Next Generation Learning Organization:
Facing the "Perfect Storm" and the "New Norm"

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Session Learning Objectives:

1. How the perfect storm that aligns challenges on the campus side with facilities management side challenges is driving the need to assess and align facilities with academic programming priorities – and how to facilitate that (based on a successful case study example)

2. Learn about data-based financial and performance visualization and the benefits it can provide

3. Discover how to use data analytics for improved building performance and bridging the gaps of current staff skill-sets with the effective operation of complex building systems

4. Hear how effective interpretation of building data analytics allow for an enhanced training and staffing model

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Polling app test question

Yes, I'm in.

No, I'm not.

Start the presentation to use live content. Still no live content? Install the app or get help at **PollEv.com/app**

Washburn University Campus

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"Perfect Storm" and the "New Norm"

- Chronic funding, staffing, skill-set, and facility support challenges with no end in sight*

- Sea change well underway with IoT, cloud based computing, data analytics, AI and more complex facility systems*

- Washburn University: Next-Generation Learning Organization

Are we here?

* sightlines APPA UB University Business NACUBO NAVIGANT RESEARCH Gartner

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Industry Insight into the "Perfect Storm"

- Aging/retiring workforce – public & private
- Aging building stock
- Aging energy grid
- Strategic focus on energy efficiency
- IoT, cloud computing, AI, data analytics
- Digital tools, advanced sensors, smart equipment, and new service paradigms
- Ever-advancing technology & skills gap

We are here...

NC3 Trane Centers of Excellence

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Progression of the Washburn / Trane Partnership

Climate & Energy Control Technology Labs

Students are learning from industry-trained instructors in new state-of-the-art labs and

2017 – Next-Generation Learning Organization with Data Analytics & Intelligent Services (IS)
- Analytics demonstration with campus data
- Proof-of-concept pilot
- Sept. 2017 – Washburn/Trane session at 2017 CAPPA

2018
- Data Analytics / IS Program with highest priorities buildings
- Developing true partnerships with mutually-shared priorities, processes and successes
- Washburn/Trane session at 2018 APPA

2013 – Washburn/Trane/ NC3 Training Partnership
- Climate & Energy Control Technologies lab
- BAS Industry-recognized Certifications
2014 – Washburn/Trane session at 2014 APPA

2013 – $12.3M Campus Energy Saving Project
- Major HVAC upgrades in 5 buildings
- Lighting, envelop, other ECMs in 13 buildings
- Initiated Standards of Comfort & tightened schedules
- Began to collaborate on mutually-shared priorities

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Washburn University Facilities Services Priorities

The Facilities Services mission is to support and extend Washburn University's focus of excellence in teaching and the effective delivery of quality academic programs. This mission is accomplished through the exceptional delivery of facilities services in a timely and cost effective manner along with great customer service.
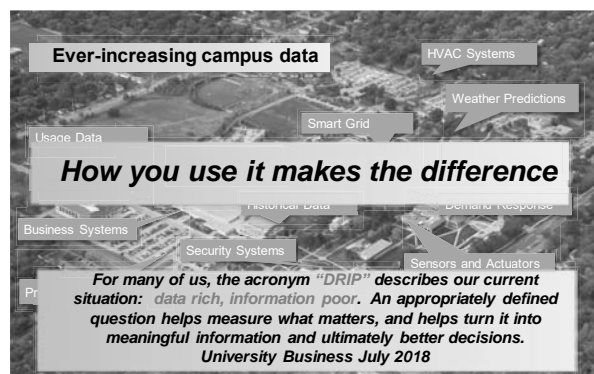
Key Performance Indicators (KPIs)

- Equipment is working properly
  - Equipment is monitored daily and repairs are made expediently by facilities technicians and contractors.
- Equipment is maintained for longevity
  - Equipment is given proper preventative maintenance and decisions are made for longevity of equipment.
- Positive customer impact
  - Customer comfort and customer satisfaction.
- Maintain good communication and relationships with stakeholders.
  - We are aware of anomalies in a timely fashion.
  - We respect our contractors and partners and rely on their expertise.
- Energy efficiency
  - Equipment programming, scheduling and unoccupied setbacks are used to maximize efficiency.
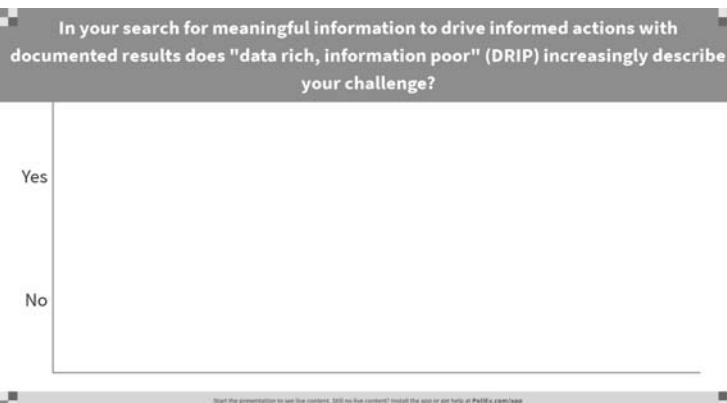
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End-use Cost of Energy

- National averages for the cost of electricity remained **relatively stable** during 2009-2016

- **Utility bills for end users, however tell a different story.** As described in section 2.8.3, utility pricing schemes such as time-of-use and **peak demand can add significantly** to the cost of energy for all.

- Year-over-year utility bill increases have driven **building owners** and operators to **search for solutions** that suit the needs of their size of business, building or portfolio of buildings

NAVIGANT
RESEARCH REPORT

Energy Efficient Buildings Global Outlook
HVAC, Lighting, Building Envelope, Building Controls, Water Efficiency, Water Heating, and Commissioning and Installation Services; Global Market Analysis and Forecasts

Published 3Q 2017

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Ever-increasing campus data

HVAC Systems
Weather Predictions
Smart Grid
Usage Data
Historical Data
Demand Response
Business Systems
Security Systems
Sensors and Actuators

How you use it makes the difference

For many of us, the acronym "DRIP" describes our current situation: data rich, information poor. An appropriately defined question helps measure what matters, and helps turn it into meaningful information and ultimately better decisions.
University Business July 2018
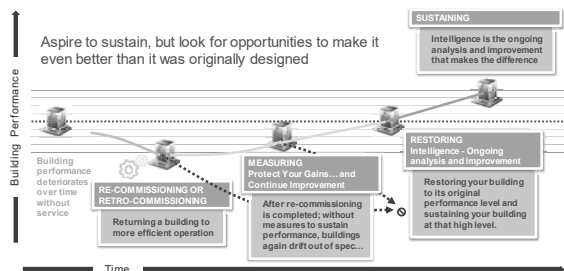
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Successful Policies and Practices

- Maximize investment return by:
  - Investing with space utilization in mind
  - Connecting renewal to modernization
  - Investing to reduce current costs

- Organize strategically to optimize service effectiveness and operating efficiency
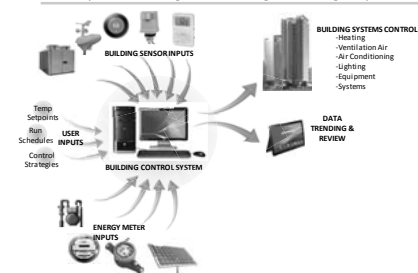
Every campus we see successfully tackling these challenges analyzes their data and utilizes comparative metrics to track performance, communicate accomplishments, and articulate needs to the community or leadership.
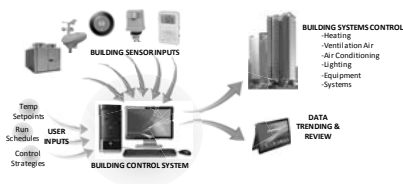
sightlines

State of Facilities
in Higher Education
2017 BENCHMARKS, BEST PRACTICES & TRENDS

Space — Get the most from your biggest asset
Capital — Investment planning to align mission and risk
Operations — Improve effectiveness and lower overhead

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In your search for meaningful information to drive informed actions with documented results does "data rich, information poor" (DRIP) increasingly describe your challenge?

Yes

No

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Why Data Analytics & Intelligent Services?

Aspire to sustain, but look for opportunities to make it even better than it was originally designed

SUSTAINING
Intelligence is the ongoing analysis and improvement that makes the difference

RESTORING
Intelligence - Ongoing analysis and improvement

Restoring your building to its original performance level and sustaining your building at that high level.

MEASURING
Protect Your Gains… and Continue Improvement

After re-commissioning is completed; without measures to sustain performance, buildings again drift out of spec…

RE-COMMISSIONING OR RETRO-COMMISSIONING

Returning a building to more efficient operation

Building performance deteriorates over time without service

Building Performance

Time

Optimized Digital Buildings – Going Beyond

Traditional Building Operation & Control

Optimized Digital Buildings – Going Beyond
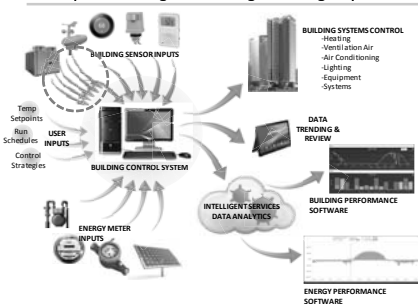
Data Analytics & Intelligent Services (IS)

DATA ANALYTICS-DRIVEN MANAGEMENT SYSTEMS

Turning building data into an action plan
- Subscription-based IS partnership program
- Identify actionable insights that impact KPIs
- Continuous commissioning
- Reduce energy use and operating costs
- Document results with data analytics

| Energy Optics Assessment	Active Monitoring	Building Performance (BP)	Energy Performance (EP)
Identifies how your building uses energy and **transforms that data into meaningful, clear information, to help you identify and monetize impactful energy projects for sustained results**	Provides 24/7 support and continuous monitoring, to proactively detect issues, quickly resolve problems or initiate action, and keep critical building systems up and running	Continuously analyze data to see what's happening in your building, **providing proactive, data-driven insights and solutions** to keep your building running optimally	Uncovers energy waste in every corner of your building and **aggregates energy data using powerful visualizations and analytics, to bring clarity, identify hidden savings opportunities and document results.**

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Making the case for Data Analytics @ Washburn

- Data Analytics demonstration with existing data from campus buildings
  - Washburn Art Building, Memorial Union

- Proof-of-concept pilot phase with 3 buildings
  - Develop roles/responsibilities/collaboration/cadence/reports/actions
  - Make the business case for program, e.g. KPIs & ROI

- Data Analytics / Intelligent Service (IS) program with 8 highest priority buildings first

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How would you describe your familiarity with data analytics?

- Neophyte
- Exploring
- Pilot underway
- Program underway

Start the presentation to see live content. 360 no live content? Install the app or get help at PollEv.com/app

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Analytics demonstration – Washburn Art Bldg.

12 annual utility data points to 35,000 data points with analytics

Energy Optics Assessment — Identifies how your building uses energy and transforms that data into meaningful, clear information, to help you identify and monetize impactful energy projects for sustained results
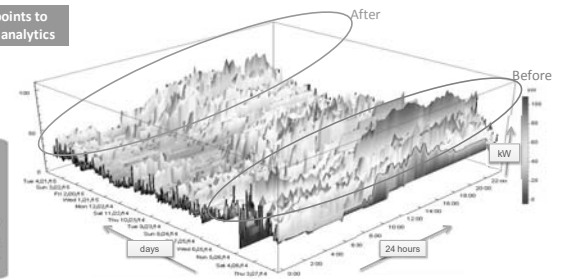
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Analytics demonstration – Washburn Art Bldg.
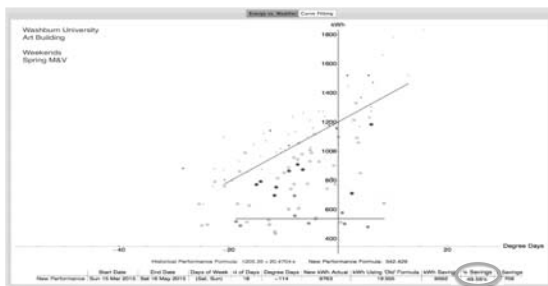
Highlights from June 2018 Data Analytics Report

- Chiller cycling and scheduling/occupancy error
  - Garvey, Henderson, Memorial Union & Petro
- OA temperature sensor accuracy
- Energy Performance analysis
  - Garvey and Petro

Washburn University Data Analytics / IS Program

	Month 1		Month 2		Month 3		Month 4	
	Performance Assessment	Digital Inspection	Performance Assessment	Digital Inspection	Performance Assessment	Digital Inspection	Performance Assessment	Digital Inspection
Buildings								
Garvey	BP/EP						BP/EP	
Lincoln	BP/EP				BP/EP		BP/EP	
Mabee		BP/EP	BP/EP				BB/EP	
Memorial Union		BP/EP	BP/EP				BP/EP	
Petro		BP/EP			BP/EP		BP/EP	
Henderson		BP/EP	BP/EP	BP/EP			BP/EP	
Morgan		BP/EP			BP/EP		BP/EP	
Stoffer Science	EP		EP		EP		EP	
Technical Support								
Remote Support Time (Hrs)	8		8		8		8	
OnSite Support Time (Hrs) *as needed	0		0		0		0	
Coaching/Analysis Meeting	1		1		1		1	
Analytics Subscriptions								
Building Performance (BP)	Y		Y		Y		Y	
Energy Performance (EP)	Y		Y		Y		Y	

Cadence of analytics repeats every 4 months

Monthly Coaching/Analysis Meeting
- Review analytics & reports
- Master Issues Log review
- Document results
- Training

Technical Support – remote & onsite
- Master Issues Log actions

Building Performance (BP)
Continuously analyzes data to see what's happening in your building, providing proactive, data-driven insights and solutions to keep your building running optimally
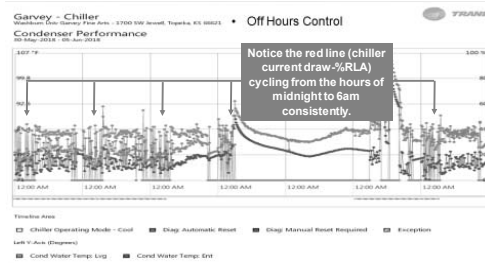
Energy Performance (EP)
Uncovers energy waste in every corner of your building and aggregates energy data using powerful visualizations and analytics, to bring clarity, identify hidden savings opportunities, and document results

Cycling Chillers

Figure A-1 – Garvey Fine Arts – Chiller Performance Analytics (1 week view)

Cycling Chillers
(Cont.)

Figure A-2 is a 1 day view of the day the error was detected. Chiller cycled 12 times before building occupancy at 6am.

Figure A-3 is a 1 day view of the day after the error was detected. Chiller remained off until building was occupied around 6am.

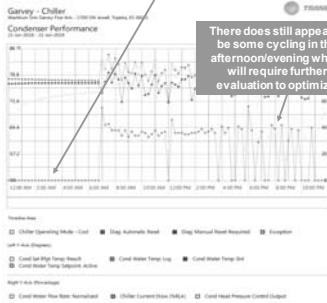There does still appear to be some cycling in the afternoon/evening which will require further evaluation to optimize.

Figure A-2 – Garvey Fine Arts – Chiller Performance Analytics (1 day view)

Figure A-3 – Garvey Fine Arts – Chiller Performance Analytics (1 day view)

Washburn KPIs impacted by this optimization:

- Equipment is working properly

- Equipment is maintained for longevity
  - ✓ Reduced starts on chillers & AHUs will extend life of equipment

- Energy efficiency
  - ✓ $5,413 in annual savings for just Memorial Union; additional savings for Garvey, Henderson and Petro

Equipment information –				
AHU-1 FAN 15 HP or ~11 kW				
AHU-6 FANs 60 HP or ~45 kW				
Chiller 1 348 kW				
ELECTRICAL IMPACT/SAVINGS (1 year)				
Name	kWh use	% Reduction	Adjusted kWh	$/kWh	Savings $
AHU-6	13160	25%	9870	0.05	$493.50
AHU-1	53836	25%	40377	0.05	$2,018.85
CHILLER	37002	25%	27751	0.05	$1,387.57
TOTALS	103998		77998		$3,899.92
GAS IMPACT/SAVINGS (1 year)					
Per Trace 700 heating savings is 3783 therms					
therms saved		$/therm	$ Saving		
3783		0.4	$1,513.20		
TOTAL SAVINGS		$5,413.12			

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Cycling Chillers – Spectral Analysis

The Spectral Analysis tool is a graphical representation of 15 min interval data over a defined period. The x axis is days and the y axis is time from midnight to midnight.

The yellow checker-board pattern was the chiller and associated AHUs cycling.

Notice the increase in green in the early morning beginning on 6/21/18 when the correction was made.

Energy Performance (EP)
Uncovers energy waste in every corner of your building and aggregates energy data using powerful visualizations and analytics, to bring clarity, identify hidden savings opportunities and document results.
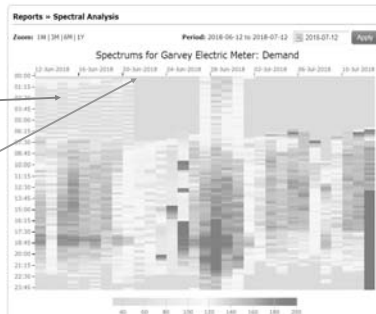
Figure A-8 – Garvey Fine Arts – Electric Demand Spectral Analysis (1 month)

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OA Temp Sensor Test

The DOAS unit OA temperature sensor (orange) does not accurately track the actual OA temperature (pink).

Updated the OA sensor programming to reference a more accurate sensor located in the building, thereby improving system operation.

Building Performance (BP)
Continuously analyzes data to see what's happening in your building, providing proactive, data-driven insights and solutions to keep your building running optimally
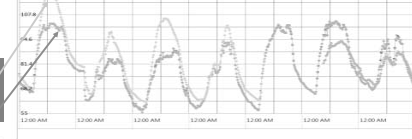

Figure A-4 – Garvey Fine Arts – OA Accuracy Test

Washburn KPIs impacted by this optimization:
- Equipment is maintained for longevity
- Positive customer impact
- Energy Efficiency

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Energy Performance Analytics

Helps evaluate if the building is performing better or worse than the model indicates it is capable of, based upon the baseline.

Normalized for weather data so hot/cold years will not negatively or positively affect the baseline.

The baseline period is from May 11, 2016 to May 11, 2017.

From May 12, 2017 to present, the savings, plus or minus, are shown in the chart.

The reporting period says not much has changed in the way the building is using electrical energy.

Reducing loads or shortening scheduling will cause the red trend line to bend up.

Building Performance Analytics will help determine what tasks can be done to help the trend bend up.

Washburn KPIs impacted by this optimization:
- Energy Efficiency

Figure A-6 – Garvey Fine Arts – Electricity Baseline

AHU-1 & 2 Supply Pressure Control (BP) Analytics

Supply air pressure (light blue) was not accurately tracking the supply air static pressure setpoint (dark blue).

Analytics remote service tech did some loop tuning control modifications and now the supply air pressure much more closely tracks the setpoint.
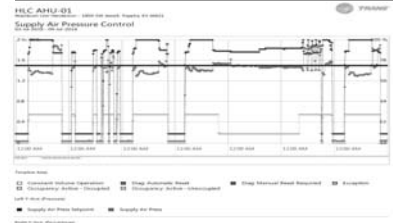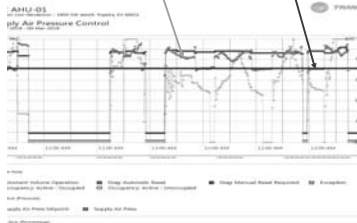

Figure A-9 – Henderson Learning Resources Center – AHU-1 SA Pressure Control March 2018

Figure A-8 – Henderson Learning Resources Center – AHU-1 SA Pressure Control July 2018

Washburn KPIs impacted by this optimization:
- Equipment is maintained for longevity
- Positive customer impact
- Energy Efficiency

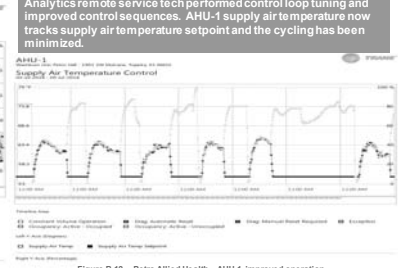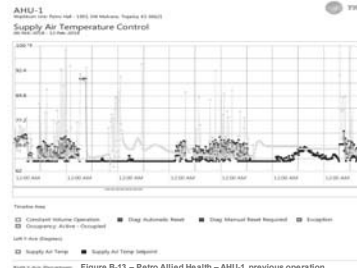## Highlights from July 2018 Data Analytics Report

- Henderson AHUs 1 & 2, and Petro AHU-1 control improvements

- Documentation of resolution of chillers cycling last month - resulting in energy savings from 8-10%

- Equipment is working well, but getting quite a few warm space temps. Optimizing occupied/unoccupied set-points would help improve system operation.
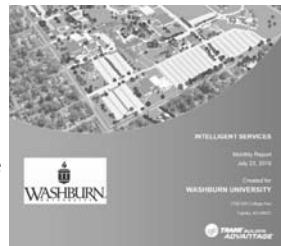
Petro AHU-1 Supply Air Temp Control (BP) Analytics

Analytics remote service tech performed control loop tuning and improved control sequences. AHU-1 supply air temperature now tracks supply air temperature setpoint and the cycling has been minimized.

Figure B-13 – Petro Allied Health – AHU-1 previous operation

Figure B-12 – Petro Allied Health – AHU-1 improved operation

Washburn KPIs impacted by this optimization:
- Equipment is working properly
- Equipment is maintained for longevity
- Positive customer impact
- Energy Efficiency

Chiller Cycling/Chiller Plant Building Performance (BP)

After updating the schedule error found by the June analysis the early morning chiller cycling has been greatly reduced.

Rarely does the chiller turn on in the early morning hours. The chiller plant delta T also looks great.

There could still be some improvements in limiting chiller plant cycling in the afternoon and evening. Trane will work with Washburn University to optimize the unoccupied setpoints and chiller plant setpoints to improve overall plant operation.
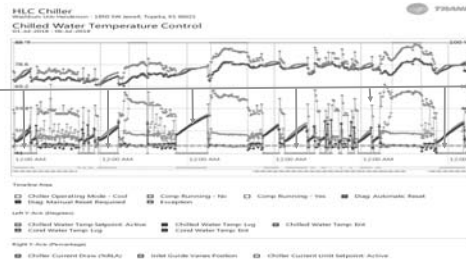
Figure A-11 – Henderson Learning Resources Center – Chiller cycling

Washburn KPIs impacted by this optimization:
- Equipment is working properly
- Equipment is maintained for longevity
- Energy Efficiency

Chiller Cycling/Chiller Plant Building Performance (BP)

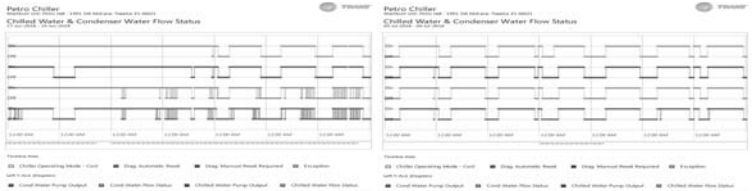Figure B-10 – Petro Allied Health – Chiller Plant Performance

Figure B-11 – Petro Allied Health – Improved Chiller Plant Performance

Before updating the schedule error found by the June analysis – note the early morning chiller cycling and chilled water and condenser water flows.

Chiller plant cycling has dramatically decreased. The chilled water and condenser water flow tracks each other. This repair has decreased chiller plant starts improving system longevity while also making the system more energy efficient.

Washburn KPIs impacted by this optimization:
- 1) Equipment is working properly
- 2) Equipment is maintained for longevity
- 3) Positive customer impact
- 5) Energy Efficiency

Energy Performance (EP) Analytics - Henderson
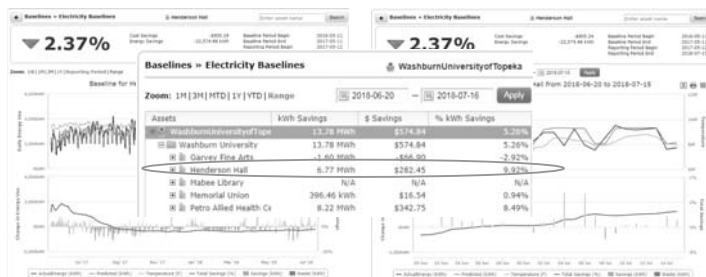
Reiterating from the previous report, the baseline is the building electricity usage compared against itself for that baseline year. From May 12, 2017 to present (the reporting period), the savings, plus or minus, are shown in the chart. The reporting period says not much has changed in the way the building is using electrical energy.

This EP analytic shows the Total Savings trending positively after the recent scheduling changes. During that time span, there has been a near 10% increase in savings.

Energy Performance (EP) Analytics - Petro

Reiterating from the previous report, the baseline, in this case one year, is the building electricity usage compared against itself for that baseline year. From May 12, 2017 to present (the reporting period), the savings, plus or minus, are shown in the chart above. So basically, the one year baseline period is where the building has been.

This analytic shows the Total Savings trending positively after the recent scheduling changes. During that time span, there has been an 8.49% increase in savings.

Master Issues Log

- Shared Google doc to track KPIs, issues, analytics, observations, actions, assignments, resolutions

- Working document updated by Washburn and Trane

Continuous Solution for Non-Stop Improvements In Building Performance
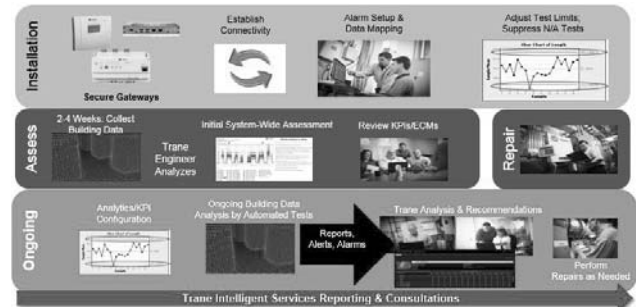
Are key stakeholders as aware of the implications of funding for deferred maintenance and Facility Department personnel as you would like them to be?

Yes

No

Being Connected For A Comprehensive View
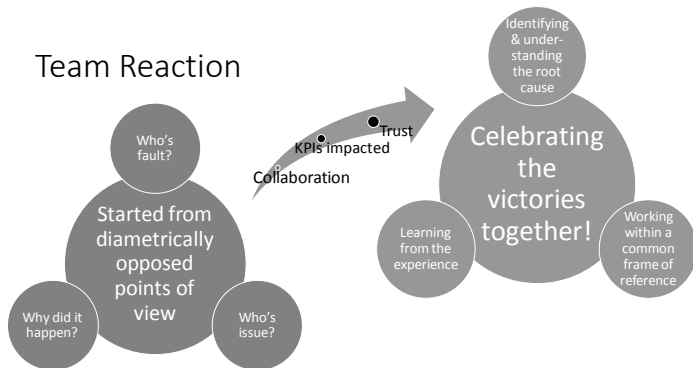
Customized Dashboards

- Real-time views of building & energy performance

- Measure Key Performance Indicators (KPIs)

- Track outcomes and opportunities to improve

- Document and verify successes to make the case for additional funding

Team Reaction

Who's fault?

Why did it happen?

Started from diametrically opposed points of view

Who's issue?

Collaboration

KPIs Impacted

Trust

Identifying & under-standing the root cause

Learning from the experience

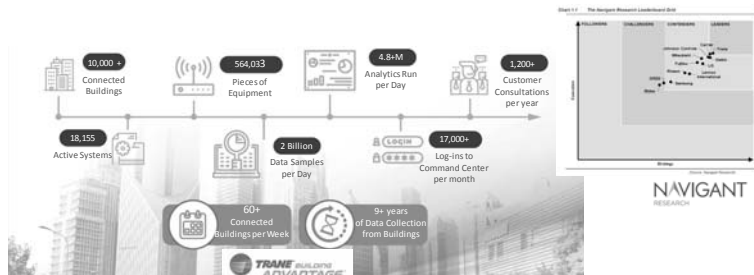Celebrating the victories together!

Working within a common frame of reference

Do you think that advanced data analytic tools (not just BAS) would enhance the management of building performance and the communication of prioritized needs and accomplishments to key stakeholders?

Yes

No

Need more information

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Choosing a partner with market-leading experience in improving building performance with data analytics

10,000 + Connected Buildings

564,033 Pieces of Equipment

4.8+M Analytics Run per Day

1,200+ Customer Consultations per year

18,155 Active Systems

2 Billion Data Samples per Day

17,000+ Log-ins to Command Center per month

60+ Connected Buildings per Week

9+ years of Data Collection from Buildings

TRANE BUILDING ADVANTAGE

NAVIGANT RESEARCH

Q&A / More Information

- Rich Connell, FMA, MA, EFP, Director of Facilities Services, Washburn University Rich.Connell@Washburn.edu
- Keven Ward, Public Sector Consultant, Trane Keven.Ward@Trane.com
- Project website: TraneMidAmerica.com/Washburn
- Midwest Training Center website http://tranemidamerica.com/mtc/

Next Generation Learning Organization:
Facing the "Perfect Storm" and the "New Norm"

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