American Energy Assets

BAS, Operational Energy Savings, Building Analytics, and M&V:

OnTrack & Ninja Box

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Introduction

Overview

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- **Apparently, Hospitals will always need Savings**
  - "Stuff vs. Staff"
  - Low-hanging Fruit programs are popular with Consultants, GPOs, etc.
- **Capital programs have 3+ year paybacks, where Operational programs have 3 to 4 month paybacks**
- **Building Automation Systems "BAS" focus on Comfort**
  - Alarms go off when a fan stops or when HVAC can't meet a setpoint or when a Thermostat is out of range.
- **BAS Data is available for Efficiency – Do you have the resources to dedicate toward that effort?**
  - AEA offers this as a service called "OnTrack"
  - Software shops offer Data Analytics platforms for self-performers

What level of Cost Reductions is possible?

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- **Where are they found? 3 or 4 waves**
  - 1st Wave – Air Handling Units
  - 2nd Wave – Chilled Water Systems
  - 3rd Wave – Steam Plants and Heating Equipment
  - 4th Wave – VAVs and other Terminal Boxes
- **What are the downsides? Any impact to patient satisfaction?**
  - No cheap tricks – no changes to space temperature/humidity requirements.
  - Work with groups who specialize in healthcare vs. the "built environment."
- **Are the savings real? How can you measure savings accurately?**
  - Worse Case Scenario: "We saved $200K, but the utility bills went up!"
  - We prefer measuring at the meter, since that's where the bill is generated.
  - Need to factor weather and rate fluctuations into baseline tracking.
- **Are the savings sustainable?**
  - Long-term supervision is a good idea.
  - Modulating components can always fail, and BAS tends to disconnect itself.

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About AEA (and me)

Background

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- Paul Zoby – Mechanical Engineer with background in Construction, Consulting Engineering, and 25 years in Energy Conservation space.
- Denver, Colorado-based, privately-held energy conservation company founded in 2003. Regional presence in Missouri, Ohio, New Jersey, and North Carolina.
- Today 100% of customers are acute care, 501.c.3, tax-exempt hospitals. 90+ hospitals in 20+ states.
- Over 25 years in the healthcare energy conservation space – initially implemented turn-key capital programs, then transitioned to operational savings programs in 2007.
- Vendor neutral – AEA does not manufacture any type of equipment, nor do we represent any product lines.
- Demand side focus – AEA focuses solely on lowering the amount of energy you consume. This is complementary to any other energy initiatives.

BAS Integration

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BAS Systems We've Integrated

- Johnson Controls Metasys
- Trane Tracer & Summit
- Siemens (Staefa, Landis)
- Andover Continuum
- Tridium Niagara N4, AX & R2
- Carrier
- Barber-Coleman
- Honeywell
- Automated Logic
- Computrols
- Allerton
- Others….

NINJABOX
SAVING ENERGY THROUGH SHEER INTIMIDATION

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What We Find

Fault Detection: Valve & Damper Repairs

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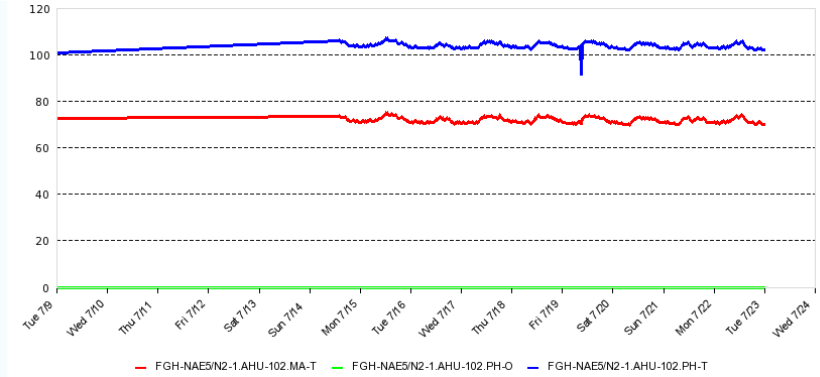
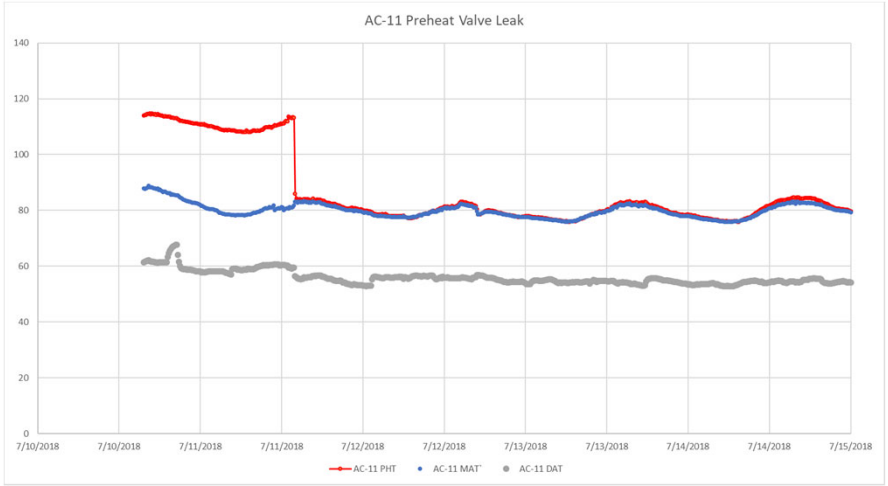
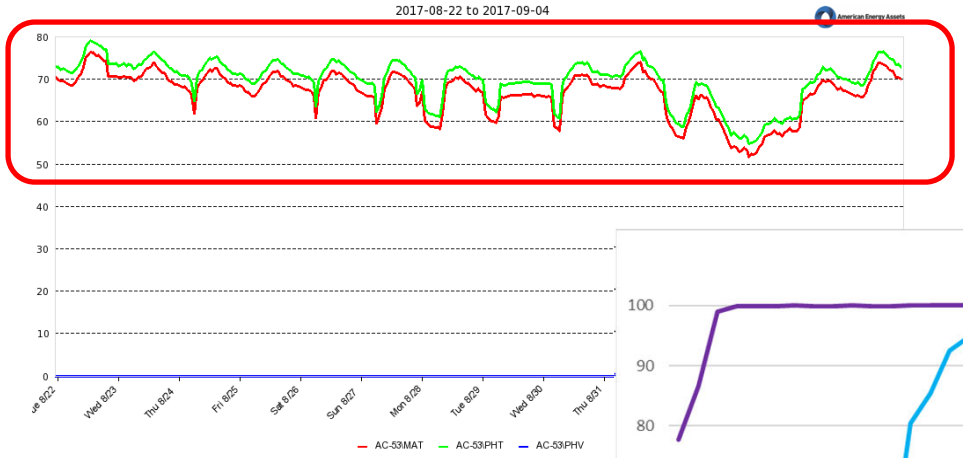
Heating Valve Leak - Valve 100% closed but 24 degree airside rise across coil ~ bad valve or sensor?



Analysis w/o BAS – Not all AHU's are connected to the BAS, so we use Hobo Loggers to uncover opportunities in Pneumatic Controlled AHU's.

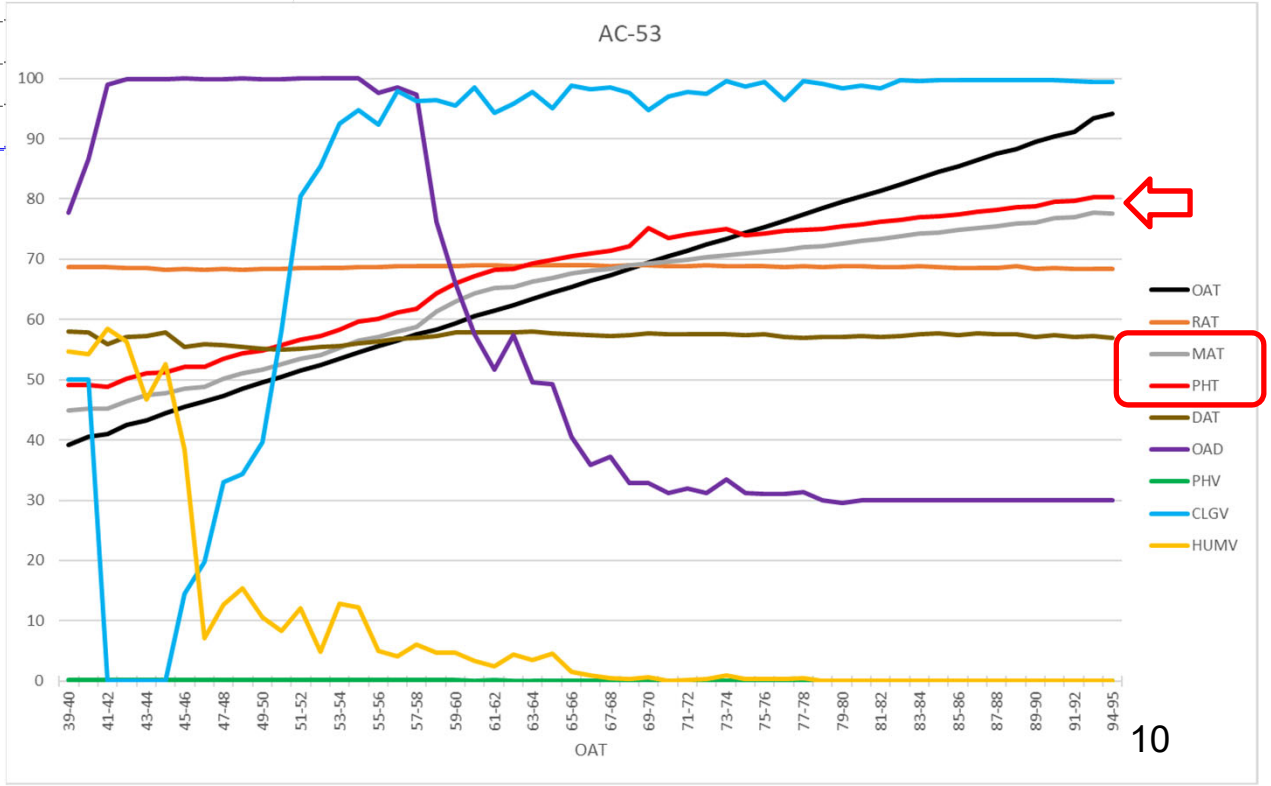


Single AHU Component vs. All AHU Tracking



- Basic Hourly chart of Valve and Coil Temp Data shows Temp rise across coil when PHV is closed.
- More Detailed plot of AC-53 components shows same Delta-T across full OAT operating range.

- Interesting that CLG Valve is more than 95% open above 54 deg. & open when OA Dampers are in Econ mode.



All AHU Comparisons: Economizer Damper Control

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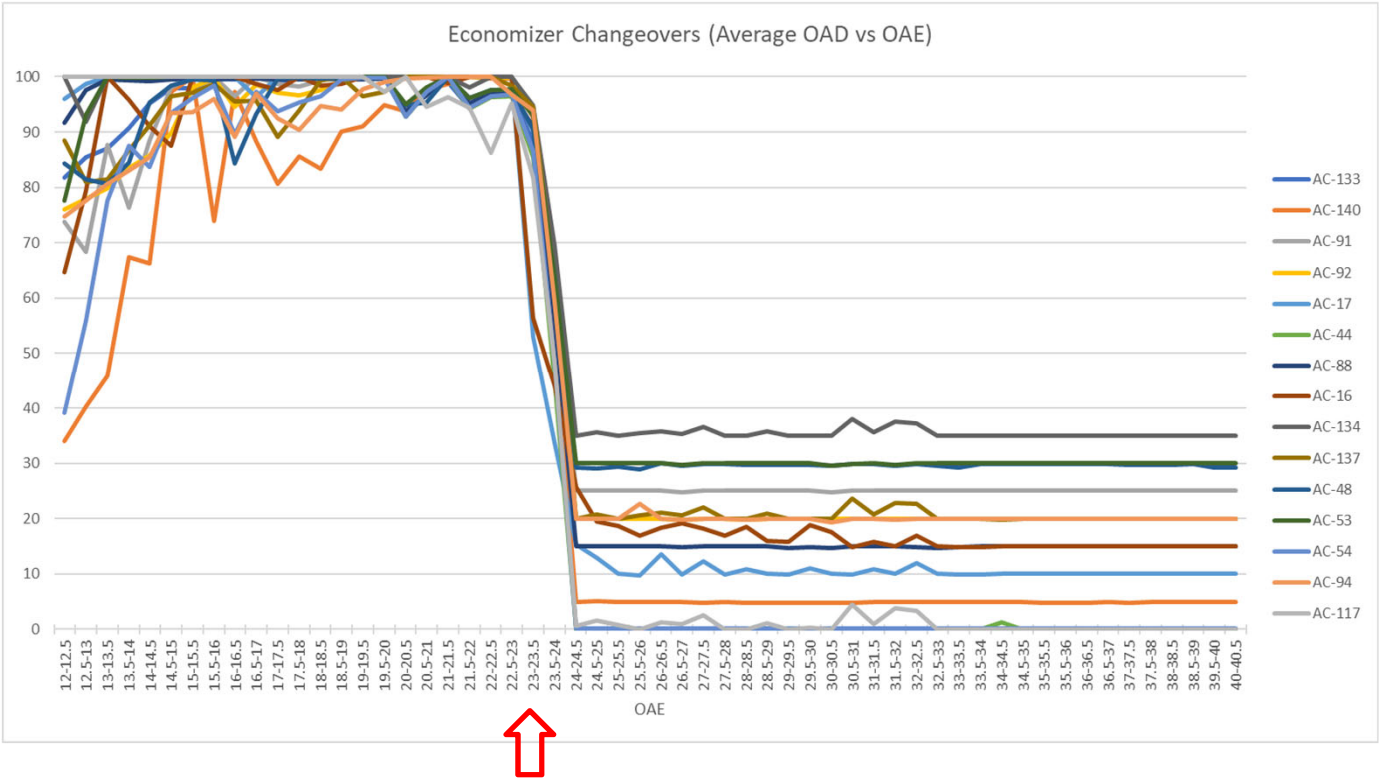
- OA Damper Position in the Vertical Axis.
- OA Enthalpy bins in the Horizontal.
- OAD vs. OAE for 15 AHUs.



- Very clear 23.5 btu/lb Enthalpy transition period
- Using a Global Enthalpy sensor for all control routines.

Psychometric Heat Map

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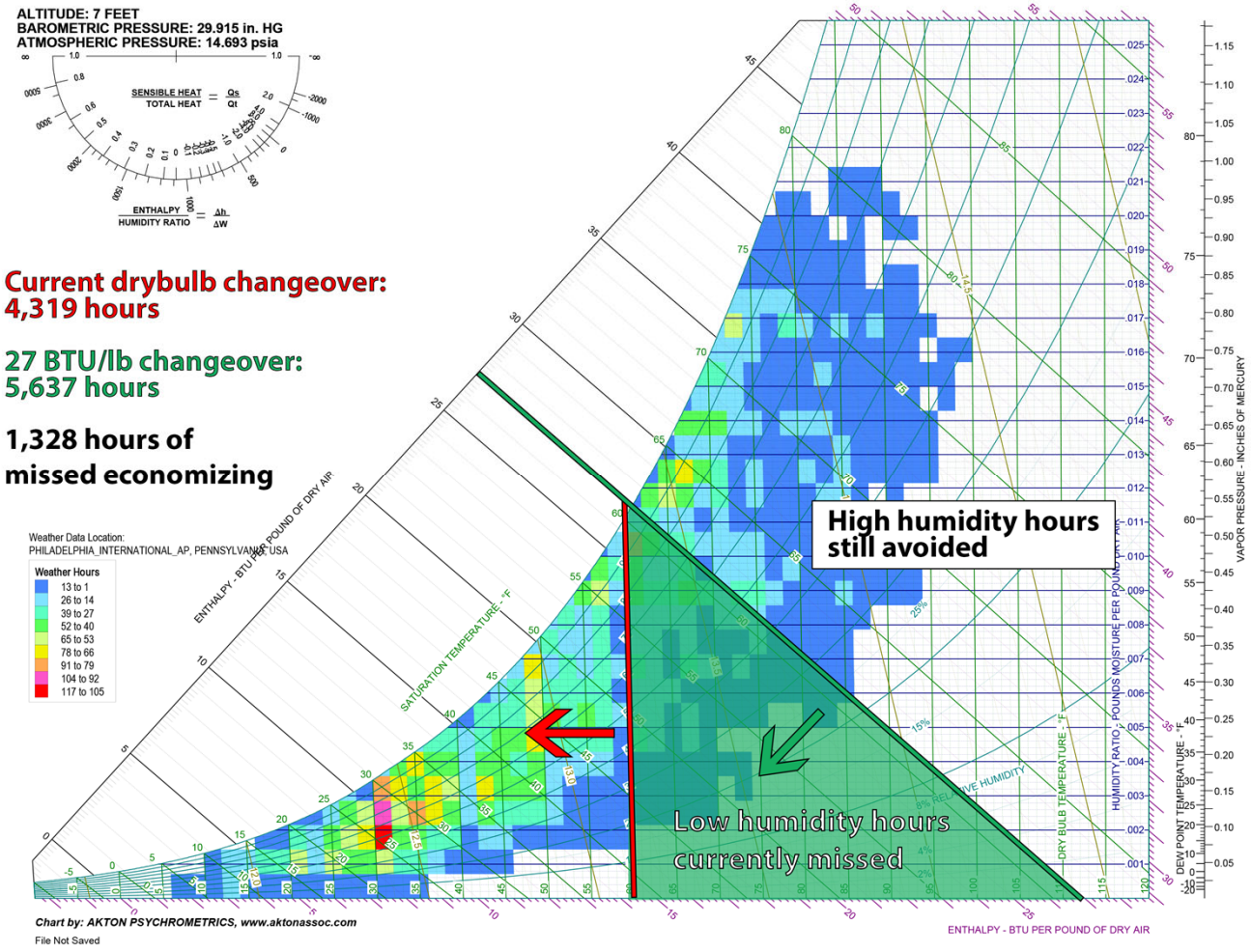

Economizer Opportunity: Changeover Setpoints & $

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Unit Name	BAS	Unit Type	Area Served	Current Changeover	Recommended Drybulb Changeover	Drybulb Savings	Recommended Enthalpy Changeover	Enthalpy Savings
AHU LL	Trane	Mixed Air	Lower Level Quad A & C Subway, Quad C 1st Floor	Assumed 50 F	65 F	$ 6,688.00	27 BTU/lb	$ 7,422.00
AHU-1	Trane	Mixed Air	1st Floor	Assumed 50 F	65 F	$ 6,945.00	27 BTU/lb	$ 7,707.00
AHU-2	Trane	Mixed Air	2nd Floor West Tower	Assumed 50 F	65 F	$ 5,952.00	27 BTU/lb	$ 6,605.00
AHU-3	Trane	Mixed Air	3rd Floor	Assumed 50 F	65 F	$ 6,389.00	27 BTU/lb	$ 7,090.00
AHU-4	Trane	Mixed Air	4th Floor	Assumed 50 F	65 F	$ 7,113.00	27 BTU/lb	$ 7,894.00
AHU-5	Trane	Mixed Air	5th Floor	Assumed 50 F	65 F	$ 5,343.00	27 BTU/lb	$ 5,930.00
AHU-6	Trane	100% OA	6th Floor	N/A	N/A	N/A	N/A	N/A
AHU S/1	Trane	Mixed Air	Quad B 1st Floor Dietary	Assumed 50 F	65 F	$ 6,414.00	27 BTU/lb	$ 7,240.00
AHU S/12	Trane	Mixed Air	Quad B 3rd, 4th, 5th & 6th	Assumed 50 F	65 F	$ 6,207.00	27 BTU/lb	$ 7,040.00
AHU S/13	Trane	Mixed Air	Quad A 3rd, 4th, 5th & 6th	Assumed 50 F	65 F	$ 4,537.00	27 BTU/lb	$ 5,151.00
AHU S/14	Trane	Mixed Air	Quad C 5th & 6th	Assumed 50 F	65 F	$ 4,588.00	27 BTU/lb	$ 5,229.00
AHU S/15	Trane	Mixed Air	Quad D 4th, 5th & 6th	Assumed 50 F	65 F	$ 5,650.00	27 BTU/lb	$ 6,408.00
AHU S/23	Trane	Mixed Air	OR Suites 19, 20, 7, 11	Assumed 50 F	55 F	$ 573.00	24 BTU/lb	$ 1,418.00
AHU S/24	Trane	Mixed Air	Dietary/Cafeteria?	50 F	65 F	$ 2,224.00	27 BTU/lb	$ 2,496.00
AHU S/26	Trane	Mixed Air	Not sure if still in use	N/A	N/A	N/A	N/A	N/A
AHU S-1	JCI	Mixed Air	Quad B 1st Floor (Dietary)	50 F	65 F	$ 1,281.00	27 BTU/lb	$ 1,420.00
AHU S-2	JCI	Mixed Air	Quad C & D Subway (General)	Assumed 50 F	65 F	$ 4,530.00	27 BTU/lb	$ 5,028.00
AHU S-3	JCI	Mixed Air	Quad A Subway, Scan Room, X-Ray 2nd Floor (Radiology)	Assumed 50 F	55 F	$ 1,105.00	24 BTU/lb	$ 2,402.00
AHU S-4	JCI	Mixed Air	Quad A & C Subway Quad C 1st Floor	Assumed 50 F	65 F	$ 3,228.00	27 BTU/lb	$ 3,586.00
AHU S-5	JCI	Mixed Air	Quad D 1st Floor Emergency Room	Assumed 50 F	65 F	$ 911.00	27 BTU/lb	$ 1,018.00
AHU S-6	JCI	Mixed Air	Quad A & C 1st Floor Computer Room	Assumed 50 F	65 F	$ 6,580.00	27 BTU/lb	$ 7,304.00
AHU S-7	JCI	100% OA	Quad B 2nd Floor	N/A	N/A	N/A	N/A	N/A
AHU S-8	JCI	Mixed Air	Quad C & D 2nd Floor Surgery Heart Cath	Assumed 50 F	55 F	$ 2,702.00	24 BTU/lb	$ 5,516.00
AHU S-9	JCI	Mixed Air	Central Cores 2nd, 3rd & 4th, 5th & 6th	Assumed 50 F	65 F	$ 1,430.00	27 BTU/lb	$ 1,627.00
AHU S-10	JCI	Mixed Air	Quad C 4th Floor Labour and Delivery	Assumed 50 F	55 F	$ 529.00	24 BTU/lb	$ 1,144.00
AHU S-11	JCI	Mixed Air	Quad C & D 3rd Floor ICU, CCU, Burn Unit	Assumed 50 F	55 F	$ 1,272.00	24 BTU/lb	$ 2,762.00
AHU S-16	JCI	Mixed Air	Sub-Basement Mechanical Room	Assumed 50 F	65 F	$ 1,365.00	27 BTU/lb	$ 1,544.00
AHU S-17	JCI	Mixed Air	Radiation Therapy	Assumed 50 F	55 F	$ 684.00	24 BTU/lb	$ 1,363.00
AHU S-18	JCI	Mixed Air	Dietary Addition	Assumed 50 F	65 F	$ 3,196.00	27 BTU/lb	$ 3,568.00
AHU S-19	JCI	Make Up Air Unit	Kitchen MAU	N/A	N/A	N/A	N/A	N/A
AHU S-20	JCI	Believe FCU	1st Floor Lobby	N/A	N/A	N/A	N/A	N/A
AHU S-21	JCI	Mixed Air	CCU	Assumed 50 F	55 F	$ 814.00	24 BTU/lb	$ 1,814.00
AHU S-22	JCI	100% OA	New Laboratory	N/A	N/A	N/A	N/A	N/A
AHU-1 (NCE 2)	JCI	Mixed Air	Control Room	Unclear if can econ.	N/A	N/A	N/A	N/A
AHU-2 (NCE 2)	JCI	Believe FCU	Switch Gear Room	N/A	N/A	N/A	N/A	N/A
					Total:	**$98,250.00**	**Total:**	**$ 117,726.00**

*Critical units are shown in blue

Central Plant Performance

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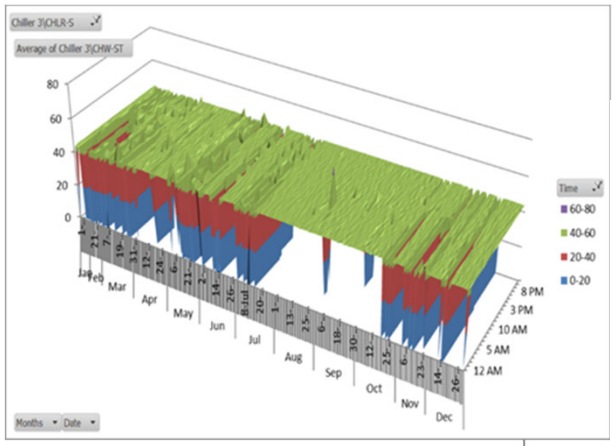
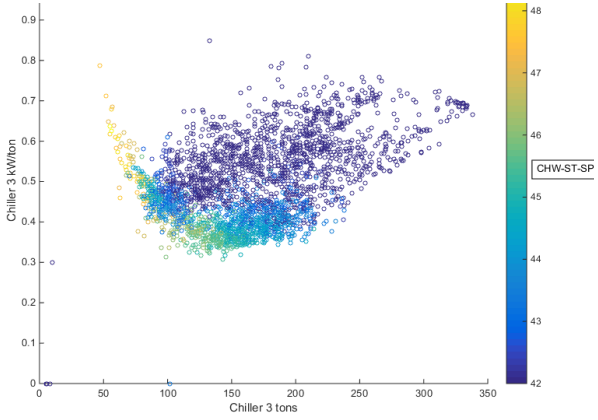
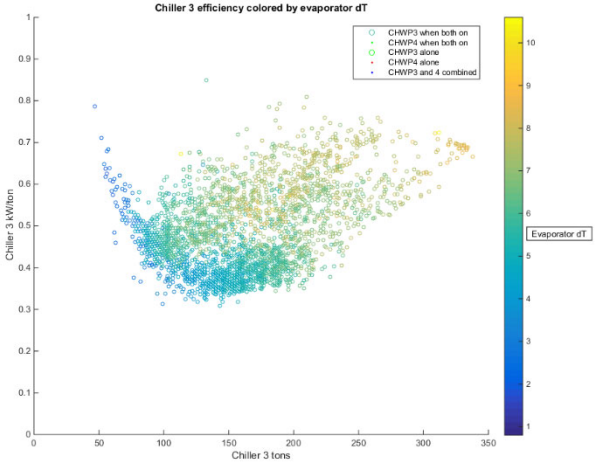


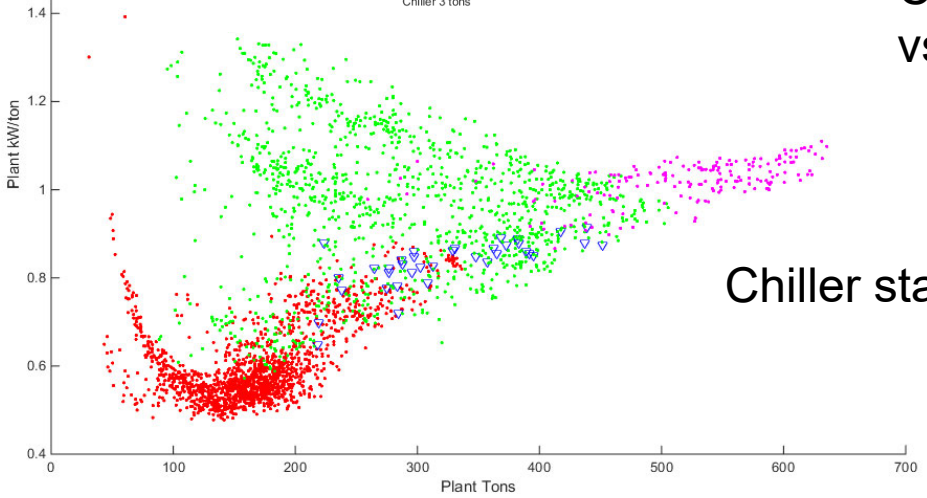
CHW-SP – Reset?

Chiller Efficiency vs. CHW Supply Temp Setpoint





Chiller Efficiency vs. CHW delta-T



Chiller staging vs. Efficiency

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How We Measure Savings

Weather-Adjusted Baselines

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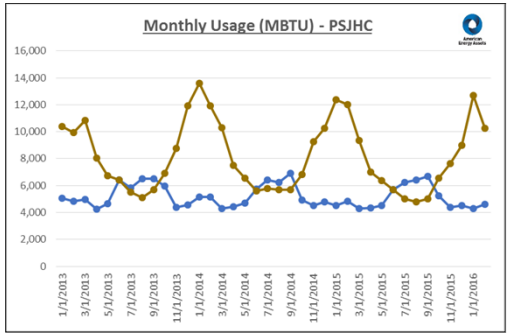
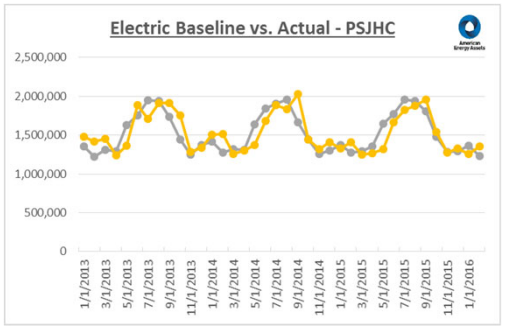
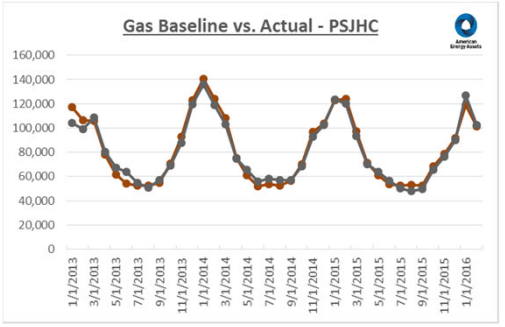
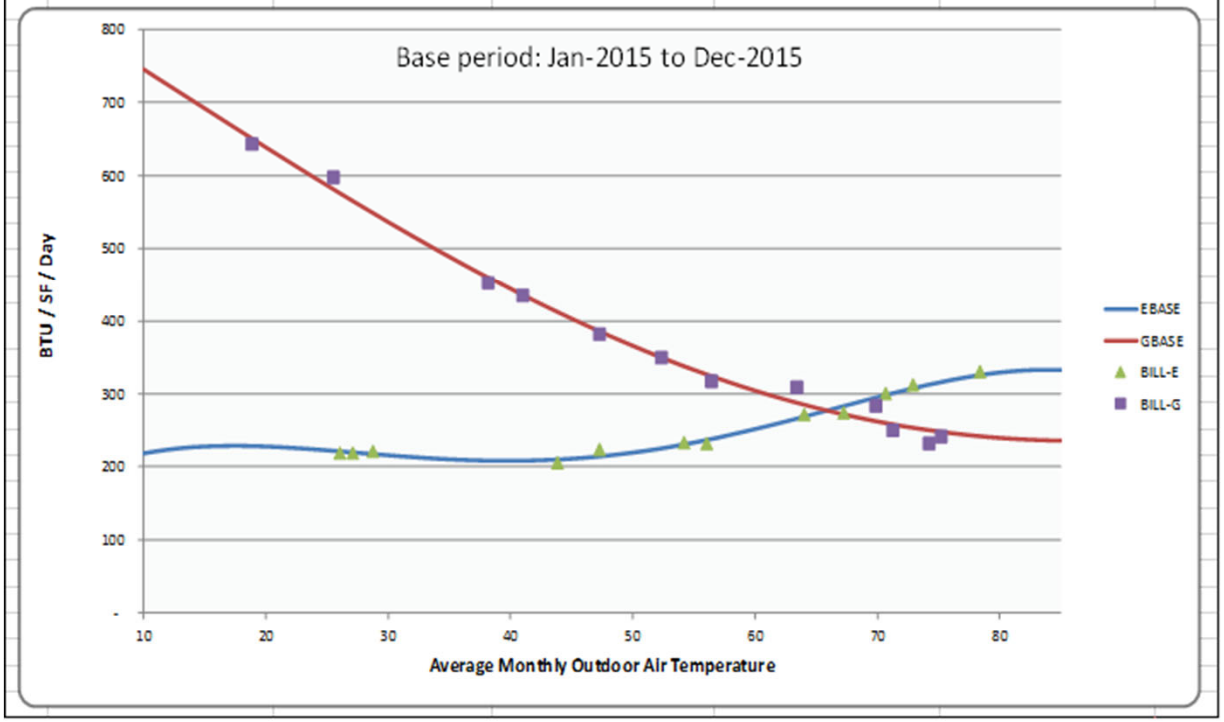






Presence St. Joseph Chicago - Baseline Formulas

	m1	m2	m3	m4	b	
exp:	1	2	3	4	0	R2
E	3.34698695905160E-03	-1.58652479524192E-04	2.72341974590841E-06	-1.45031410039942E-08	4.38840552594240E-02	0.99
G	-1.01531585420899E-04	-4.64633558828698E-07	1.34718443692082E-08	-4.64852458954916E-11	8.50125878577398E-03	0.99



BOB – Savings Determination

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Compare year over year actual costs & factor in weather and rate effects.

Energy Savings

Select date range for savings analysis:

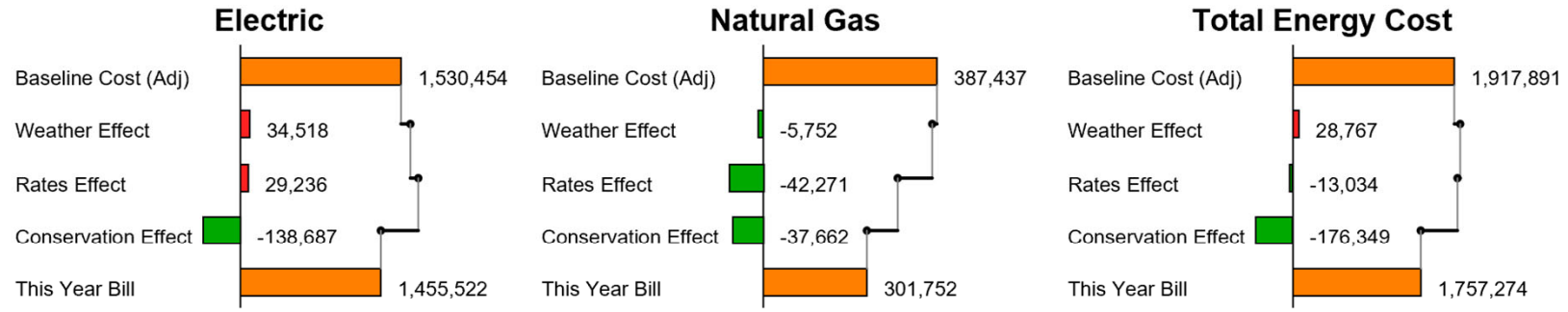
From: Feb 2016

To: Jan 2017

Compare Against: (•) Baseline Year ( ) Previous Year

Show Completed Project Savings? ☐

AEA Savings analysis (comparing baseline year) for the period 2/1/16 to 1/31/17



Utility	T-0	T-1	CPU-0	CPU-1	Baseline Cost (Adj)	+ Weather Effect	+ Rates Effect	- This Year Bill	Usage Savings
Electric			0.089	0.092	$1,530,454	$34,518	$29,236	$1,455,522	$138,687
Natural Gas			0.574	0.504	$387,437	($5,752)	($42,271)	$301,752	$37,662
Total:					$1,917,891	$28,767	($13,034)	$1,757,274	$176,349

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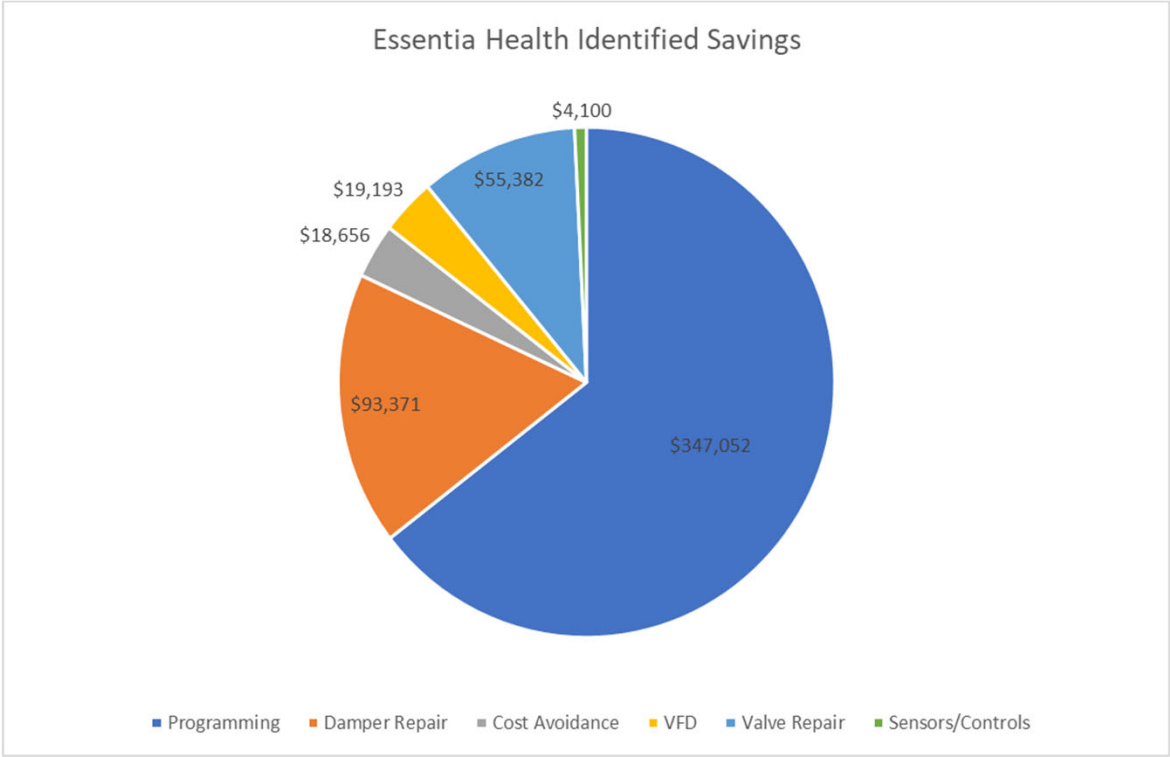
How Did We Perform with Essentia?

Performance Example

We achieved $417,638 in Utility Savings at these Essentia locations:

- Detroit Lakes, Duluth, Fargo, & Brainerd Hospitals
- Virginia, Ada, Fosston, Deer River, Northern Pines, & South University Clinic



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Thank You