
OREGON
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ENERGY 350

OR APEM 2016 Fall Forum

RCx Stories from the Field

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The Process of RetroCommissioning

- Commissioning is:
  - An extremely important, but costly, time consuming endeavor
  - Includes functional testing of every device
  - Typically done on new construction or major renovation projects
  - Should be done on all mechanical system upgrades

- Retrocommissioning:
  - Can be full point to point commissioning of existing building, but most people aren't willing to pay for that
  - More exploratory
  - Leverages control systems as a window into mechanical systems

Tips for RetroCommissioning

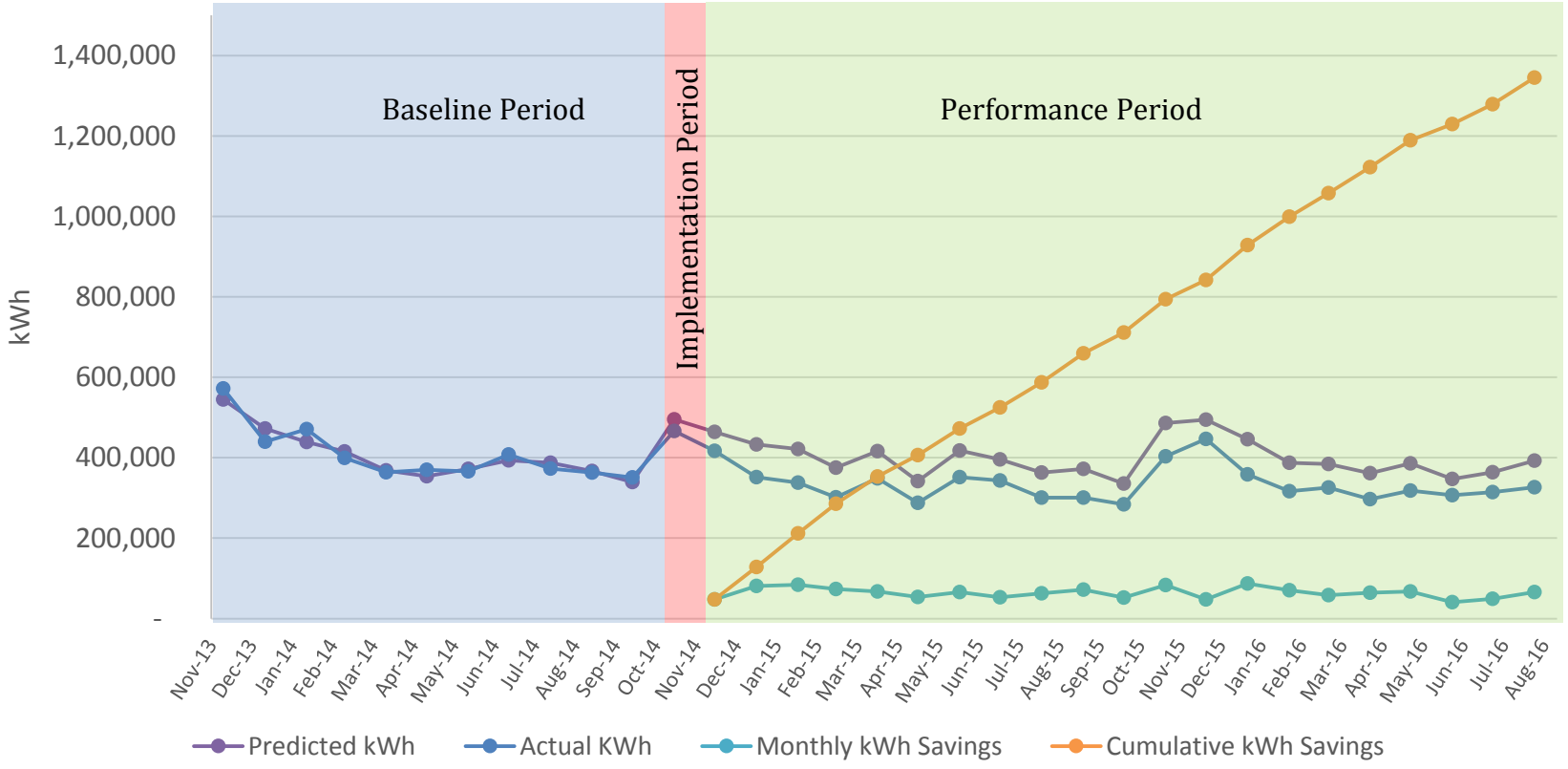
- Know your stuff! – Your job is to find opportunities that building managers, HVAC contractors and control contractors missed
- Question Everything!
- Approach interactions with humility
  - Remember that you're being critical of someone's baby (facility managers spend a lot of time with the systems you're looking for flaws in)
  - You might learn something (if your mind is open to it)
- Need to be specific in measure identification and SOW to implement
    - A contractor needs to price your recommended fix
    - A contractor needs to implement it in a way that achieves the desired energy savings
- The details matter! Without careful oversight of RCx implementation, the building may not save any energy!
- Oversee contractors carefully! Give them punch lists!
- Make sure contractor payment is tied to approval by you as the RCx agent

RCx Stories from the Field

Case Study – 1000 Broadway

- Energy Star Building
- Has implemented a number of capital projects, even LED lighting
- All electric, water cooled DX, VAV airside systems
- Through Retrocommissioning, saved 16% of energy use (794,386 kWh)
- Energy Star score went from 80 to 91
- Project included minimal capital equipment
- Savings have been measured and verified at the meter
- Building manager billed the expense to the triple net – means the tenants paid for it!

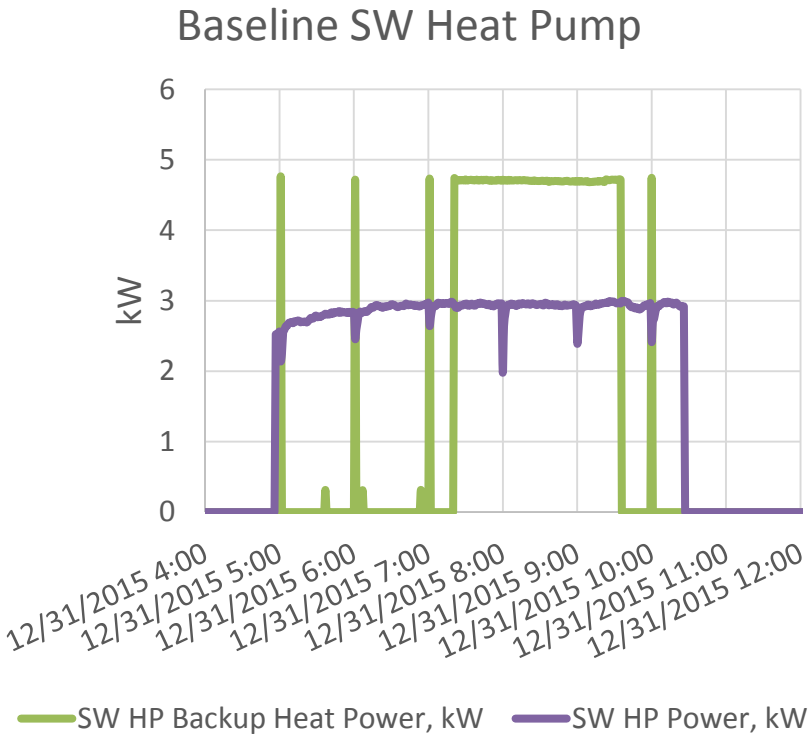
1000 Broadway Results (CUSUM)

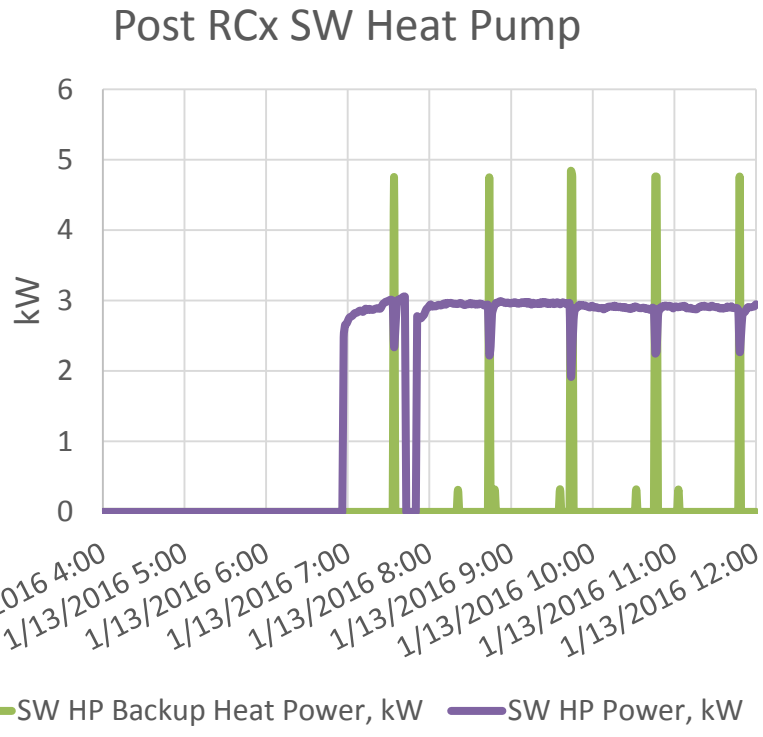


LEED Buildings aren't Necessarily Efficient!

- Newer LEED Gold Building
- EUI 69 kBtu/sft
- 14% savings potential for $15,000 in RCx measures

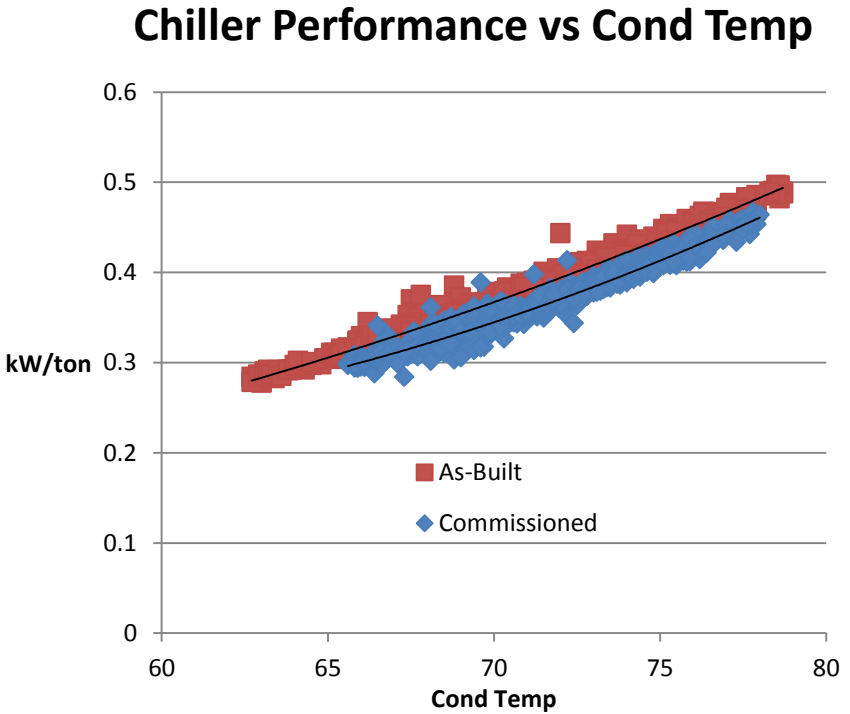
Heat Pump RCx on E350's Office



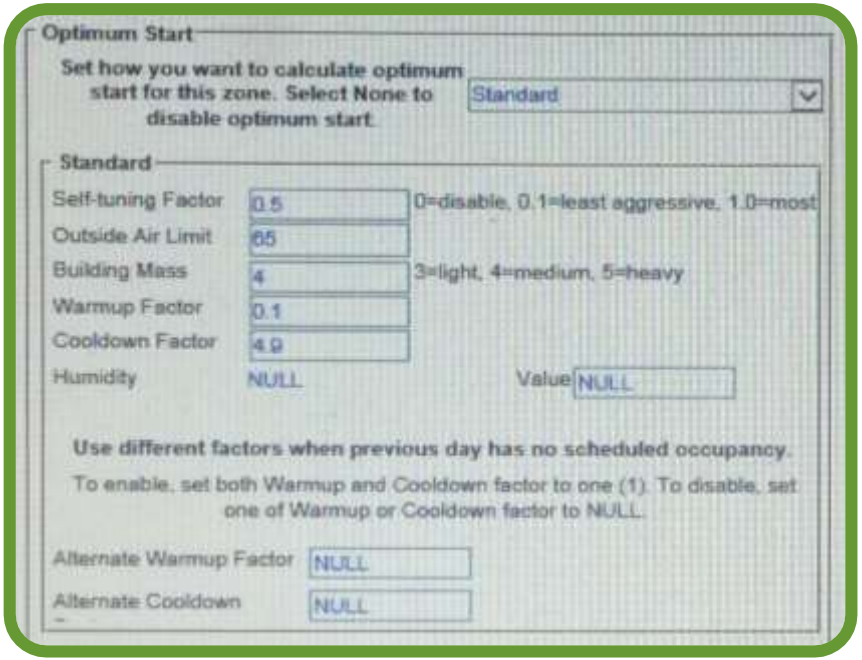


Capital and Retrofit Projects Need to be Commissioned!

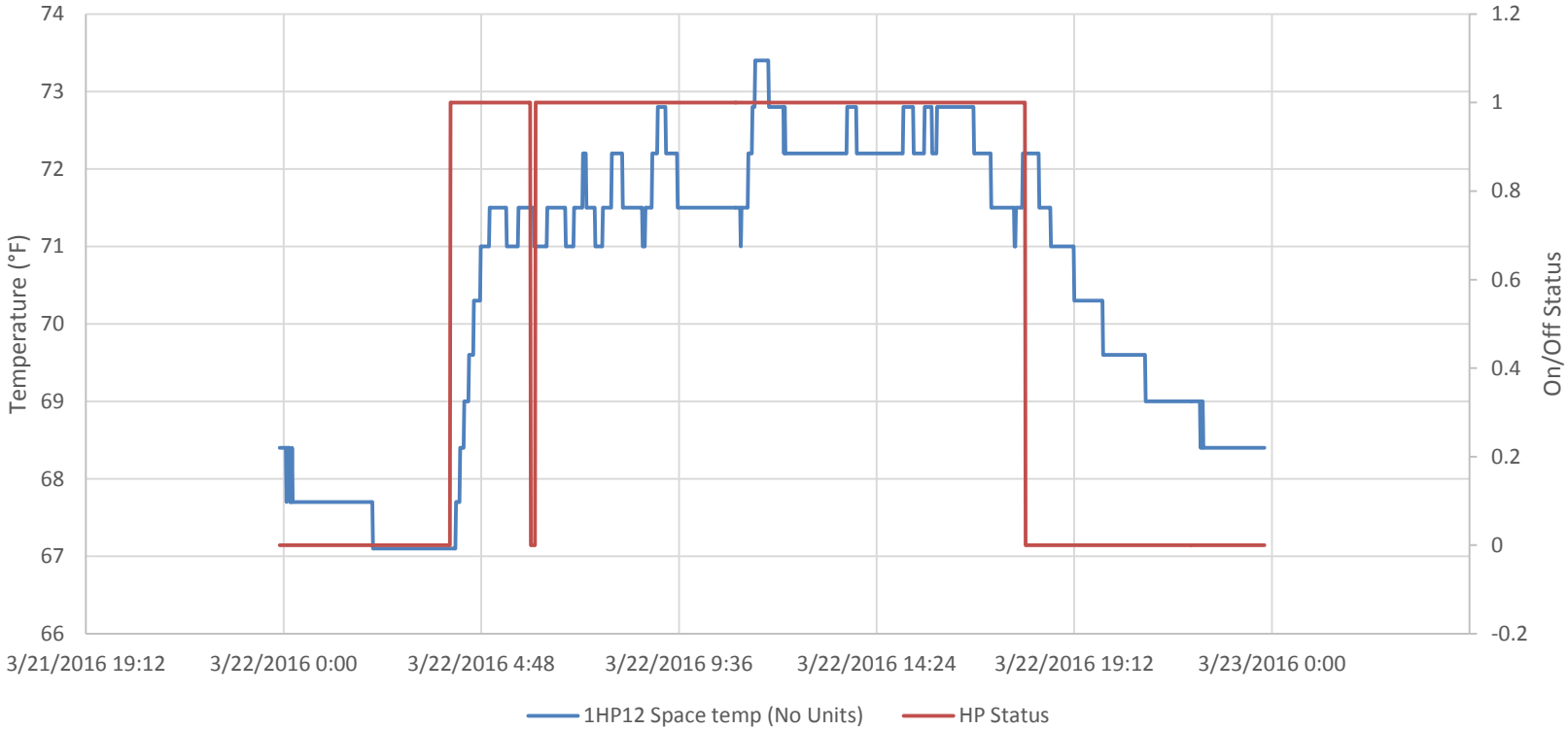
- We rarely agree that a project is done when a contractor or customer says it's done
- Usually when a project is first considered complete, they're missing 10-100% of the anticipated energy savings
- The incremental savings that comes from the final commissioning phase are the most cost effective savings available.



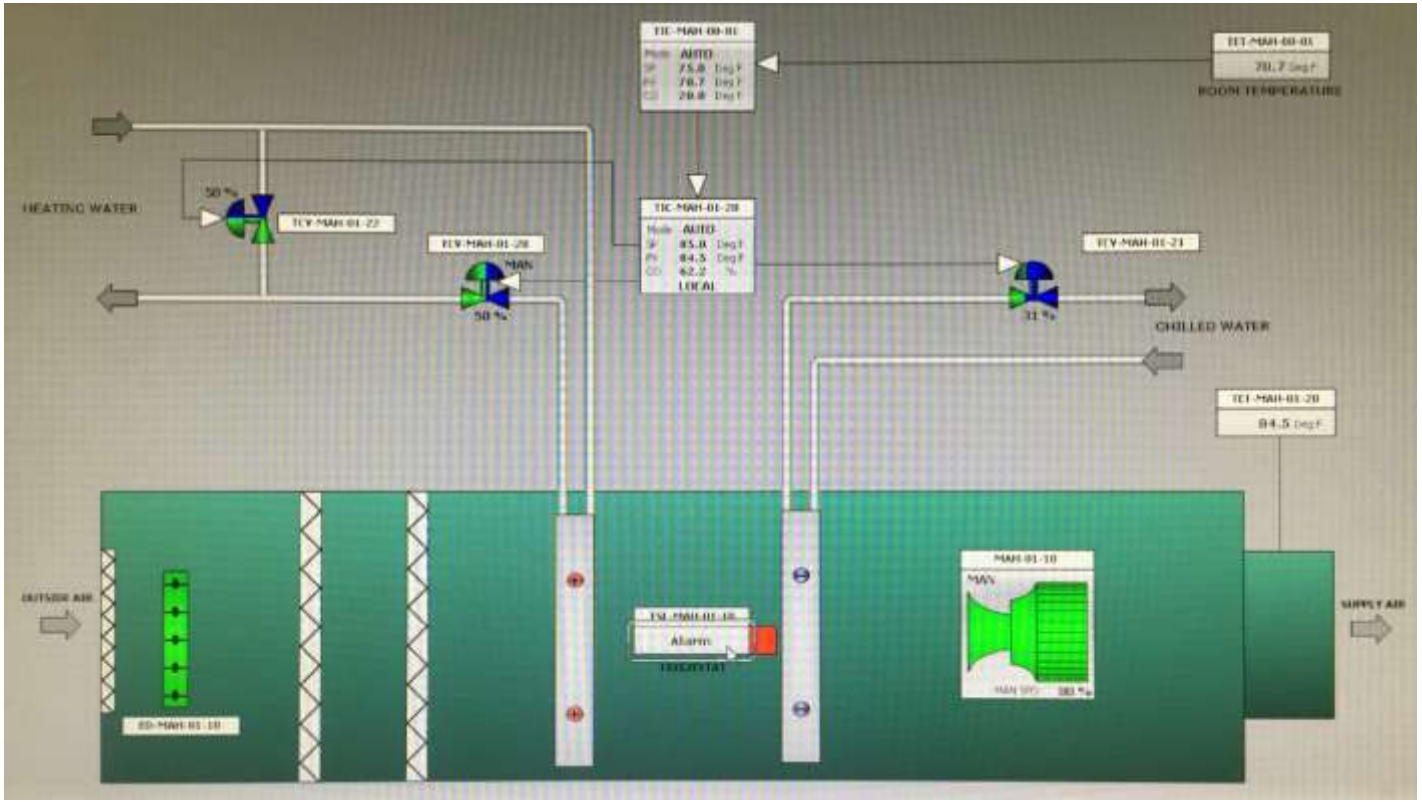
What's Wrong with This?



Scheduling Example Continued



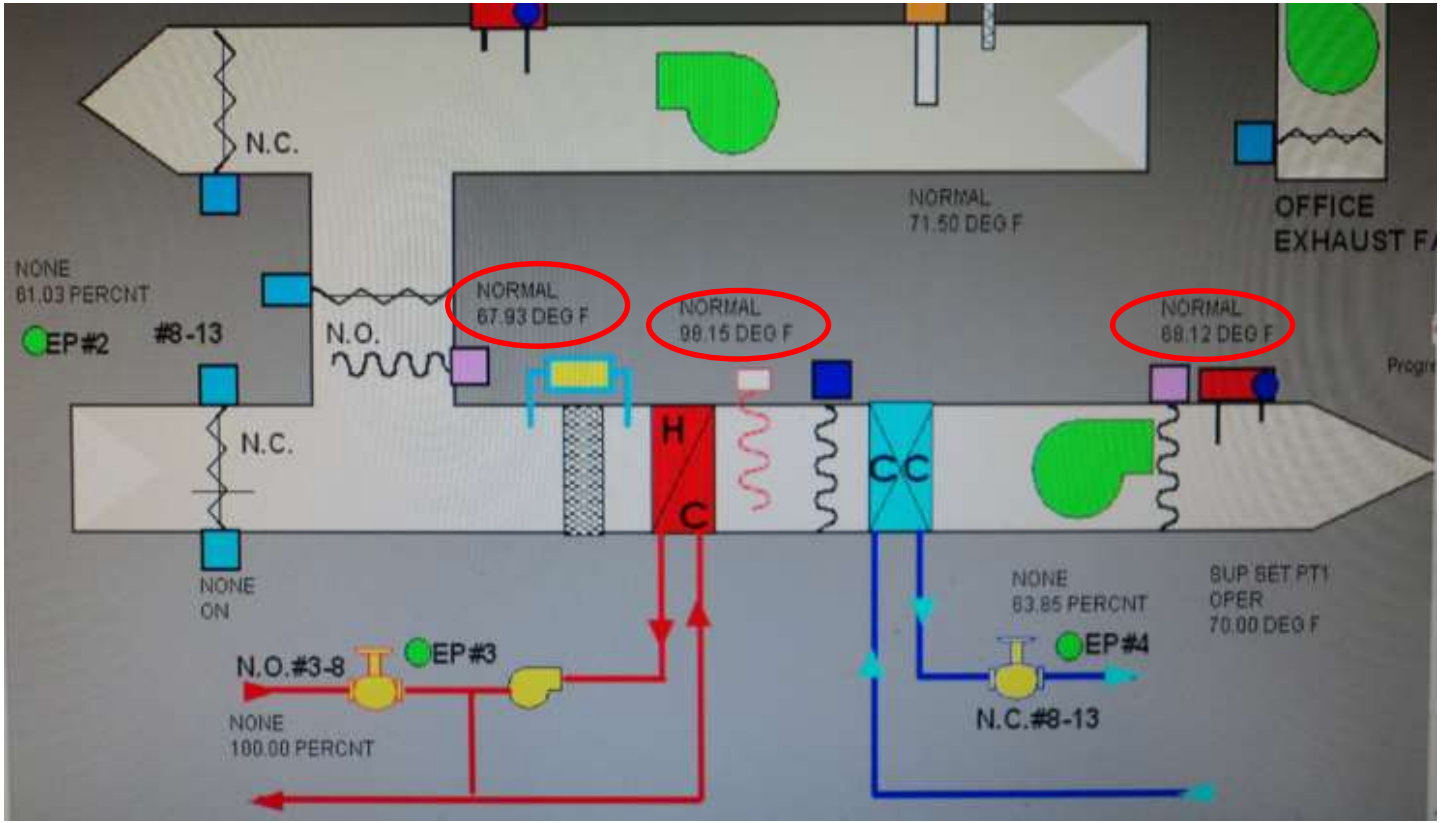
Operator Overrides are Extremely Inefficient



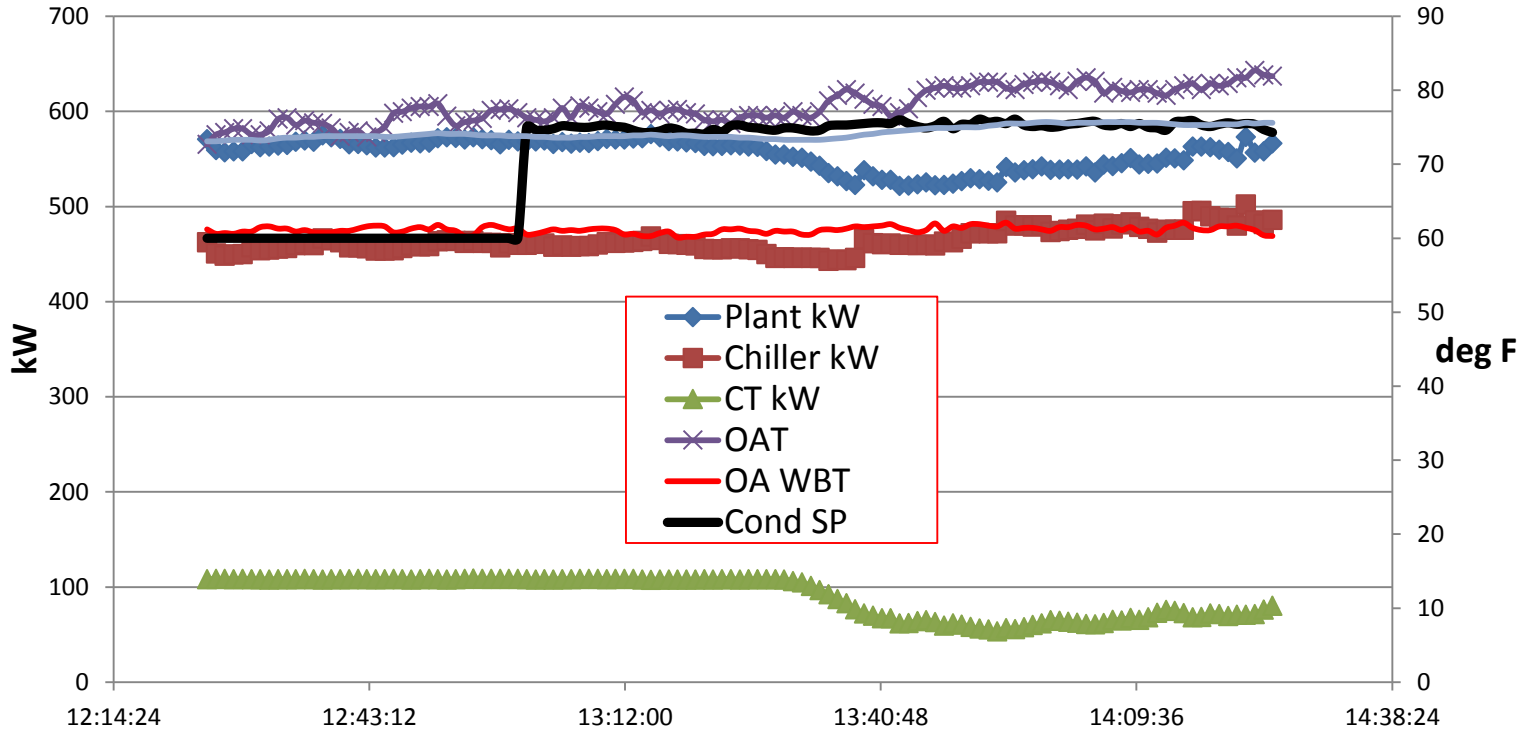
Leaking Valves

- We rarely see leaking valves when looking at them.

Leaking Valves



Central Plant RCx – Wet Bulb Approach Tower Control



What is it and What's Wrong?

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Broken Economizers

- Very common issue in both commercial and industrial facilities.

What is it and What's Wrong?

Broken Belt on Energy Recover Ventilator (ERV)

What is it and What's Wrong?

Refrigerant Condenser Pressure Switch Never Connected

What is it and What's Wrong?

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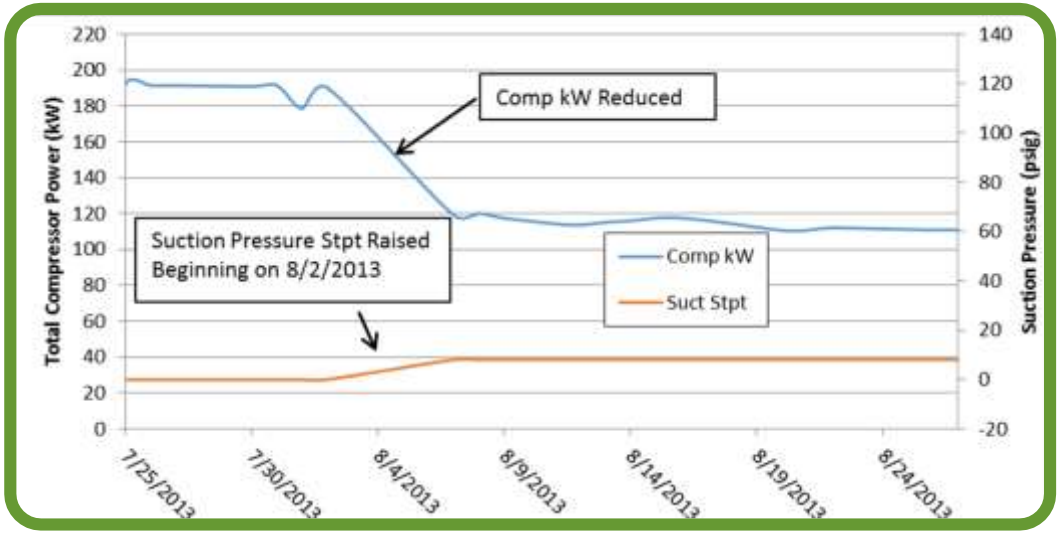


Industrial Refrigeration

- TXV Calibration
- Incrementally Raise Suction Pressure Setpoint
- Compressor Sequencing
- Together, these eliminated the need for a compressor

This was at our verification for newly installed steam traps!

The Tough Reality of RCx

Measures are subtle and tough to identify

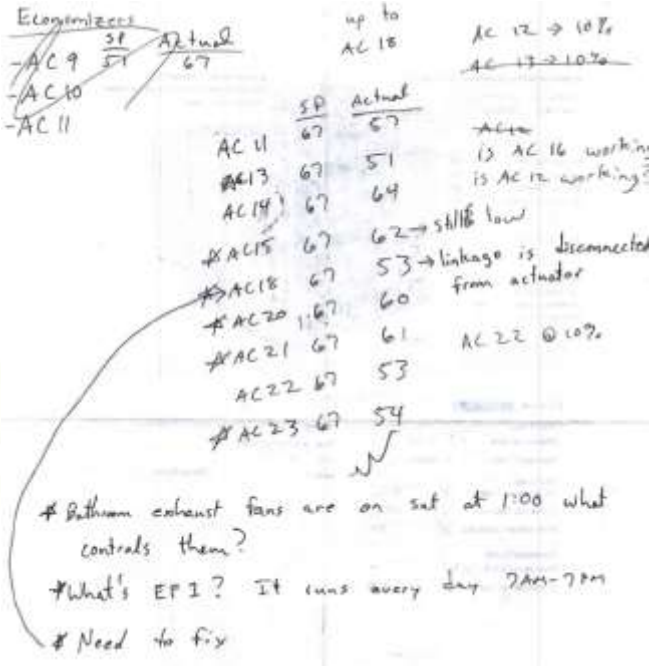
More on 1000 Broadway

- Reduce scheduled occupied times (including exhaust fans)
  - Exhaust Fans run 4:00AM-7:00PM Mon-Fri, 8:00AM-Noon Sat – Should adjust schedule to match AHUs.
  - AHUs run 6:00AM-7:00PM Mon-Fri, 8:00AM-Noon Sat – Can we make this 7AM – 6PM? They actually go into occupied mode at 6:00, but with smart stop, they're coming on at 9:00 at least in this colder weather.
  - Can we shorten the lighting schedule?
- Enable morning warmup
- Command OA Dampers fully closed during morning warmup if OAT<50
- SAT reset
- SP reset
- Fix broken economizers – Suspect economizers include:
  - AC9 – Seems to have very high minimum OA
  - AC10 – Compressor runs in cold weather
  - AC18 – Compressor runs in cold weather
  - AC21 – Compressor runs in cold weather
  - AC23 – Compressor runs in cold weather
- Fix broken VAV dampers
  - VAV 0925 Zone 25
  - VAV 1024 Zone 46
  - VAV 1116 Zone 15
  - VAV 1302 Zone 12
  - VAV 1326 Zone 10
  - VAV 1514 Zone 14
  - VAV 1928 Zone 17
  - VAV 2020 Zone 49
- Is fl 19 zone 23 temperature sensor working right? We're cooling it heavily and it says it's 77.
- Reduce Lobby & Theater OA
- Optimize CW Loop
  - Isolate the cooling tower bypass on the primary condenser water loop.
  - Reduce primary flow through HX – Do this until we get a similar DT on each side of the heat exchanger. We could also just reassure flow on each side and balance primary flow to match secondary. We should leave the primary a little more than the secondary for when the lobby & theater units need cooling.
  - Program CW pumps to sequence up and down. I think there's plenty of time when we only need one of those.
  - Reduce primary CW DP setpoint from 17 PSI to ???
  - Program the secondary pumps to lead with the good one and bring the other one on once a week for an hour to exercise it. Also make sure it's programmed so that if the lead fails, the other comes on as a backup.
- Look to Reduce Lighting Schedule – RR and hall lights run 6AM-midnight and from midnight-2AM
- AC 18 economizer linkage needs to be connected to the actuator.
- What controls BR exhaust fans? They were running at 1:00 PM on Saturday.
- What's EF-1? It runs every day from 7AM-7PM.

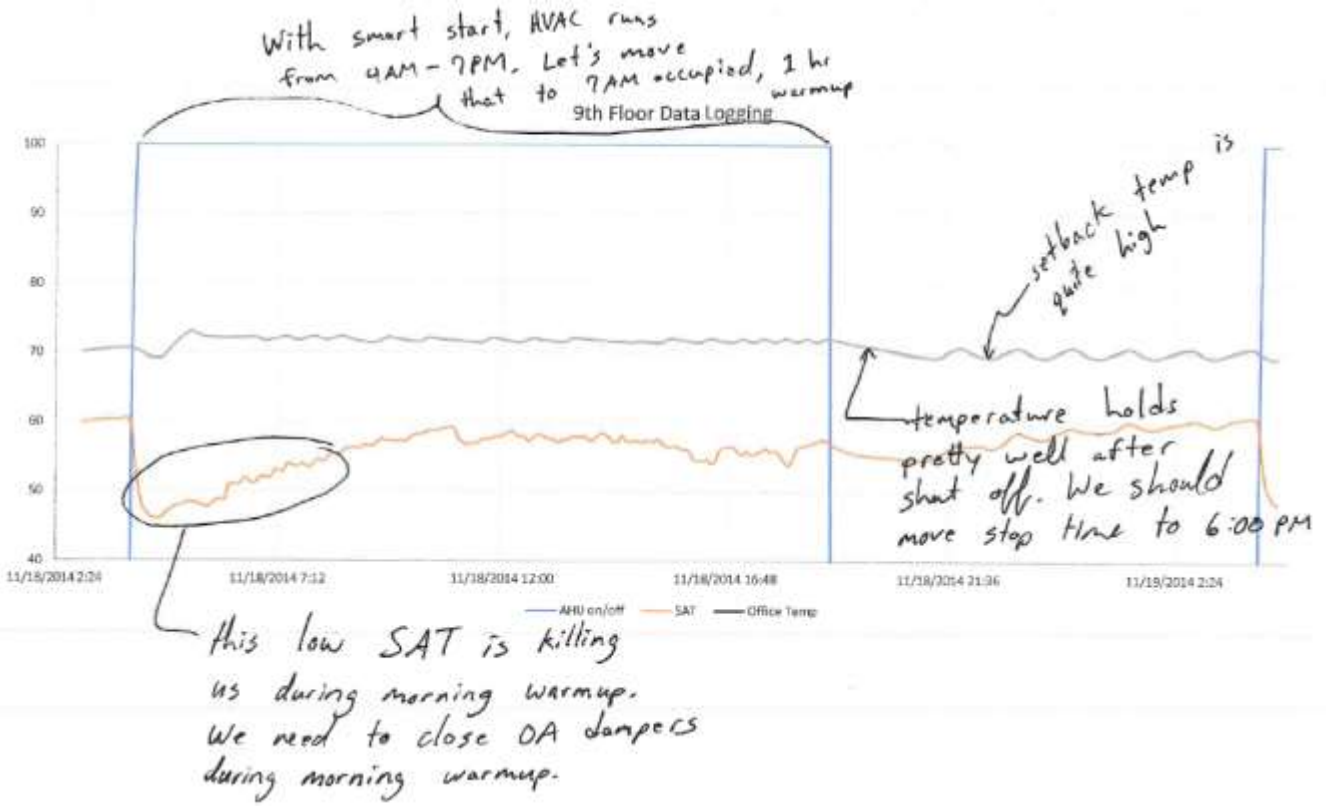
We should do a lighting sweep at 8:00 PM then bring the hallway lights back on.

They don't clean Fri & we can shut lighting off at

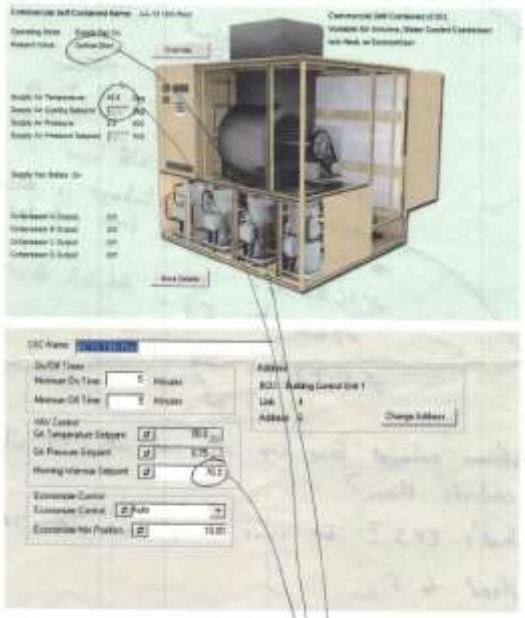
- I reprogrammed the min cfm to 60.
- why does the air valve not close more?
- why does the air valve state cooling mode, yet fan & heat are on?

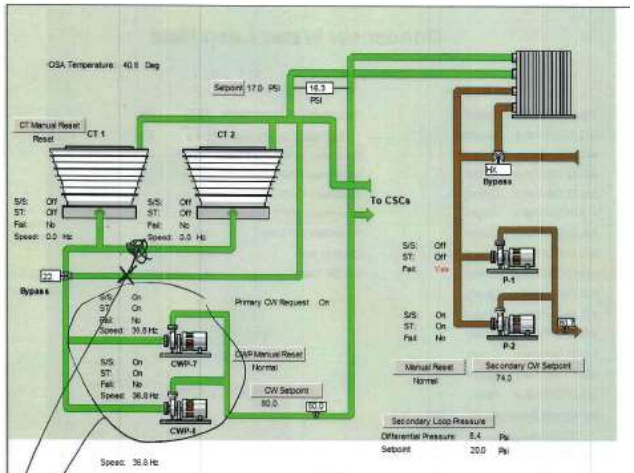


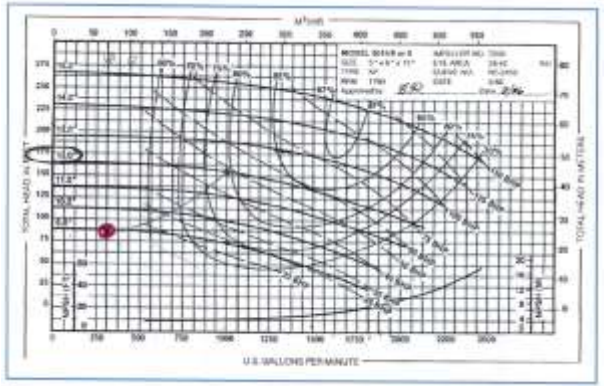
More on 1000 Broadway



More on 1000 Broadway







Conditions of Service			Motor Data		
Pump	Temp.	Suct. Press.	HP	Voltage	Eff.
I.D.H.	Sp. Gr.	Dis. Press.	RPM 1750	Phase	S.F.
Fluid	Visc.	Diff. Press.	Encl.	Hz.	

GPM	HEAD	EFF	BHP
375	54'	68%	10.0
500	104'	58%	21.3
750	125'	71%	37.7
1,000	155'	84%	48.9

VFD's in optimal start mode & programmed for a morning warmup temp of 70. Why ~~are~~ is the SAT SP 55? This is making it hard to warm up the building.

Can we isolate this?

Need to sequence these.
One should suffice most of the time.

Lessons Learned – RCx is a great opportunity – but tough!

- Finding RCx opportunities is tough!
- While most customers are open to RCx, it's too complex for them to undertake themselves.
- If you hand a customer an RCx study and end your engagement there, implementation rates will be low.
- Successful RCx requires a high level of assistance and expertise – To identify opportunities, but also through the implementation & verification phases.
- RCx needs to be Commissioned! – Contractors rarely get it right the first time! The details matter! QC is critical to achieving savings!

Closing Thought – Assume Nothing – Question Everything!

ENERGY 350

Questions?

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