

Indiana University Health

"Building" Optimization in Real Time

Handout Version

9/30/2016

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Metrics

Inside ASHE
– Fall 2016 Issue has an article on metrics




Volume x Quality = Value
Cost





Today's Agenda

- Team
- Metrics
- Managing in Real Time
 - Examples
- Panel Q&A






Changing Paradigms



- Listening vs. Managing
- "Opportunities," Not Problems
- "Safe" Set points
- HOW to manage risk
- Industry partners are valued team members – not "just contractors"



Building....

- HBR: Great Leaders BUILD:
 - Team
 - Trust
 - Network

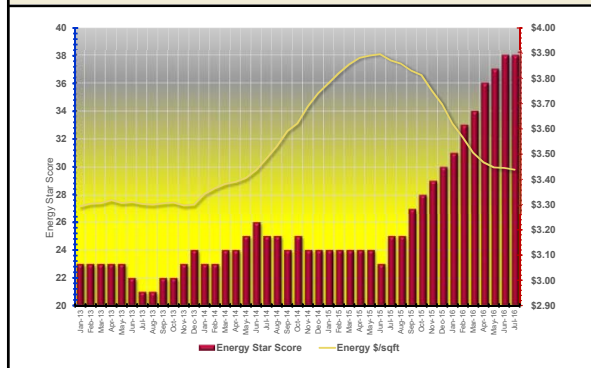


Heroes of the Process

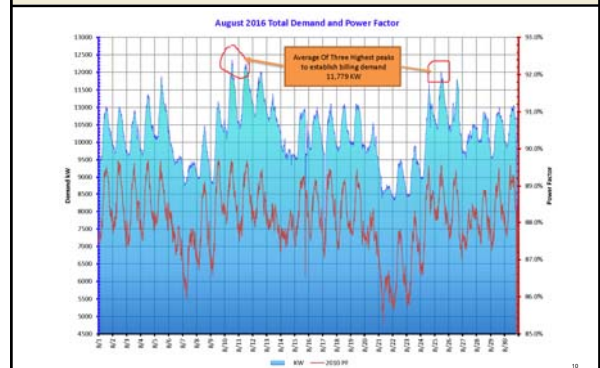
- Continuity of Care
- Collaborative & Creative Thinking
- Honest Conversation
- Persistence
- High Performing Team



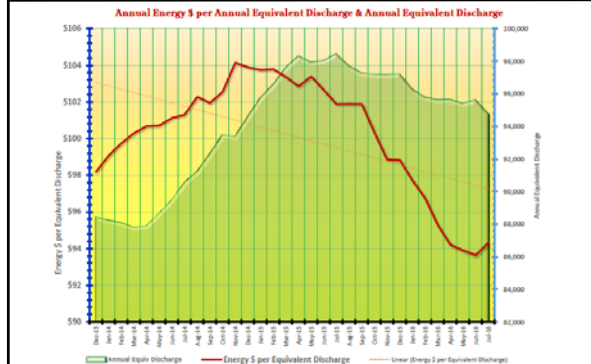

Methodist Hospital Energy Star and Cost/SF Tracking



Monthly Peak Demand



Energy \$ per Equivalent Discharge

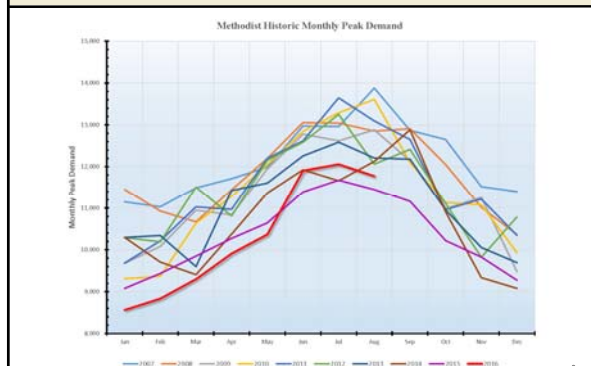


IUH AHC Future of Facilities Engineering

- Keys to Success
 - What's Best for the Patients
 - Customer Satisfaction at Every Level
 - Prioritize Competing Capital Needs
 - Manage Risk
 - Continuous Research & Testing of New Innovative Methods for Improved Efficacy & Efficiency



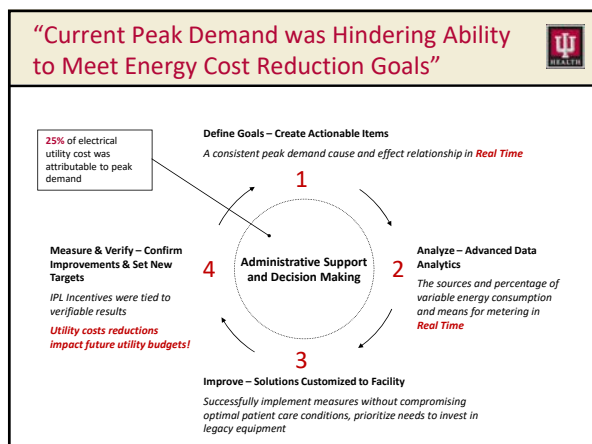
Month Peak Demand from 2007 to present



EARLY INITIATIVES - PREREQUISITE

BUILDING AUTOMATION – OPEN PROTOCOL

"Current Peak Demand was Hindering Ability to Meet Energy Cost Reduction Goals"



Real Time Monitoring Examples/Definitions

- 4 Surgery Infection Control**
RTM for the surgery department is a tool that **informs maintenance and operations personnel of immediate system conditions** that affect RH, temperature, or room pressures.
- 5 Domestic Water Chemistry**
RTM for the domestic hot water systems informs operators and the water treatment team on **current return water temperatures and residuals levels** of disinfection chemicals.
- 6 Life Safety PM's & ILSM's**
RTM for the life safety PM's and ILSM's **provides daily updates of life safety work order completion and status of associated interim life safety measures in place.**

Managing in Real Time Examples

- Demand Management Dashboard
- Condenser Water
- Operating Rooms
- Air Handling
- Domestic Hot Water
- Life Safety Work Orders

CENTRAL PLANT

Real Time Monitoring Examples/Definitions

- 1 Real Time Monitoring.**
Real Time Monitoring (RTM) is a tool that **informs maintenance and operations personnel of immediate system conditions** that affect service continuity, eminent failure, energy efficiency, loss of infection control measures, and thermal comfort.
- 2 Central Plant Energy RTM.**
RTM for the central plant systems focuses on **reducing or maintaining steam and electrical demand during peak periods** as a utility cost reduction measure, rather than relying on daily, weekly or monthly reporting measures.
- 3 Air Handler RTM.**
Provides cost of delivered CFM based on control set points and **functions and as an early sub optimal detection system** based on users or operated adjusted set points to maintain space conditions.

Cooling Tower Replacement Project: Existing Cooling Towers

- Reached End of Life; Severe corrosion & leaking
- Could no longer maintain 85 deg. F supply to chillers; required continuous make up water during peak periods
- Support of plate and frame heat exchanger during winter periods was very limited



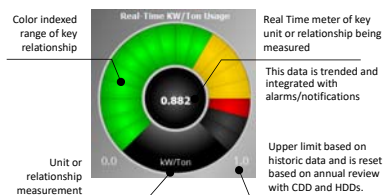
Cooling Tower Project: New Cooling Towers & Variable Flow CW

- Variable Flow Condenser Water
- Condenser Water Supply Reset
- Chiller Head Pressure Control
- Plate & Frame economizer restored
- Cooling Tower optimized to minimize fan energy (maximize surface area)
- **Required tower fan kW feedback to test and confirm tower staging sequences**

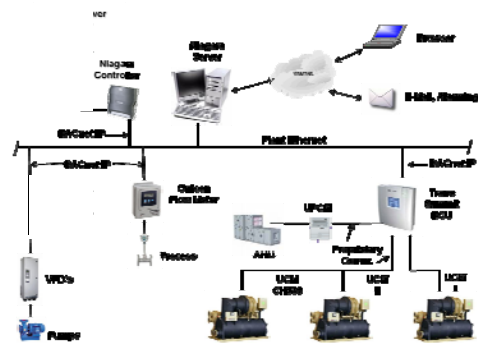


Open Protocol Platform could Accommodate Building Dashboard Tools

Core Component - Chiller Plant kW/Ton Meter



Open Protocol Networked Controls Gathered the Data from Several BACnet Devices



Real Time Need Drove Forecasting Need

- The operators discovered by using real time monitoring dashboards that not enough time existed to make adjustments to manage peak demand. This created the need for forecasting to allow ample time to prepare or adjust to peak demands



Developed Robust Workstation with Training

Peak Saving Activities by BMS Controls Technician

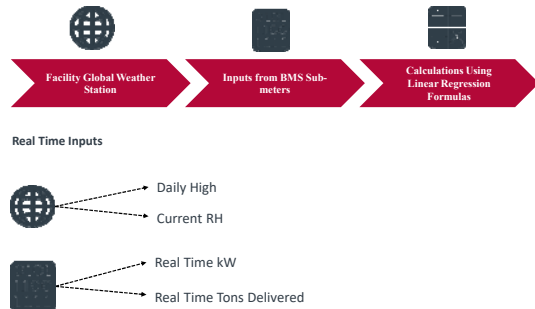
Messages Not Permitted



Robust Data Collection During Peak Shaving Periods supports Root Cause Analysis (if needed)

ENERGY/LOAD FORECASTING

Forecasting 3 Step Process



Supply Air Temperature Reset Method for Peak Shaving

Affect of Supply Air Temperature Reset – Source: Texas A&M, Wenshu Fan

10% Load Reduction

Empirical findings based on peak shaving mode

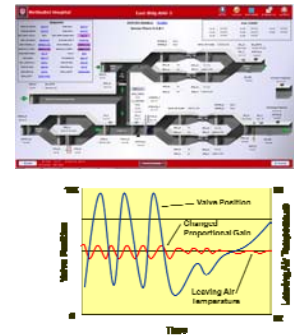
11-30% Load Reduction

In previous literatures, several case studies have shown energy savings ranging from 11% to 30% with various systems and operational scenarios

AIR HANDLING OPTIMIZATION

Setup of Dashboard & Trending of the Air Handling Control System

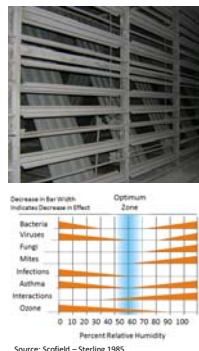
- Early detection of performance degradation or need for 'loop' tuning
- Prevents over cooling or heating
- Graphic displays to correlate multiple variables



Source: ASHRAE Commissioning Handbook

Air Handling Optimization Projects: Existing Conditions

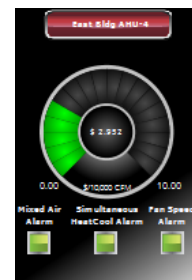
- Control set points were overridden
- Sensors had not been regularly calibrated or fixed if broken
- Dampers & actuator not functional
- Poor of if any mixed air control caused simultaneous heating and cooling
- Could not economize when outside enthalpy allowed
- Found less than desired level of humidification rates




Source: Scofield – Sterling 1985


Air Handling Optimization through Real Time \$ per CFM Dashboard

- Calculates Costs of
 - Heating & Humidification
 - Cooling
 - Supply & Return Fan Energy
- Alarms/Notifies of
 - Mixed Air Out of Range
 - Simultaneous Heating & Cooling
 - Fan Speed Out of Range
- Before - \$5-11.00/10,000 CFM
- After - \$2-6.00/10,000 CFM





SURGERY & INFECTION CONTROL



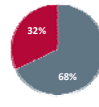
Surgery Room High RH Alarms Executive Team Reporting

Surgery Rooms High RH Alarm Reports


June 2014
ORs = 35
No. of Alarms


5,413

July 2015
ORs = 35
No. Of Alarm Days*




July 2016
n = 35 Rooms
5,044 Minutes






OR Setback Addressing Patient Safety or IC Risks

- Activate system to increase airflow before room set-up for case
- Automated activation vs manual
- Airflow reduction must maintain room at positive pressure
- Strategy must be responsive to temperature & humidity control – airflow only so no “drifting” occurs
- Also must maintain temperature and humidity in order to ensure sterility of supplies stored in OR
- Ensure that ancillary areas (i.e. Pharm, Lab, Case Cart central, Sterile Storage, Tissue storage) maintain proper temp, humidity and air exchanges per guidelines




ASHE Monograph

ASHE 170

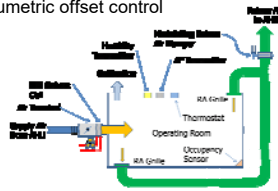
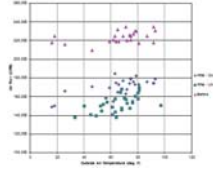


HIGH PRESSURE PROFILE PUMPING




OR Airflow Ventilation Planning

- Occupied – 15 to 20 ACH
- Unoccupied – 1 to 8 ACH
- DP - > 0.01" w.g.
- Unidirectional air above table, multiple low returns
- Volumetric offset control

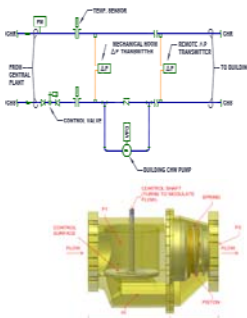



Source: ASHE



Profile Pumping


- Profile pumping arrangements are more energy efficient than selecting and operating the primary pumps to satisfy the head requirements of the most remote hydraulic circuit which over pressurizes the loop and the ‘closer’ air handlers waste chilled water, steam, and pump energy through ‘lifting’ of the control valves.






DOMESTIC HOT WATER TREATMENT

25




LIFE SAFETY PM'S AND ILSM'S

26




Domestic Hot Water



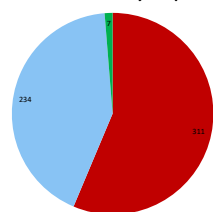
UH Domestic Hot Water Return

26



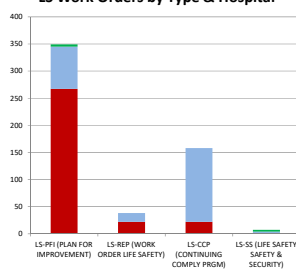
Life Safety Dashboard

LS Work Orders by Hospital




Type Description	UH	MH	RH
LS-PFI (PLAN FOR IMPROVEMENT)	267	78	4
LS-REP (WORK ORDER LIFE SAFETY)	22	16	0
LS-CCP (CONTINUING COMPLY PRGM)	22	136	0
LS-SS (LIFE SAFETY SAFETY & SECURITY)	0	6	3
	311	234	7

LS Work Orders by Type & Hospital




27/30/2016




BMS Notification of DHW Temp

- Monitoring
- Measuring
- Contributed anecdotally to new CDC Guidelines

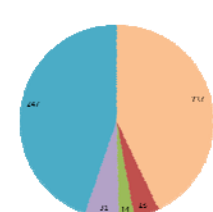


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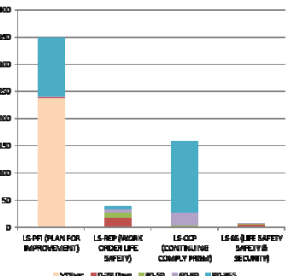


Life Safety Dashboard

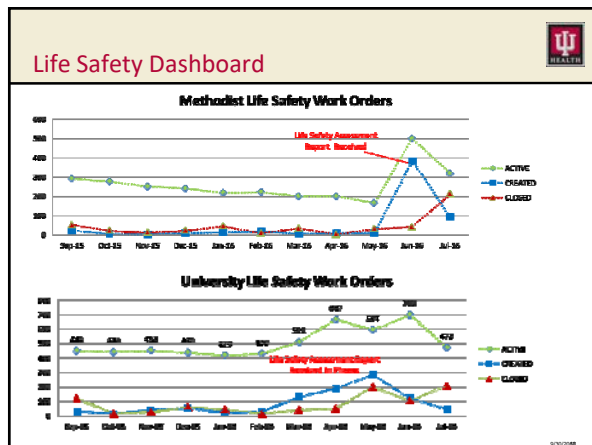
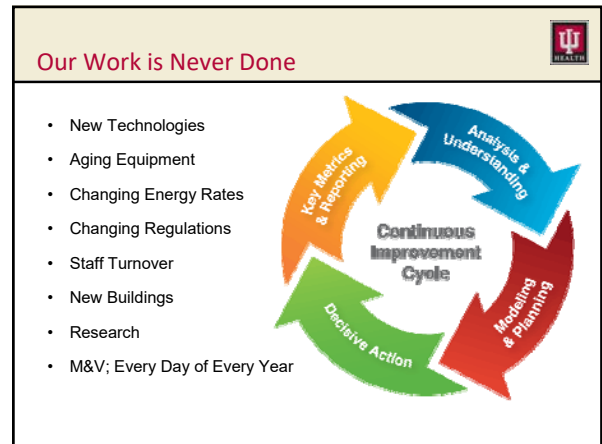
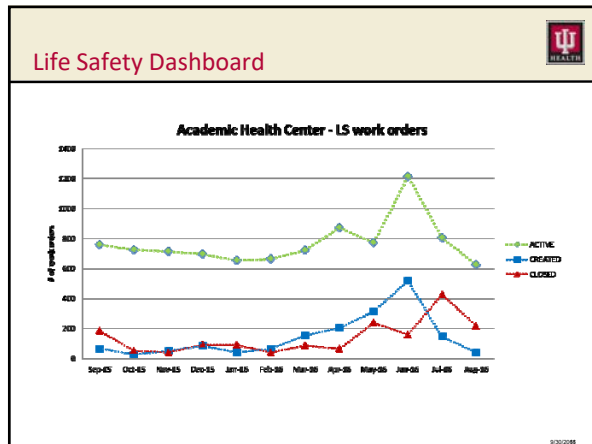
LS Work Orders by Age



LS Work Orders by Type & Age



29/30/2016



Following Up on Progress

Biannual PM for Energy Conservation Devices

Sensor or Actuator Calibration					
Sensor or Actuator	Location	BAS Value	Instr. Meas'd Value	Final Comp or BAS Value	Pass (Y or N)
Return Air Pressure					
Humidity Transmitter					
Return Air Flow Measuring Station					
Return Fan Current Transmitters					
Return Air Temperature					
Return Fan VFD or Unloader Control					
Mixed Air Signal: Operation of OSA, MA, and EA Dampers					
OS Air Flow					
OS Humidity Transmitter					

END OF PRESENTATION