frac{BHp_{old}}{BHp_{new}} \approx \left(\frac{rpm_{old}}{rpm_{new}}\right)^3$

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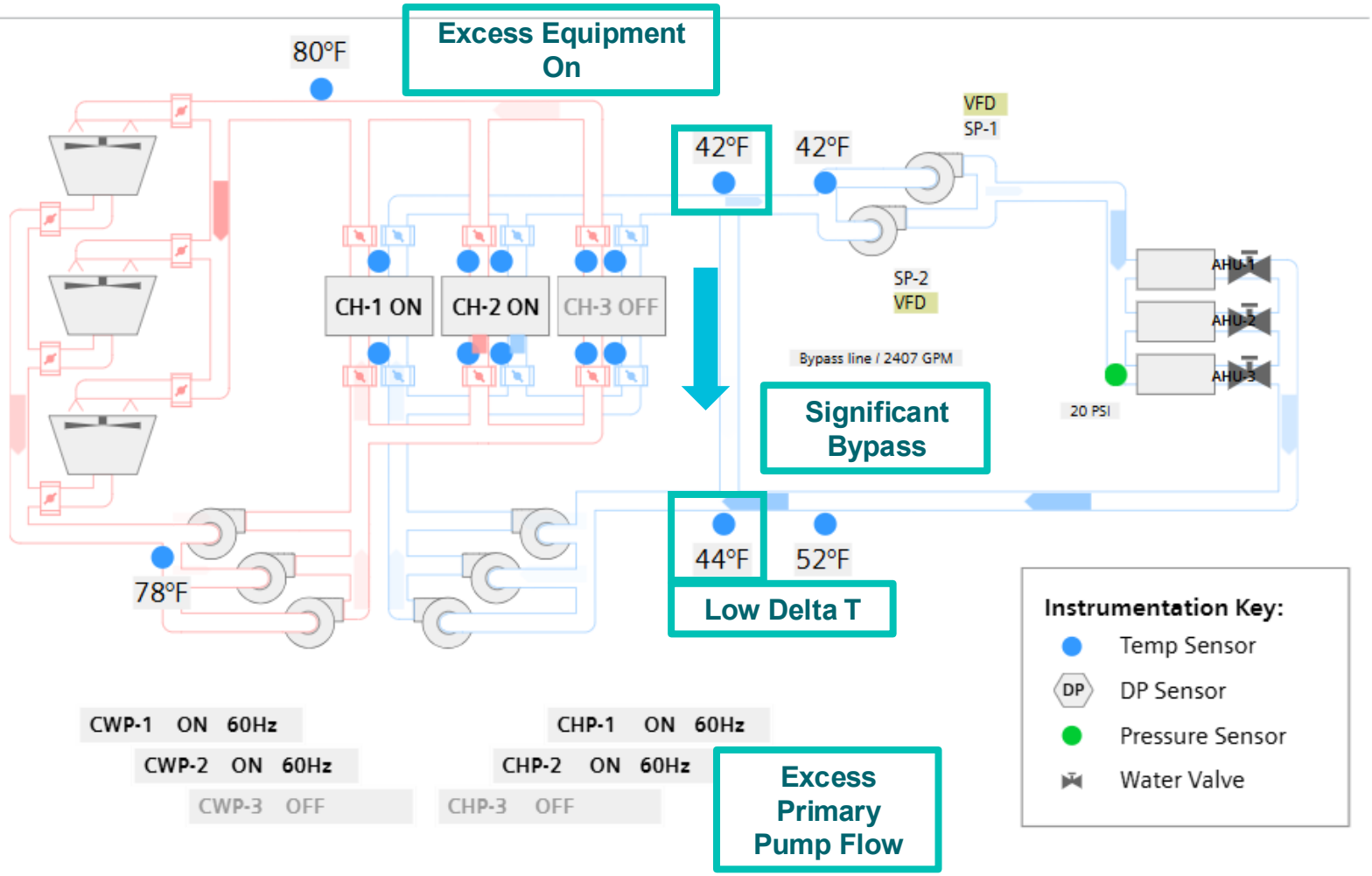
Chilled Water System – Common Operational Deficiencies

Increase the delta T by having a chilled water reset strategy based on the cooling demand on the AHU

Decrease the bypass by using a new strategy to modulate the primary and secondary pumps

Get VFDs on the pumps, take advantage of the affinity laws

Up to 20% energy efficiency increase



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Space Heating Energy Reduction

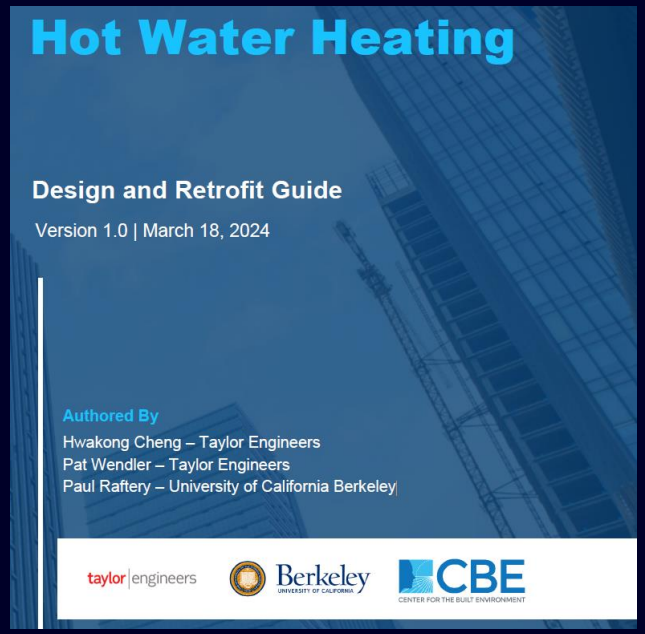
Biggest Advice – Plan for the future.

No like-for-like replacements

Understand your “real” load and needs

Most boilers run 24/7 and at one temp

Reduce the reheat on the zones



Use ASHRAE 36 Guideline for resets and plan ahead

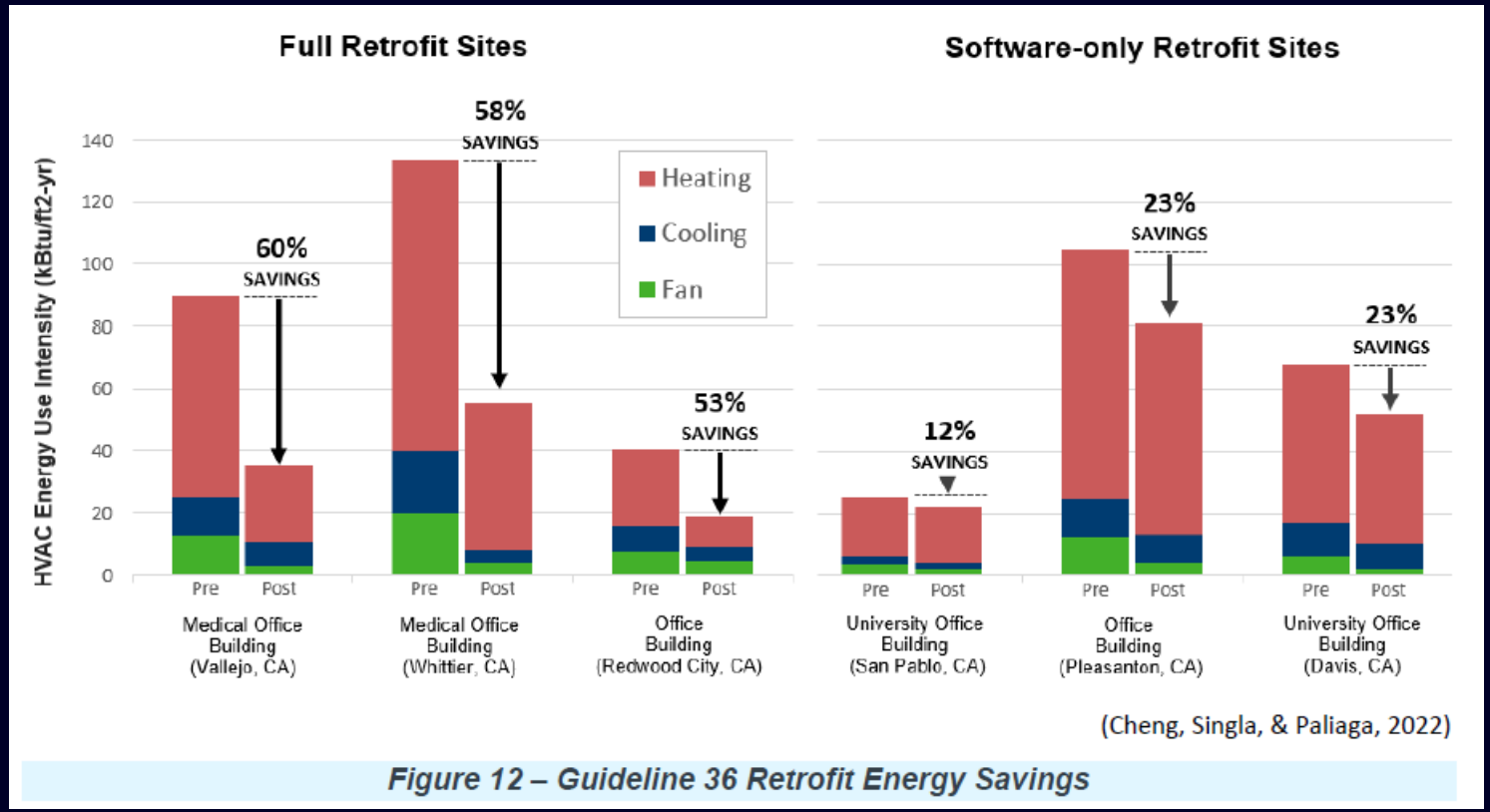


Figure 12 – Guideline 36 Retrofit Energy Savings

Air Handler Optimization – Non-Critical Areas

Optimize the schedule: the easiest is to turn off the 30 HP fan.

If it is an outpatient clinic, ensure that there is an unoccupied setting.

ASHRAE 36 Trim and Response logic with rogue zones.

Verify that your actuators/sensors work and are calibrated. They are the eyes to your system!

What temperatures are needed at the zone level?

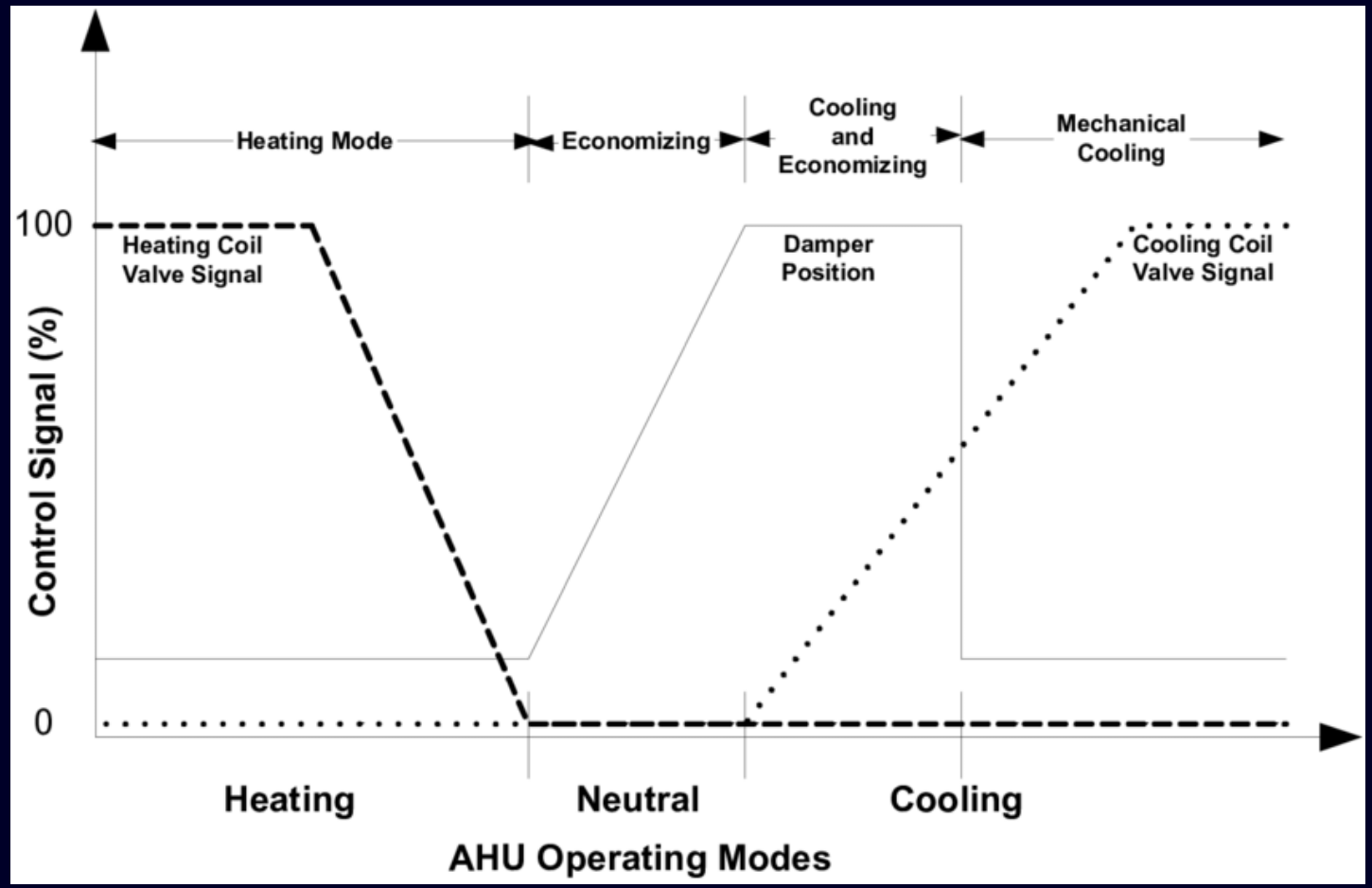
The goal is to optimize the AHU setpoint and the zone setpoints.

Review your sequences, if they have not been updated in the last 20 years, they are probably not efficient.

Reduce the reheat at the zone and reduce the cooling at the AHU.

Verify all the sensors and actuators work and are in calibration

Control upgrades are the cheapest solution with great outcomes. Pair it with mechanical upgrades!!!



Operating Rooms Setbacks

Understand the Schedule, Pressure Requirements and the Equipment possibilities.

If they pass all three, controls upgrade will be easy.

Verify with your OR team and director team

Great Incentives with less than a year ROI

ASHE Paper - Operating Room HVAC Setback Strategies

ASHRAE 170 Standard – 20 ACH Occupied
6-12 ACH Unoccupied

Laboratories and Demand Control Ventilation

Reducing ACH

BAS Schedule

If the lab is on verified schedule, controls logic can be added to decrease airflow through VAV boxes. Existing Minimums in the controllers could be used.

Occupancy Sensors

Using BACnet occupancy sensors which could be pulled into BAS, new script verifying the occupancy status is added. Timed approach shows bigger savings and less hazards

Contaminants Sensing

VOC, Gases, Particulates and CO2. 2 Air Changes while the air is clean and the volume ramps up when contaminants are present!

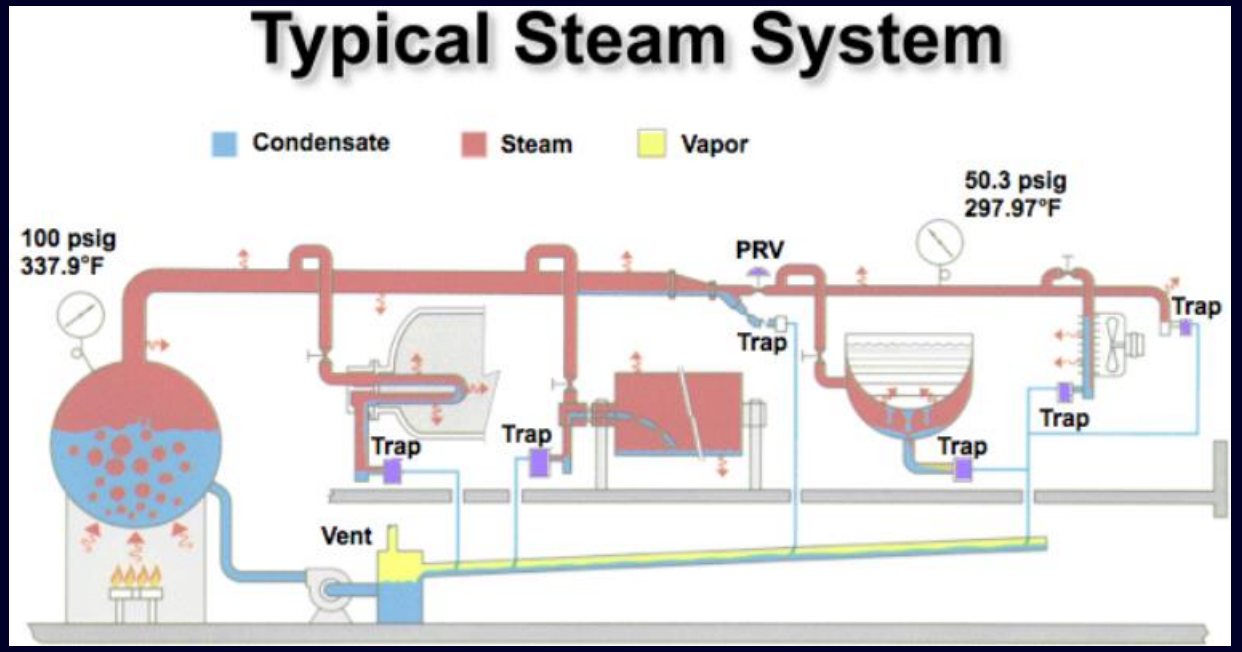
Risk Based Approach!

Miscellaneous Recommendations

Pneumatic to DCC, no compressors

Look into the Kitchen and Laundry Supply/Exhaust Fans

Take advantage of the Energy Audits offered by the state



- Steam Traps separate condensate from dry steam, essential for proper operation
- Old technology: 15% - 20% fail each year (source: US Dept of Energy)
- Typically manually inspected once per year.
- Most fail open and leak dry steam which cost $15/1,000 lbs
- $8,000 per year waste, even for smallest steam trap

Source: Department of Energy

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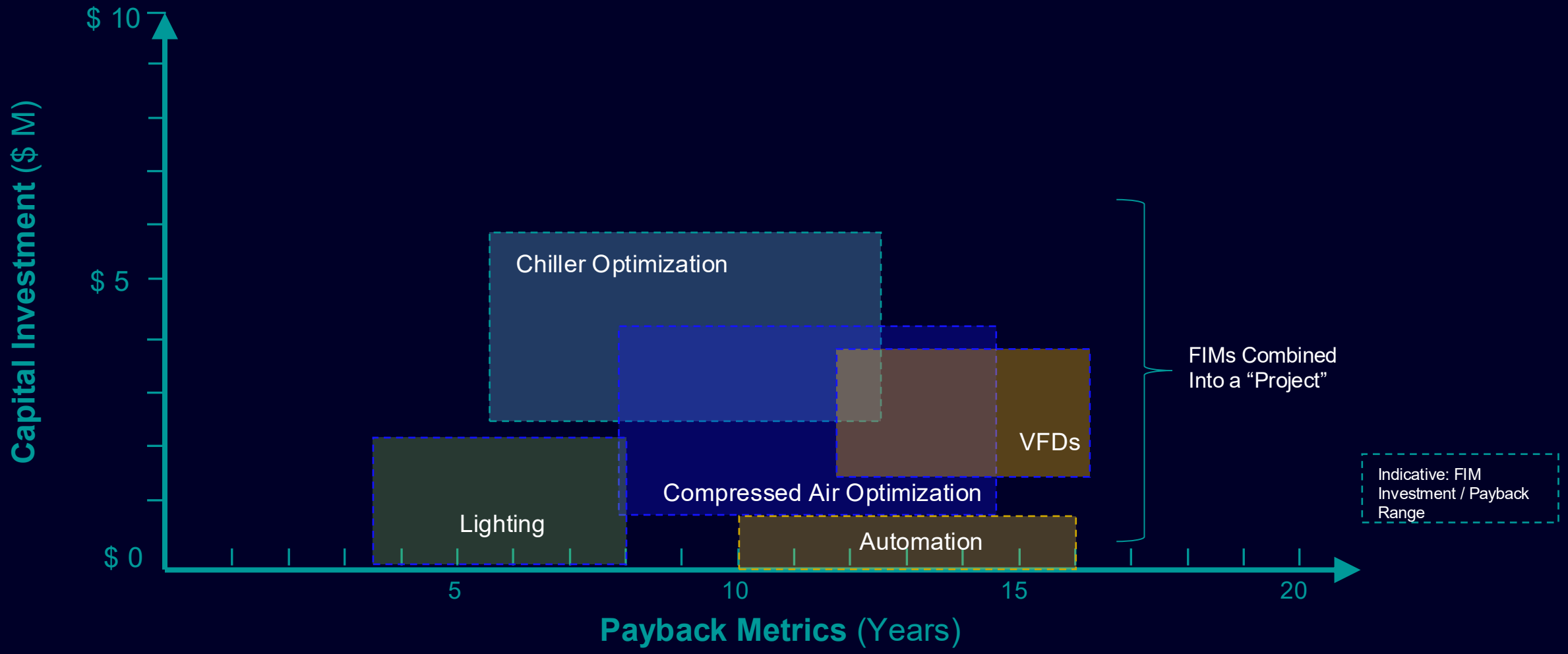
How Do We Reach the Goal?

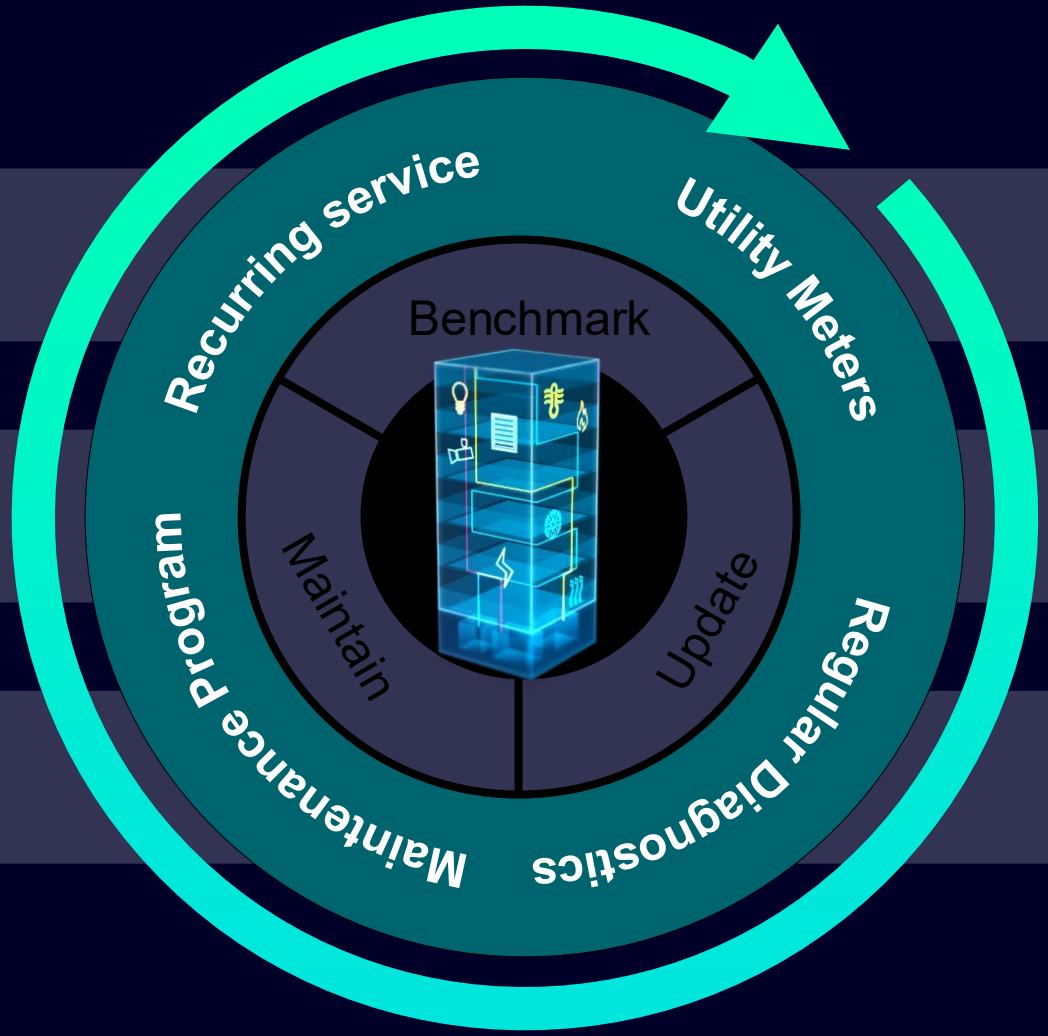


Maintain the progress

Transition to Recurring Services
Once assets running smoothly, offer to ensure it stays that way

Preventative Maintenance
Calibrate and replace equipment at the end of life, with better versions.

Use Data to Generate More Insights
Understand your occupancy levels and needs for HVAC



Engage your Utility Company
Talk to your representative and understand the programs you can join

Build Understanding
Efficient data collection & analysis, prioritizing improvement potentials

Maintain the Control Sequence
Don't leave the units in operator override, especially setpoints.

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Contact:

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