

Top 10 Low Cost Energy Savers



Outline

- The HVAC Movie?!

- https://www.youtube.com/watch?v=Kt1j_aAApwg

- How Buildings Use Energy Exercise

- Top 10 Energy Savers



How Buildings Use Energy

Office Buildings – All Climate Zones

Internal Equipment

(computers, lamps, printers, coffee pot,
anything you plug into the wall)

Space Cooling

Space Heating

Lights

Domestic Hot Water

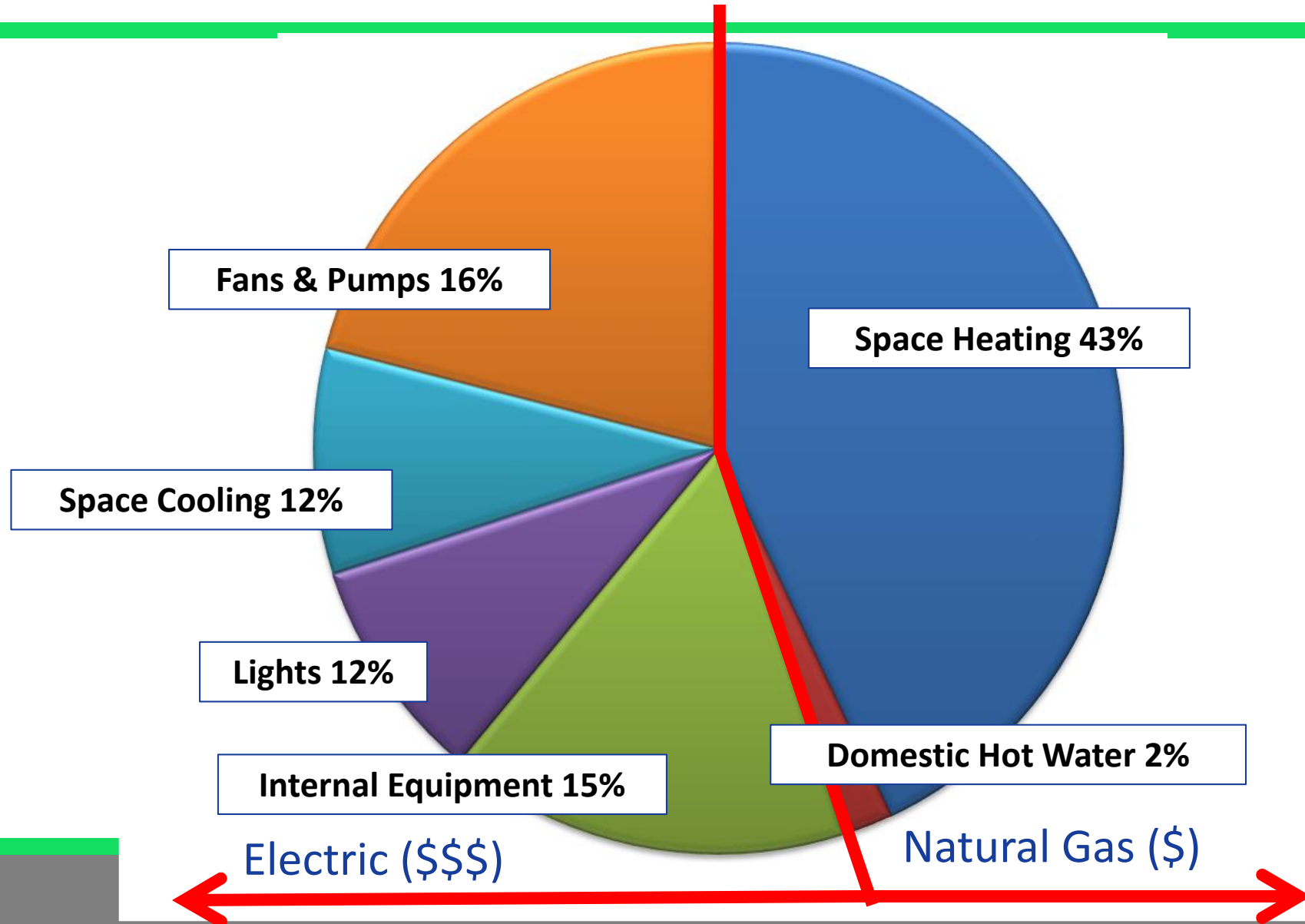
Fans & Pumps





How Buildings Use Energy

Office Buildings – All Climate Zones





The HVAC Cartoon Movie



https://www.youtube.com/watch?v=Kt1j_aAapwg



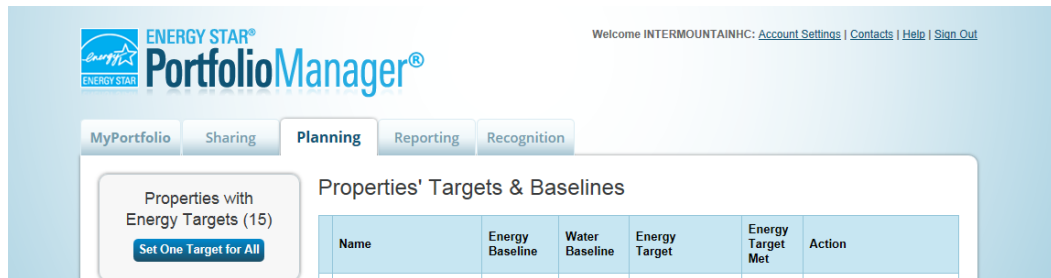
Top 10 Energy Saving Measures

1. Measure it!
2. ~~Operator Override~~
3. Upgrade Pneumatic Controls
4. Schedule Equipment
5. Increase your Chiller Plant ΔT
6. Optimize Air Handling Units
7. Use Occupancy Sensors
8. Improve VAV Box settings
9. Tune Your Boilers. Insulate.
10. Use Variable Frequency Drives (VFDs)



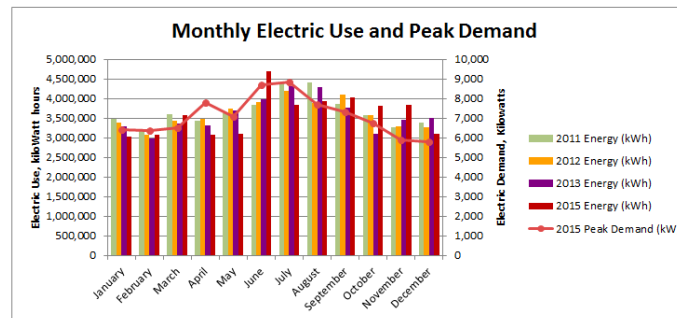
#1 Baseline Energy Performance

Energy Star Portfolio Manager:



Home Brew Spreadsheet:

Read Date	kWh Usage	kW Usage	Inv Amt (\$)
9/4/2007	3,444,000	6,000	\$ 190,752.12
10/3/2007	2,894,400	5,520	\$ 164,791.88
10/31/2007	2,959,200	6,240	\$ 152,566.56
12/4/2007	4,080,000	6,744	\$ 192,920.40
1/8/2008	4,108,800	6,504	\$ 191,592.24
2/4/2008	3,180,000	6,504	\$ 162,056.40
3/5/2008	3,504,000	6,480	\$ 172,015.00
4/2/2008	3,398,400	6,360	\$ 168,394.00
5/1/2008	3,616,800	6,960	\$ 207,063.84
6/4/2008	4,317,600	6,960	\$ 232,853.28
7/2/2008	3,856,800	8,016	\$ 208,188.33
8/5/2008	5,011,200	7,968	\$ 256,263.60
9/3/2008	4,276,800	9,072	\$ 244,043.00
10/2/2008	3,960,000	7,488	\$ 215,802.95
11/4/2008	4,257,600	7,296	\$ 224,150.88
12/3/2008	3,758,400	6,744	\$ 201,004.32
1/6/2009	4,233,600	6,840	\$ 218,623.20
2/3/2009	3,518,400	6,384	\$ 188,903.52
3/4/2009	3,621,600	6,936	\$ 198,190.08
4/2/2009	3,758,400	7,008	\$ 219,934.19
5/5/2009	4,233,600	7,104	\$ 238,242.83
6/3/2009	4,000,000	7,200	\$ 232,307.45





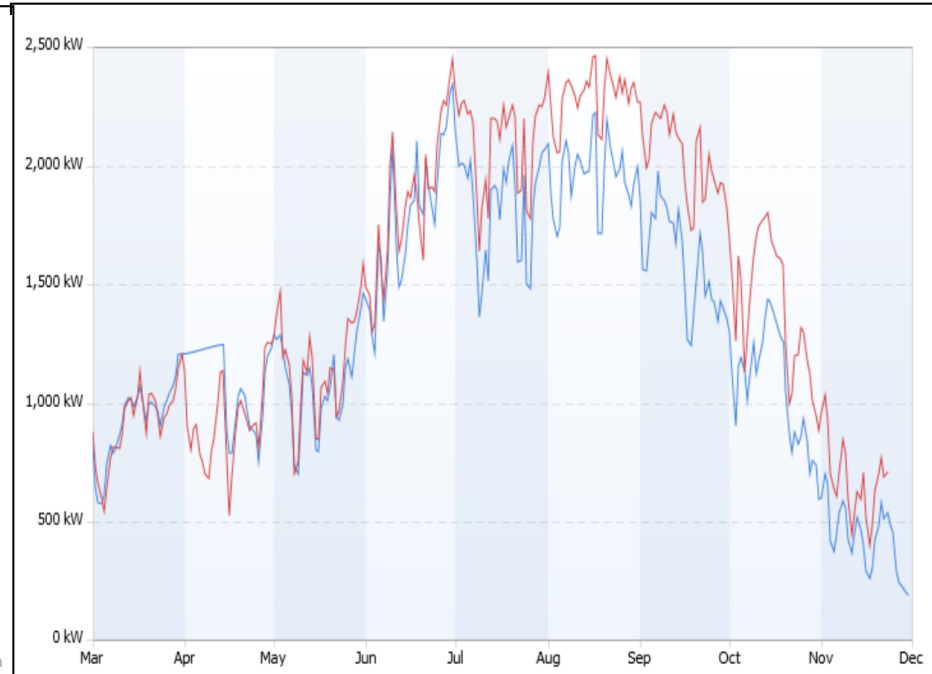
#1 Baseline Energy Performance

Live Electric Meter Data

2015 **Actual** vs **Modeled**



2016 **Actual** vs **Modeled**

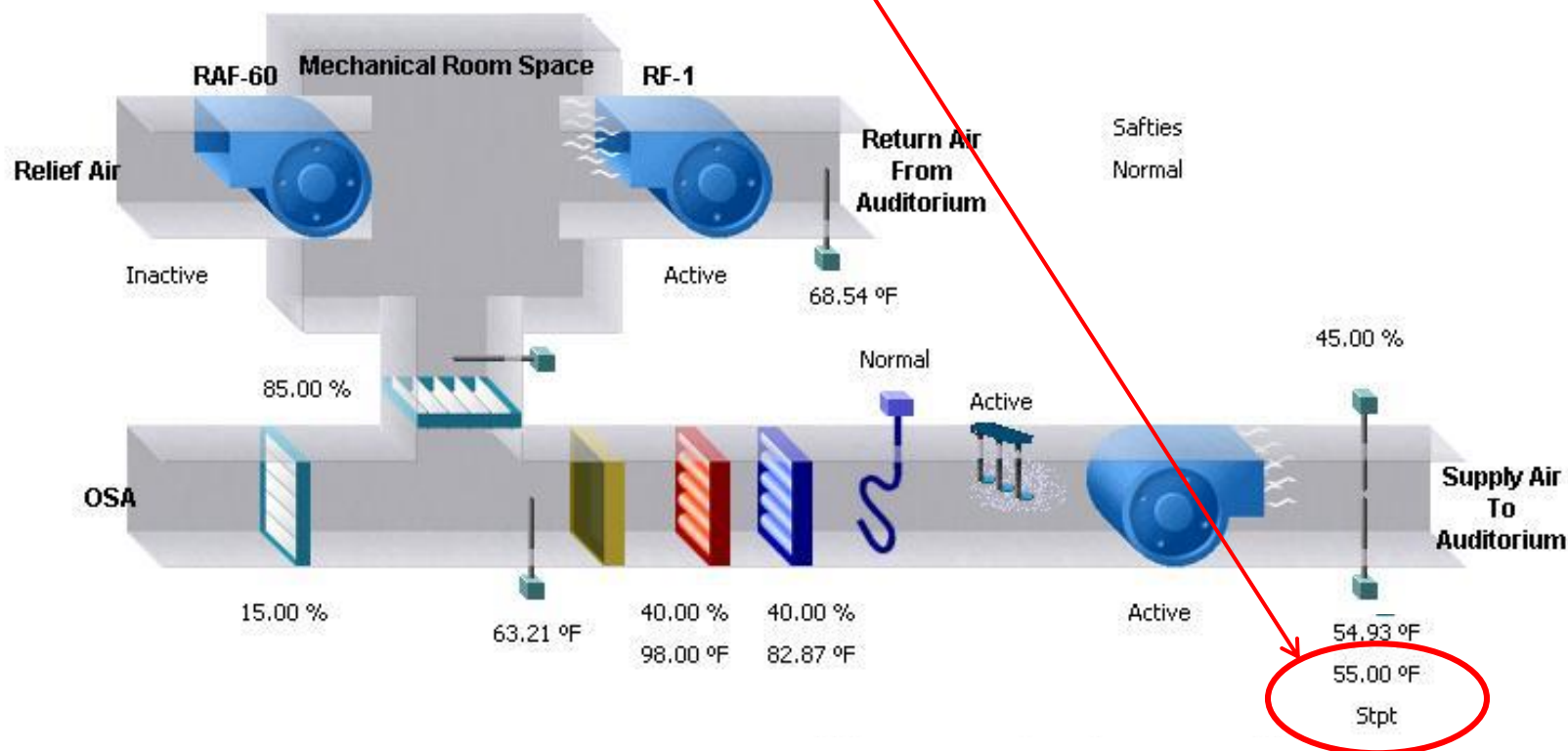




#2 Eliminate Operator Overrides!

--- Minor Infraction

Control System **setpoint** override

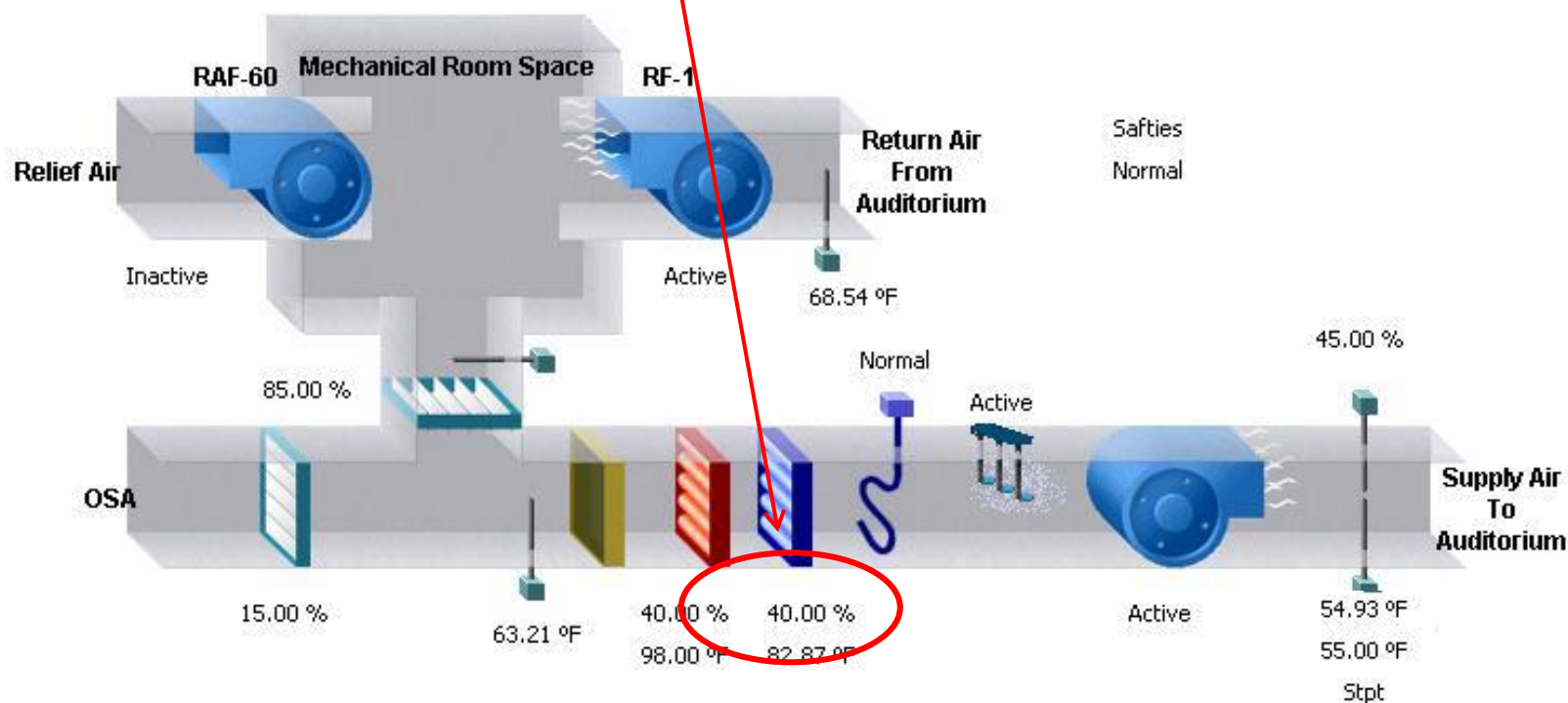




#2 Eliminate Operator Overrides!

--- Misdemeanor

Control System **device** override

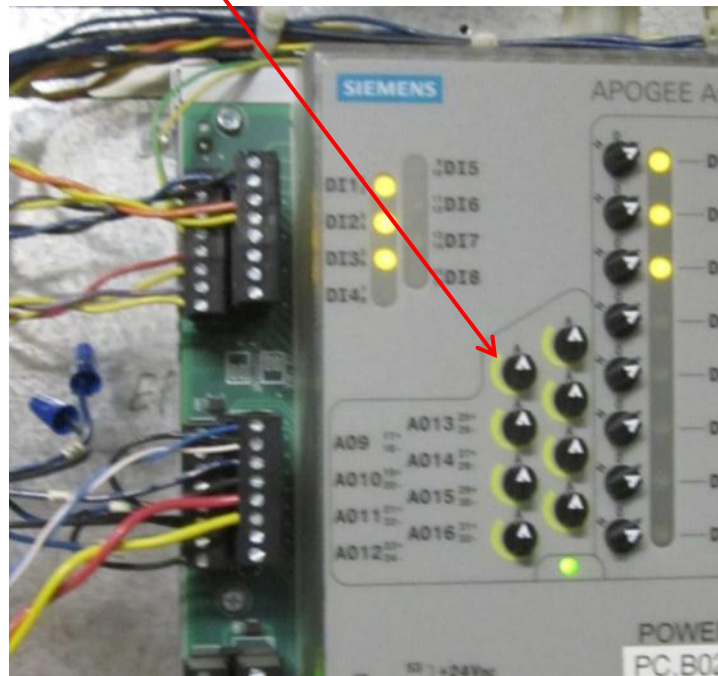




#2 Eliminate Operator Overrides!

--- Misdemeanor

Field Panel **device** position override

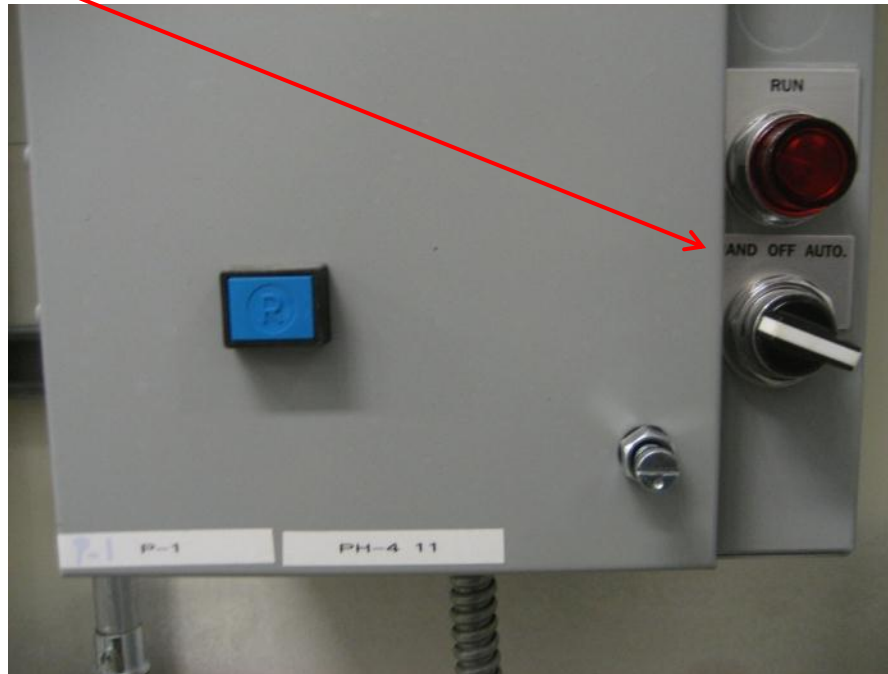




#2 Eliminate Operator Overrides!

--- Felony

HOA switch



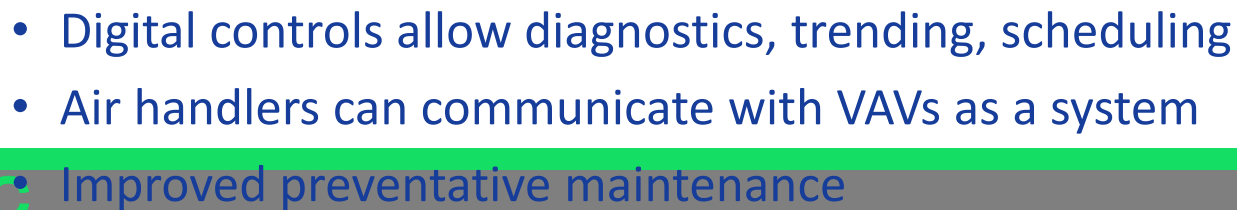
- Undetectable on control system graphics
- Undetectable on control system reports



Quiz ? #2

A building owner wants an Energy Audit – what do you do first:

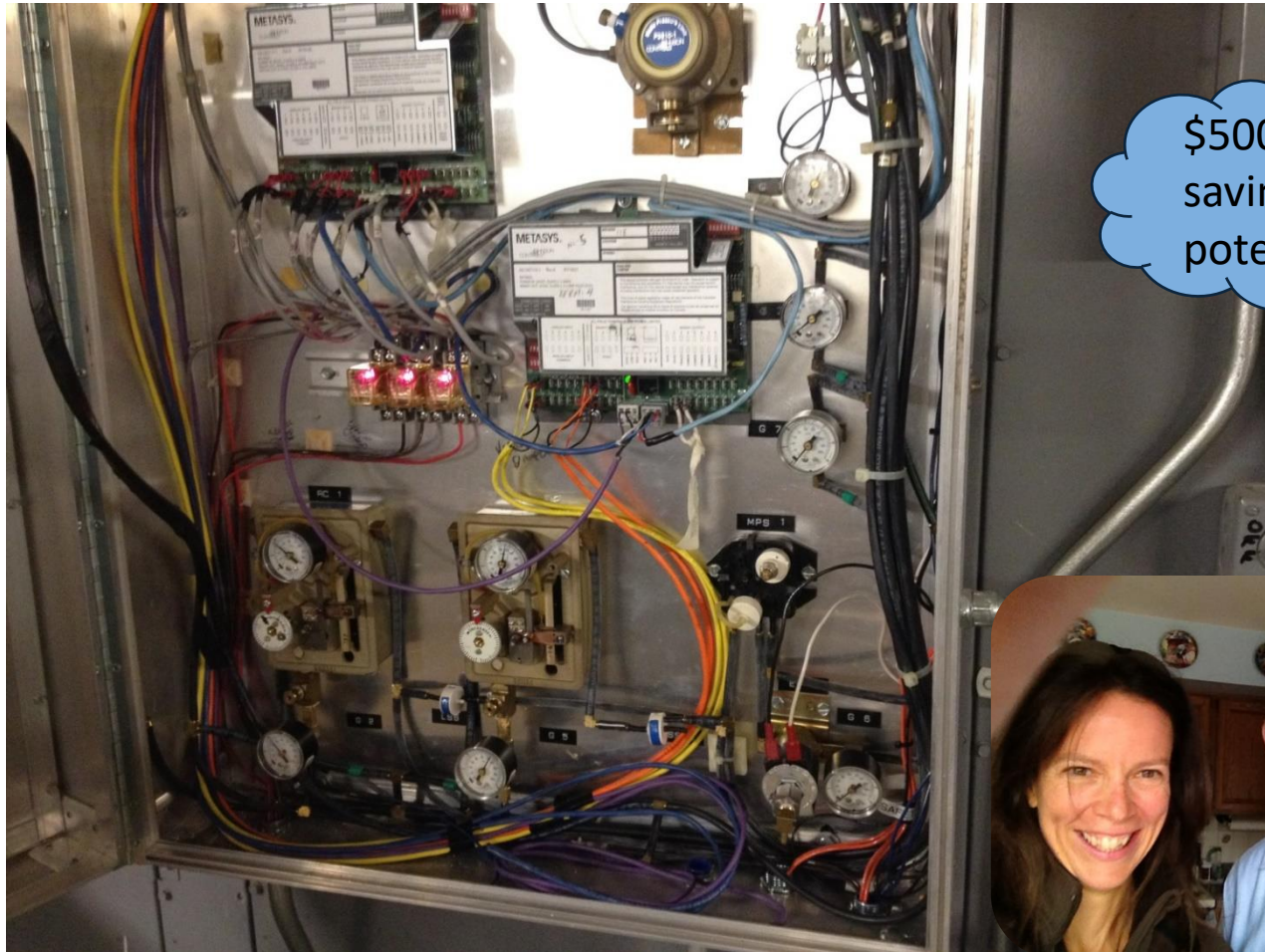
- A. Run an Operator Override report in their Building Automation System
- B. Baseline their gas and electric bills
- C. Get the horsepower of the chilled water pumps





#3 Upgrade Controls

Phase out Pneumatics



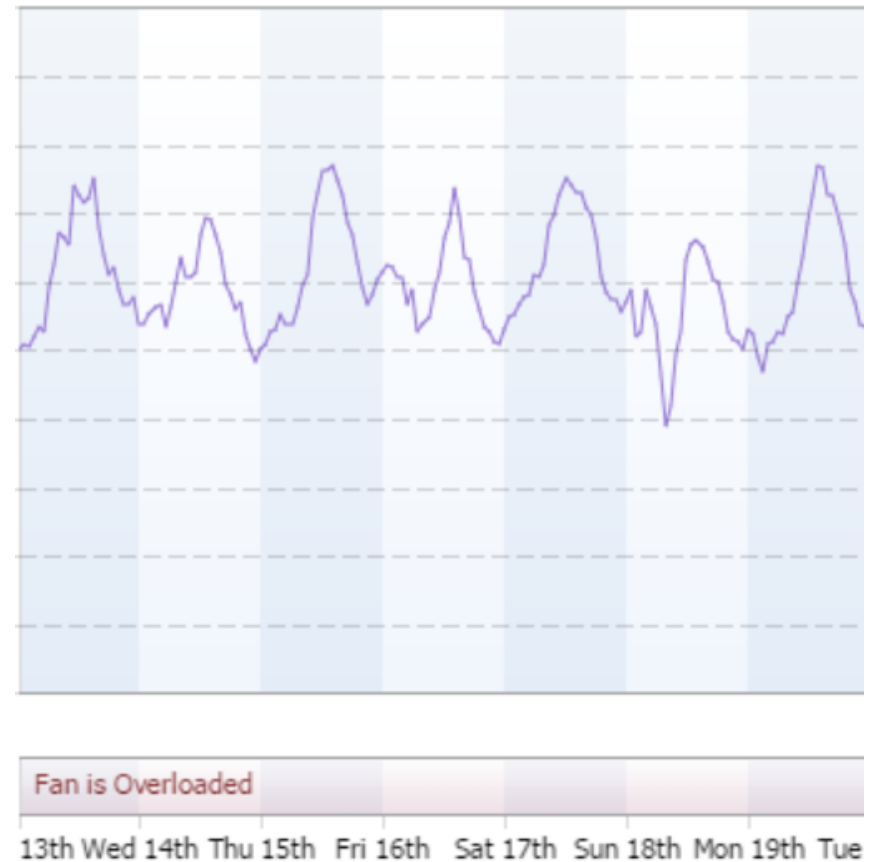
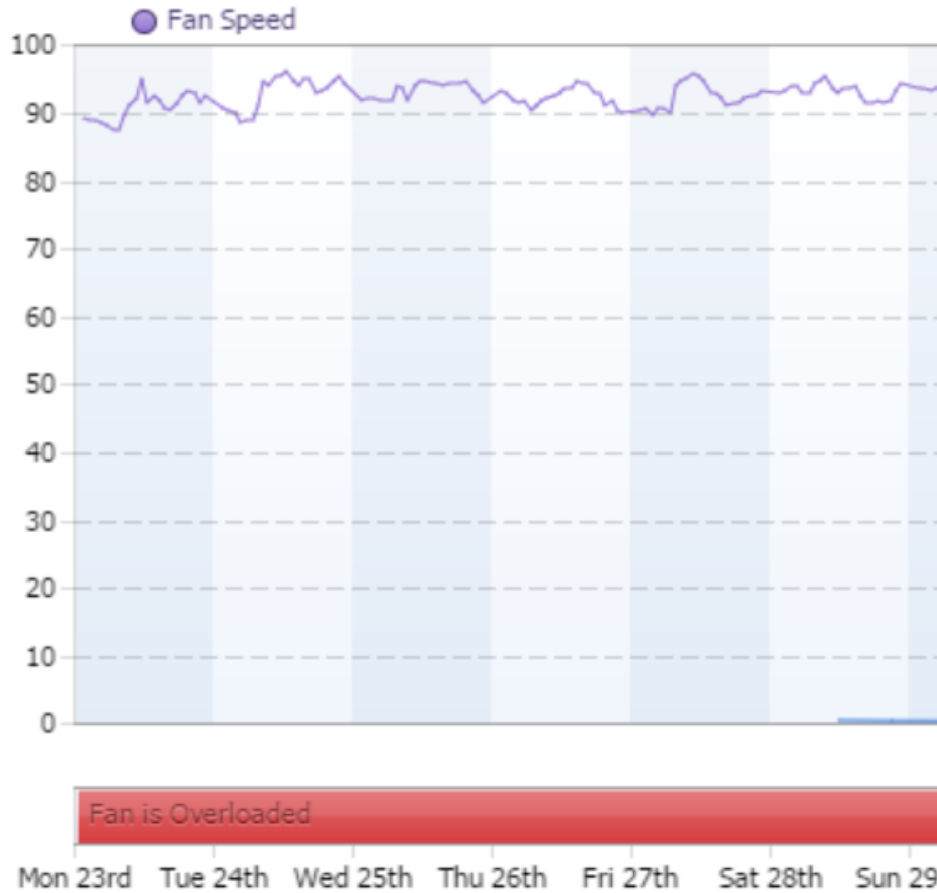
\$500,000
savings
potential!





#3a Upgrade Controls

\$5,000
savings per
year!





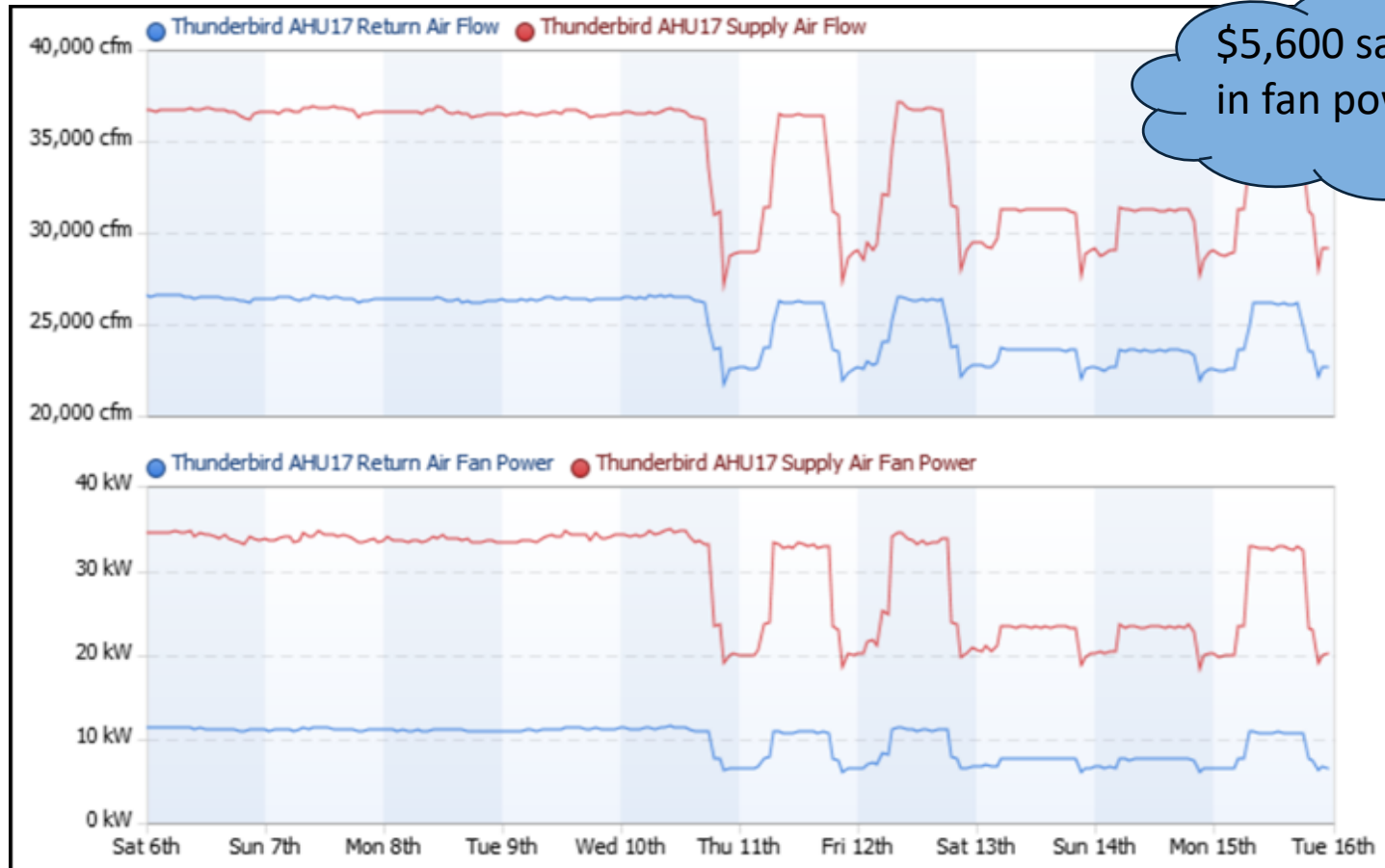
Quiz ? #3

The owner has agreed to purchase VFDs for AHU fans. How do you prioritize the AHUs to apply them to:

- A. The air handlers that give the HVAC staff trouble
- B. The air handlers with pneumatic chilled water valve actuators
- C. The largest horsepower fans with variable air volume terminal boxes



#4 Schedule Equipment



\$5,600 savings just in fan power



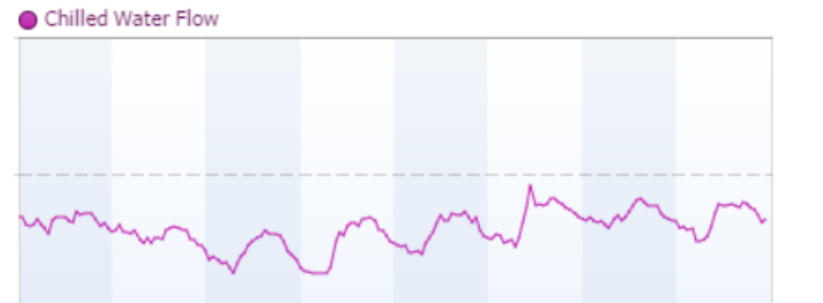
#5 Chiller Plant ΔT ?



\$78,000
savings per
year!



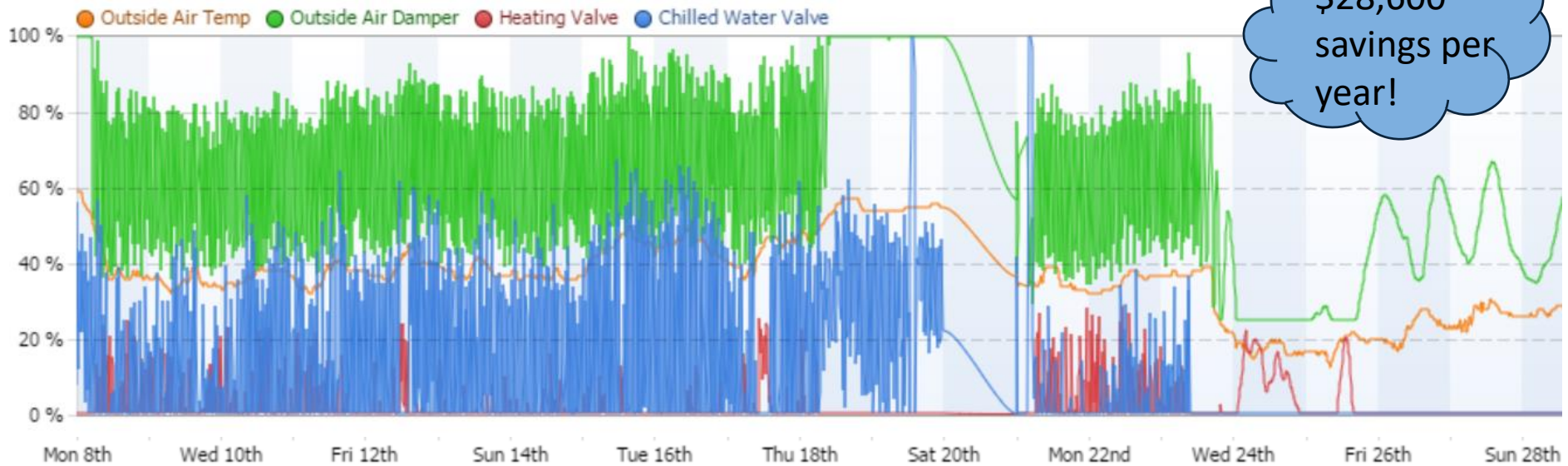
Sat 20th Sun 21st Mon 22nd Tue 23rd Wed 24th Thu 25th Fri 26th Sat 27th



8th Thu 9th Fri 10th Sat 11th Sun 12th Mon 13th Tue 14th Wed 15th Thu 16th



#6 AHU – economizer working?





Quiz ? #4

It's 55°F outside and you're standing on the roof at an air handling unit. What should the outside air damper be doing?

- A. Positioned at 100% open
- B. Modulating from 50 to 100%
- C. Positioned at minimum ventilation rate of 20% open.



#7 Install Occupancy Sensors

Conference Room VAV Box



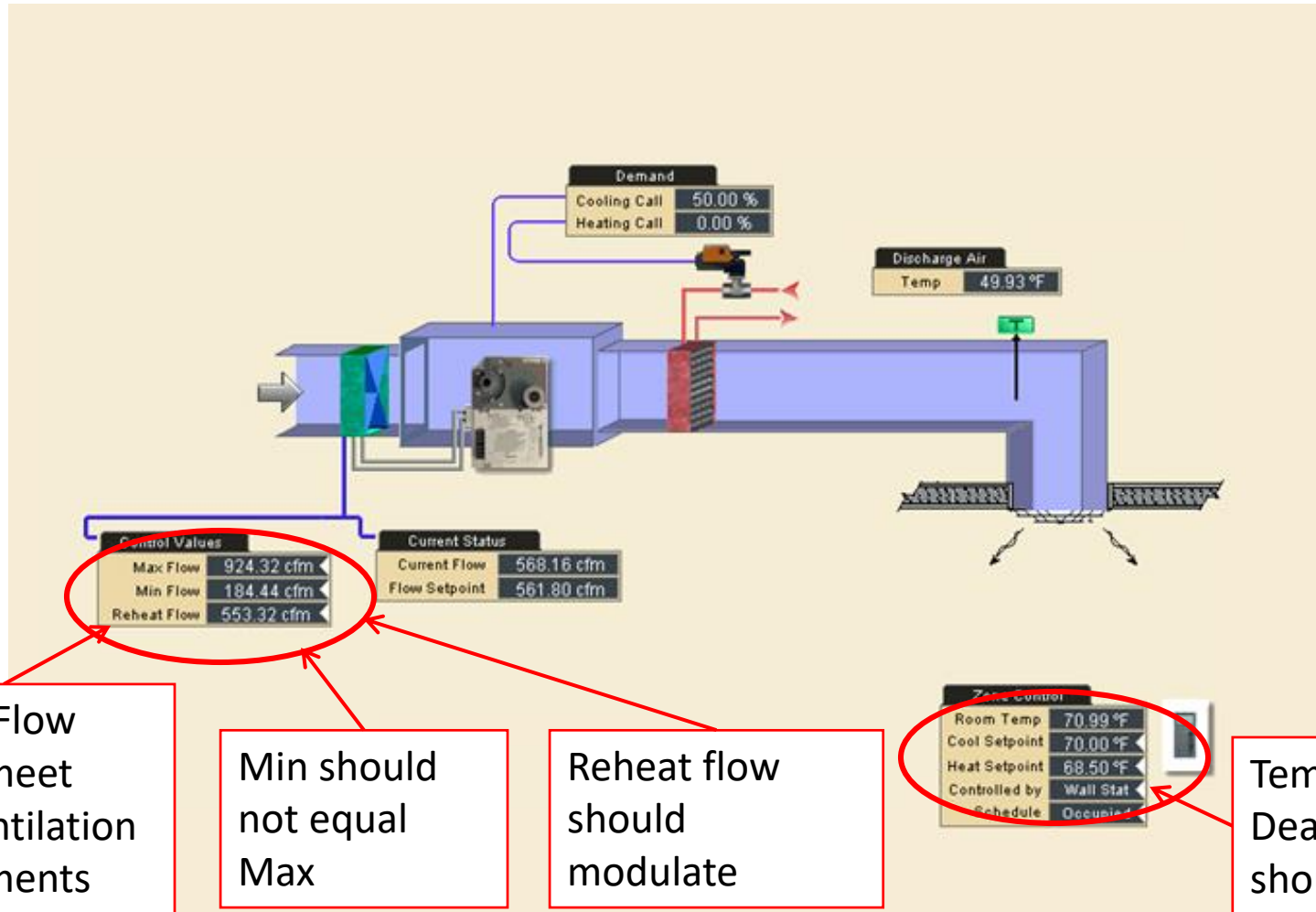
Occupied Air Flow

Unoccupied Air Flow

\$7,925
savings per
year!

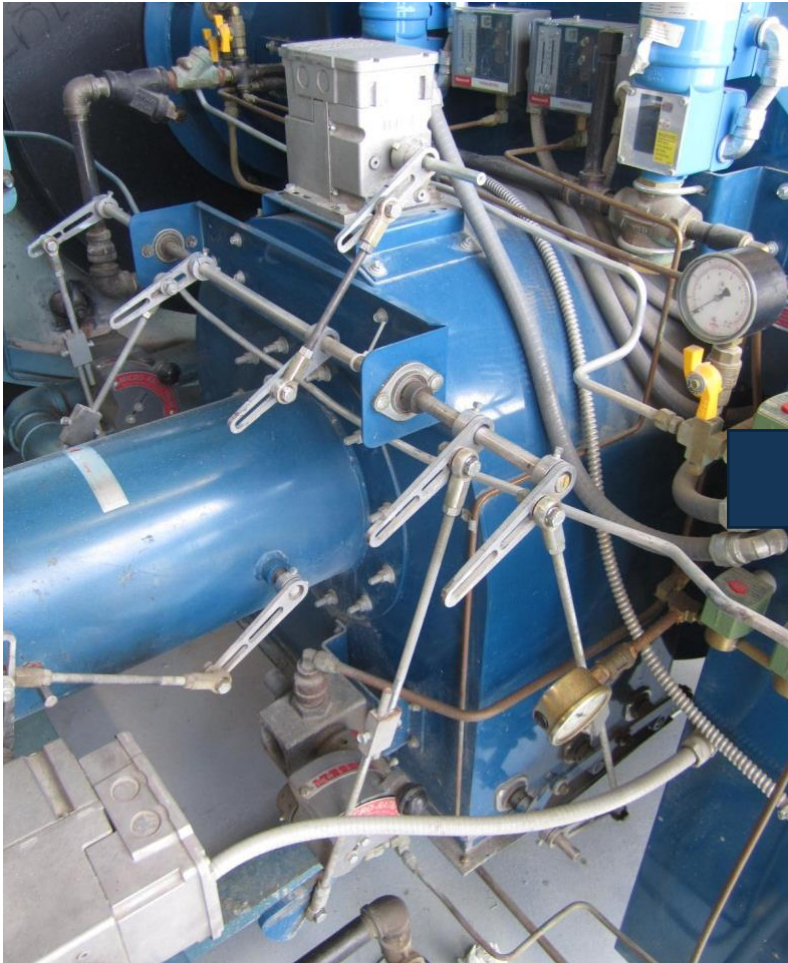


#8 VAV Box settings correct?





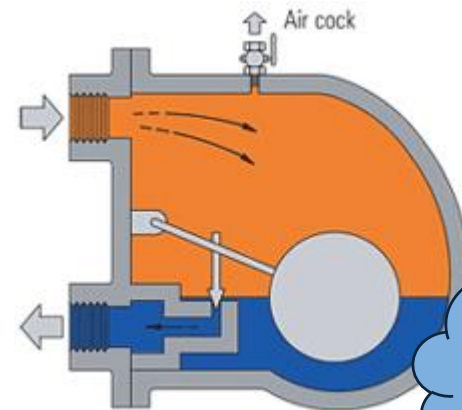
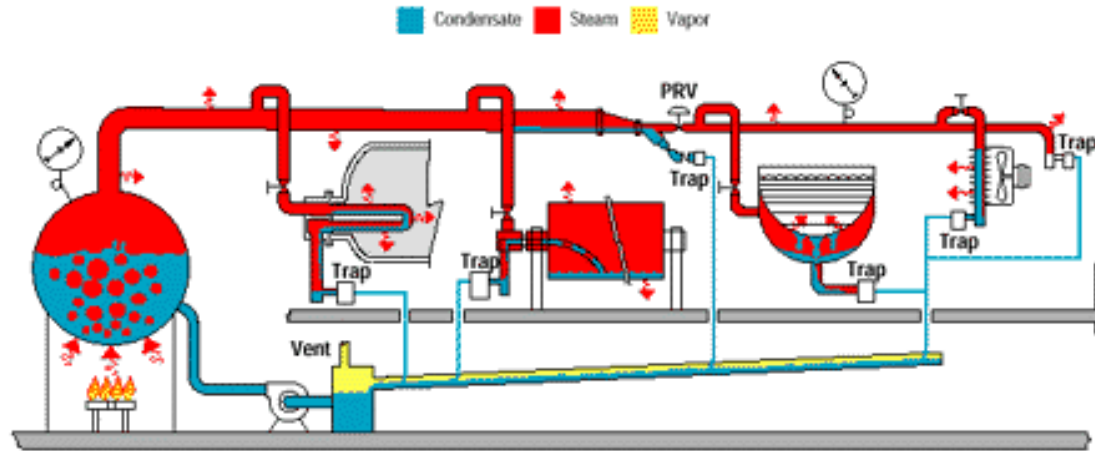
#9 Tune your Boilers



Digital Combustion Control Retrofit



#9a Check your steam traps



\$2,300
savings per
year!



Quiz ? #5

What is the biggest energy use in your building based on BTU?

- A. Cooling
- B. Heating
- C. Lighting

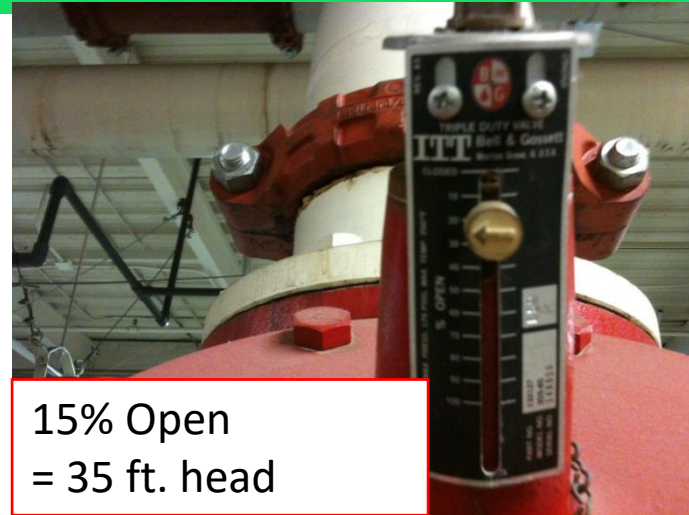


#9b Insulate

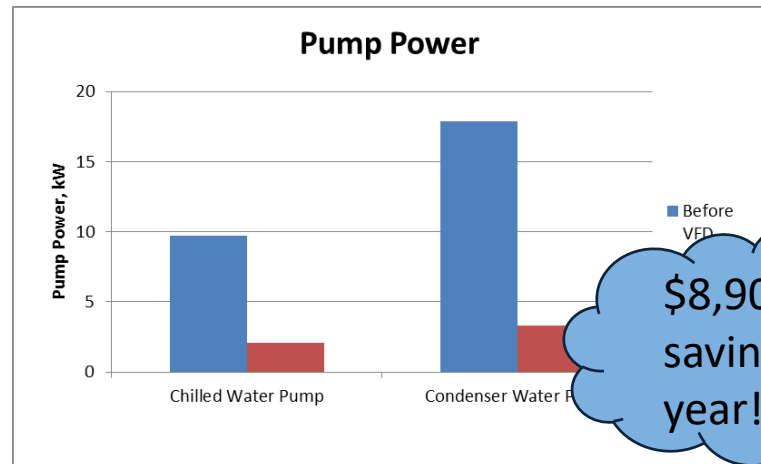




#10 Use VFDs



15% Open
= 35 ft. head



\$8,900
savings per
year!!

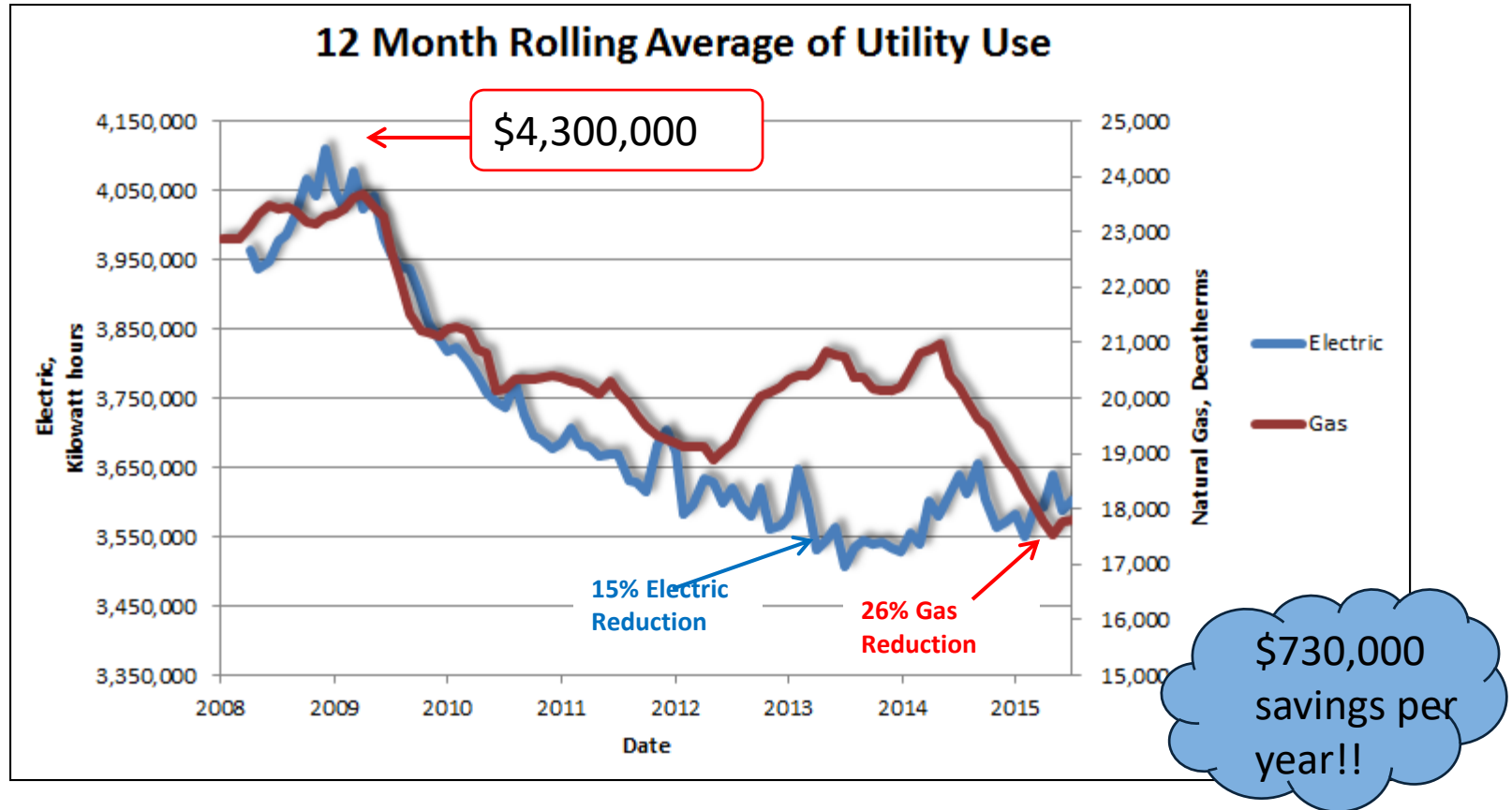


Savings Opportunity Summary

- 10-15% typical energy savings
- 30% typical ROI
- Preserve Savings with Continued Monitoring



Why?





Resources

- Office of Energy Efficiency & Renewable Energy
 - <https://energy.gov/eere/efficiency>
- Building Performance Database (Lawrence Berkeley National Lab)
 - <https://bpd.lbl.gov/>
- Energy Star Portfolio Manager
 - <https://portfoliomanager.energystar.gov/pm/login.html>
- ASHRAE – New Energy Future (an interesting read)
 - https://www.ashrae.org/File%20Library/About/Leadership/new_energy_future_web_061518.pdf

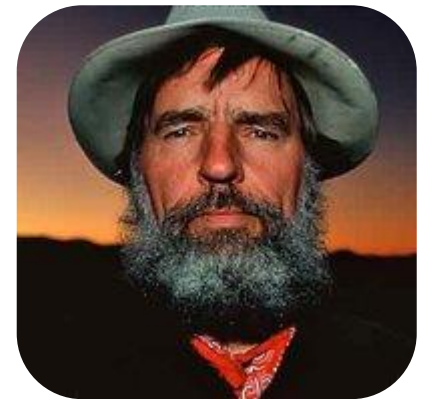


“One final paragraph of advice: do not burn yourselves out.

Be as I am – a reluctant enthusiast....a part-time crusader, a half-hearted fanatic. Save the other half of yourselves and your lives for pleasure and adventure.

It is not enough to fight for the land; it is even more important to enjoy it. While you can. While it's still here. So get out there and hunt and fish and mess around with your friends, ramble out yonder and explore the forests, climb the mountains, bag the peaks, run the rivers, breathe deep of that yet sweet and lucid air, sit quietly for a while and contemplate the precious stillness, the lovely, mysterious, and awesome space.

Enjoy yourselves, keep your brain in your head and your head firmly attached to the body, the body active and alive, and I promise you this much; I promise you this one sweet victory over our enemies, over those desk-bound men and women with their hearts in a safe deposit box, and their eyes hypnotized by desk calculators. I promise you this; You will outlive the bastards.”



-- Edward Abbey



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