How Big Data Analytics Helps Hotels Improve Maintenance and Comfort, and Save Energy
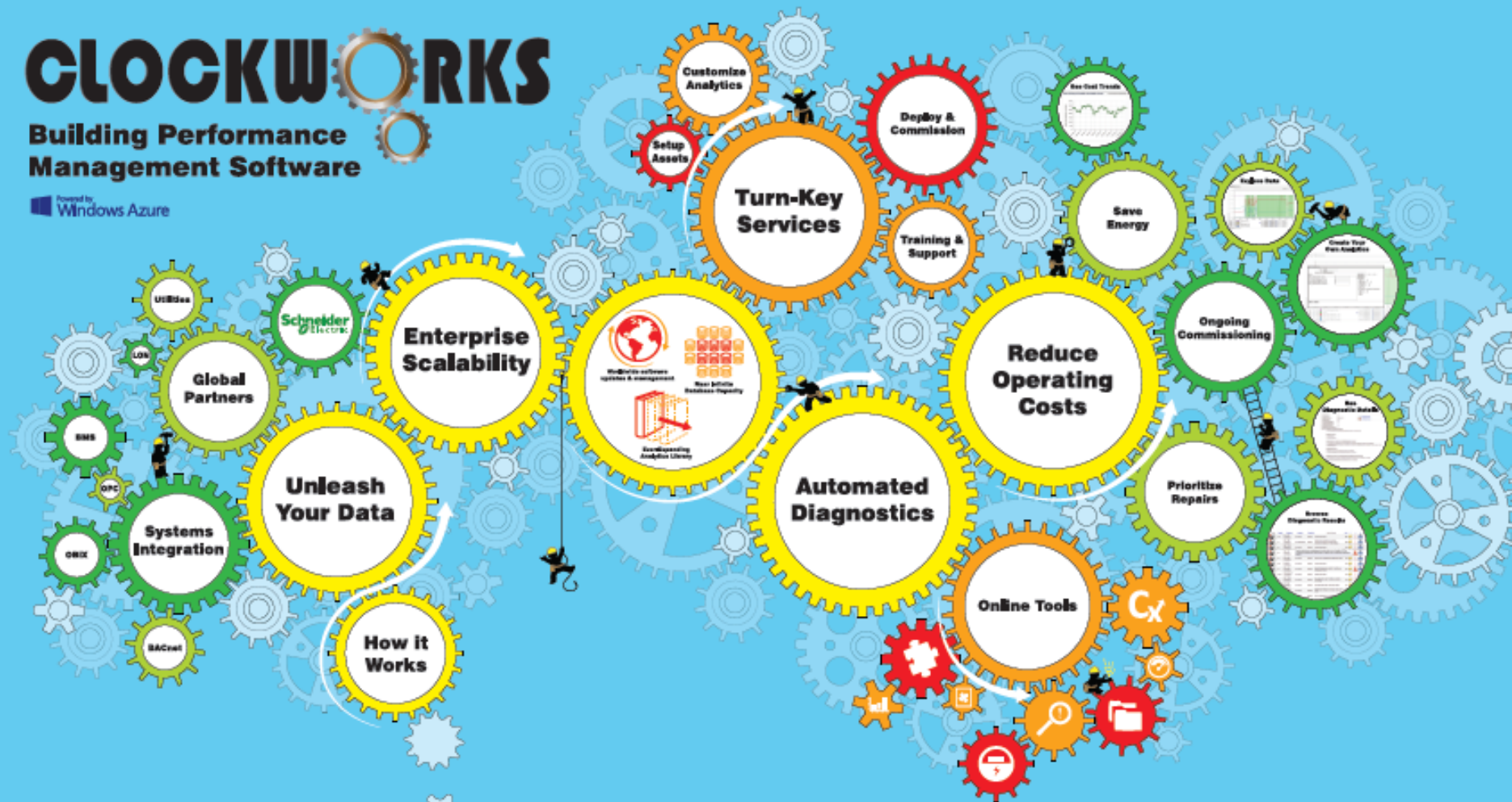
Critical facility management drivers are impacting all industries

Sustainability

Big Data/Cloud

Open Building Systems

Aging facilities

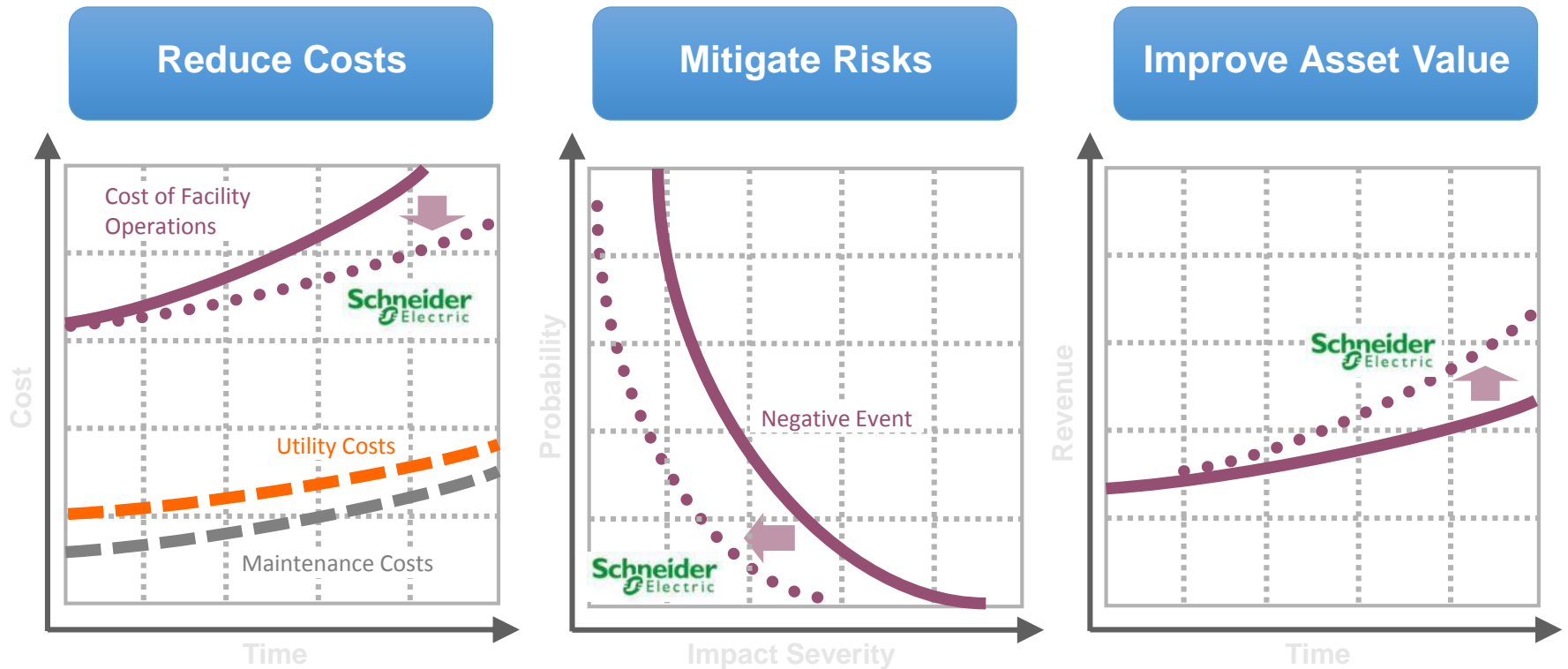Risk management

Outsourcing

We asked customers about their needs

The feedback was very clear:

Reduce Costs

Cost of Facility Operations

Schneider Electric

Utility Costs

Maintenance Costs

Cost

Time

Mitigate Risks

Probability

Negative Event

Schneider Electric

Impact Severity

Improve Asset Value

Schneider Electric

Revenue

Time

KGS BUILDINGS

Daily challenges

- Guest comfort
- Complex building systems
- Data overload
- Budget limitations

Actionable information is **required**, not just lots of building data
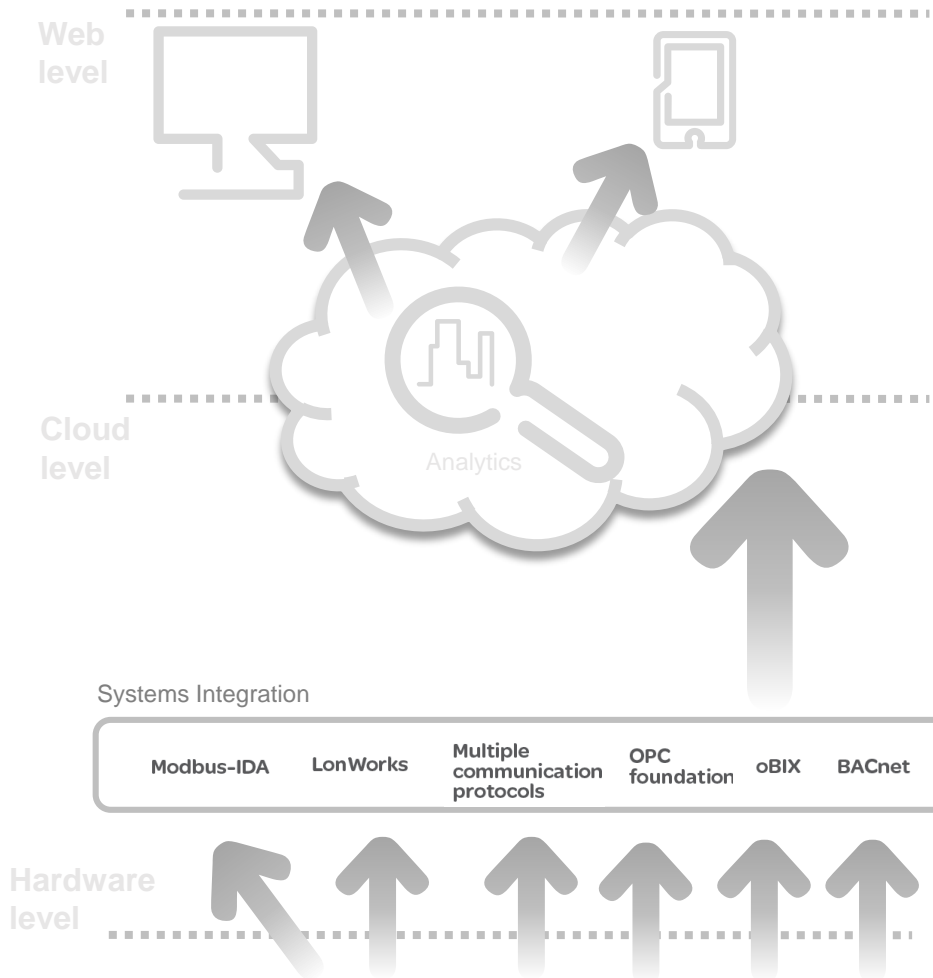
What do we hear from Hotels?

We're looking for....

- Energy and cost savings
- Prioritized maintenance
- ROI Justified Decision Making
- Utility Incentives

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Data Transfer

Web level

Cloud level

Analytics

Systems Integration

| Modbus-IDA | LonWorks | Multiple communication protocols | OPC foundation | oBIX | BACnet |

Hardware level

Example of findings…

- *Simultaneous heating and cooling*
- *Suboptimal economizer controls*
- *Opportunity for higher/lower loop setpoints*
- *Opportunity for static pressure reset*
- *Leaking valves, broken dampers*
- *Manual overrides*
- *Poor occupancy scheduling*
- *Excessive zone temperature setpoints*
- *Excess reheating*
- *Trends in chiller efficiency*
- *Short cycling*
- *Custom analytics*

KGS BUILDINGS

Technology is Great, but it's not enough:

Software

Services

KGS BUILDINGS
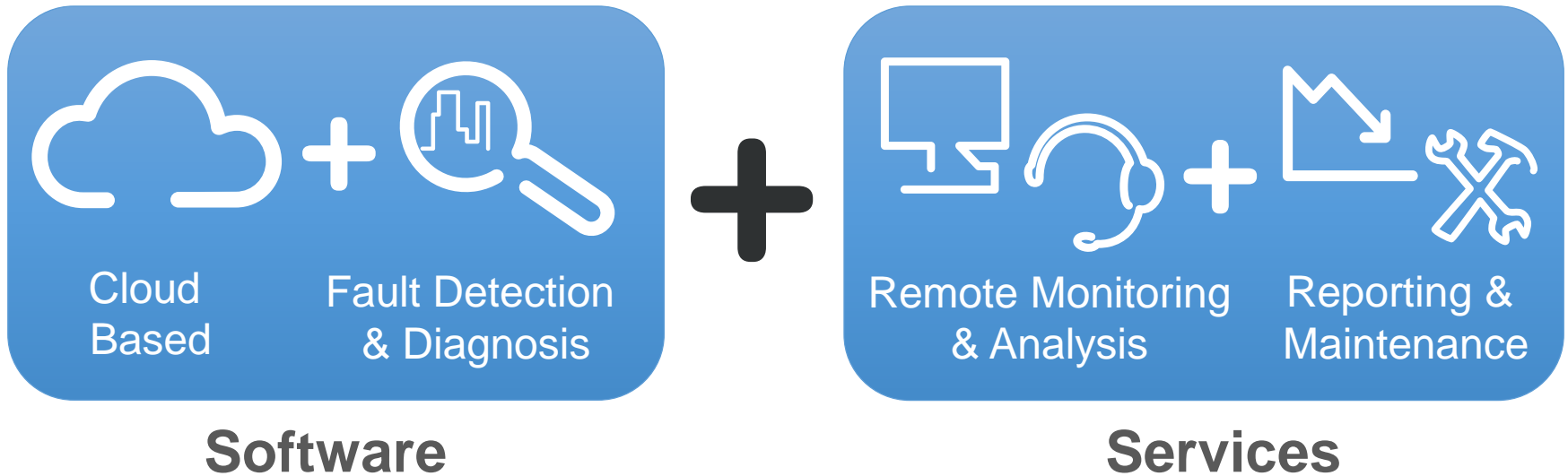
Ensuring FDD fulfills its promise

- Must work, accurately!
- Actionable information about cost, comfort, maintenance
- Identify root cause and suggest corrective action
- Identify opportunities for optimization and capital projects
- Scalable delivery
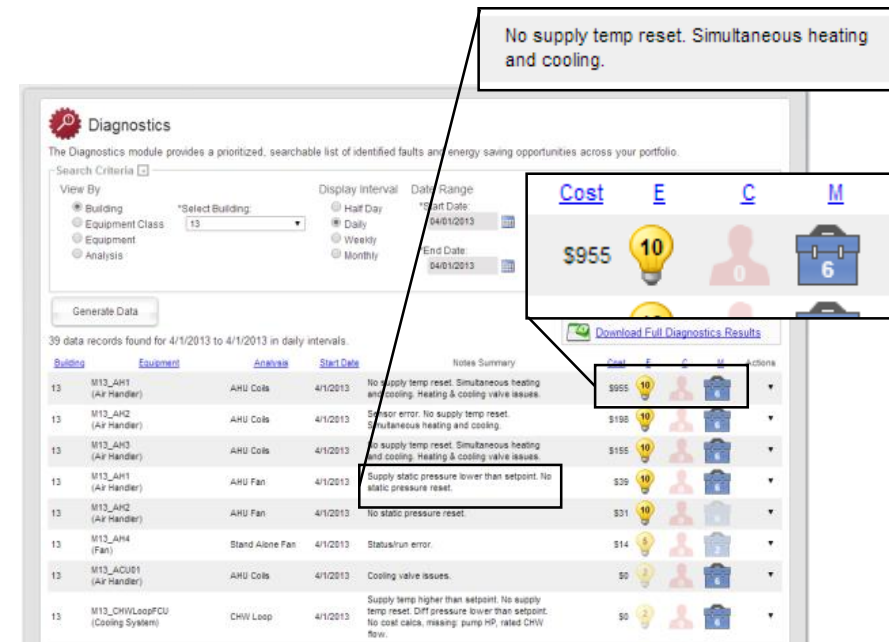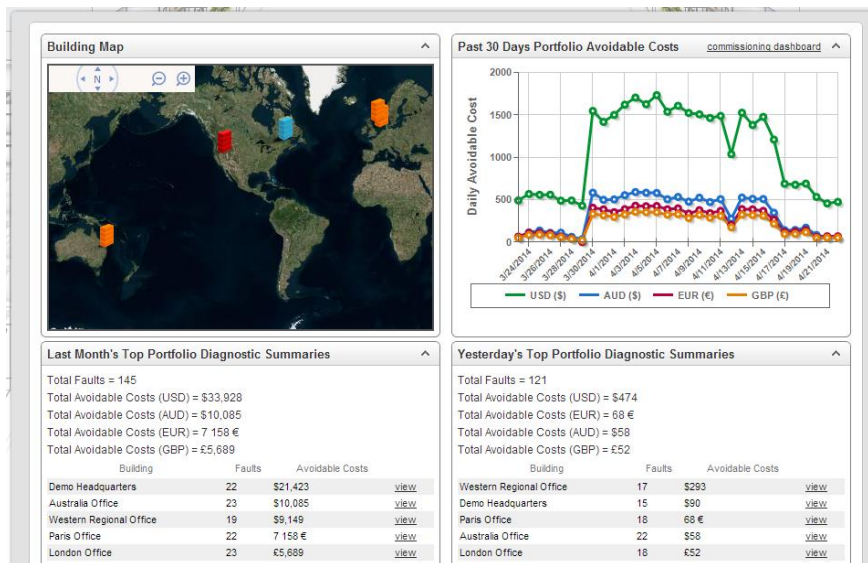
Diagnosing "broken" buildings to make them greener

Startup's software detects inefficient equipment in facilities — saving energy, time, and money.

Rob Matheson | MIT News Office
June 13, 2014

Press Inquiries

RELATED

May 22, 2014, 4:08pm EDT | UPDATED: May 23, 2014, 9:45am EDT

Former MIT students launch energy-saving software startup KGS and end up helping their alma mater

By Patricia Resende, Special to the Journal

A trio of former MIT Ph.D. students have used the skills and knowledge they learned while at MIT to launch a new startup and are now helping their alma mater save energy and money.

Nicholas Gayeski, Sian Kleindienst and Stephen Samouhos founded KGS Building in 2007 while earning their Ph.D.s at MIT. While there, Gayeski was focused on the Building Technology program, Kleindienst's research focused on daylight modeling, metrics, computational analysis, and

Enlarge Photo

Courtesy photo/ KGS

From left to right: Nick Gayeski (partner and co-founder), Sian Kleindienst (partner and co-founder), Stephen Samouhos (partner and co-founder), John Anastasio (partner and CTO)

solar | grid | efficiency | ENERGY | PODCAST | VIDEO | RESOURCE CENTER

Stealthy KGS Takes Its Building Analytics to the Cloud

Small startup out of MIT lands Schneider Electric as partner.
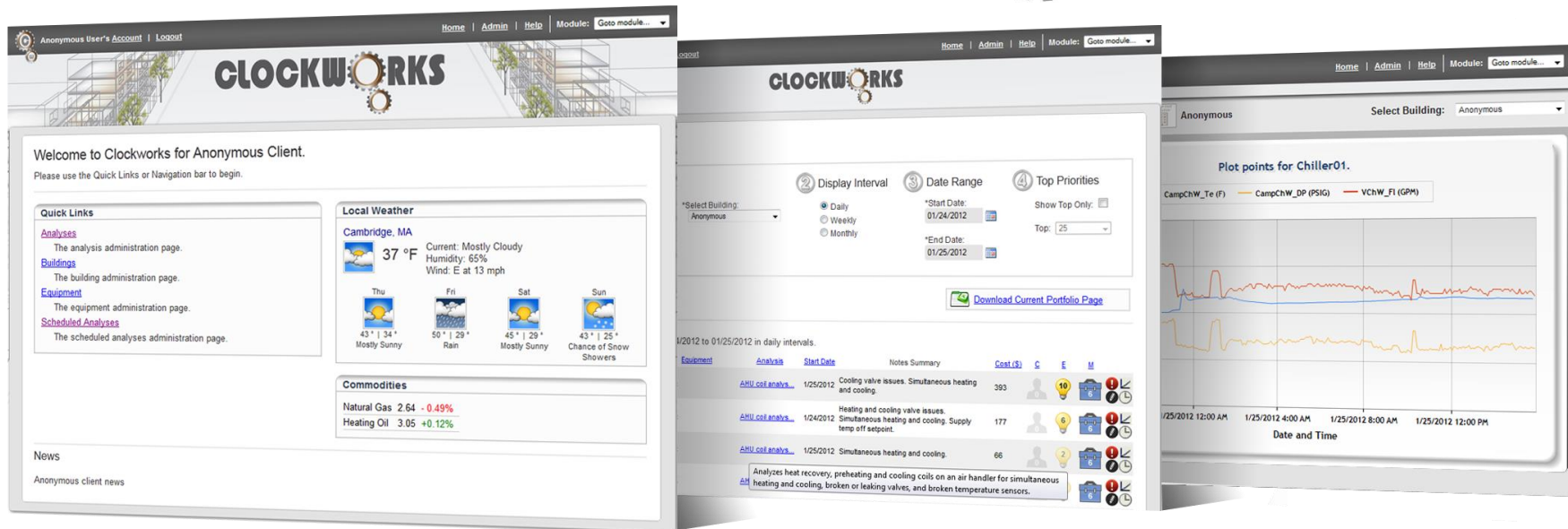
Jeff St. John
June 5, 2013

KGS BUILDINGS

Which hotels can really take advantage?

- Scale: more data = more opportunity

- Large conditioned spaces: ballrooms, convention space,

- More equipment monitored by Building Automation System the better

- Engineering responsible for many sites

KGS BUILDINGS

Web-based software enabling proactive building operations

KGS BUILDINGS

Contact info:

Alex Grace
Director of Business Development
Agrace@kgsbuildings.com
978-502-0658

For example, rules are only one approach…
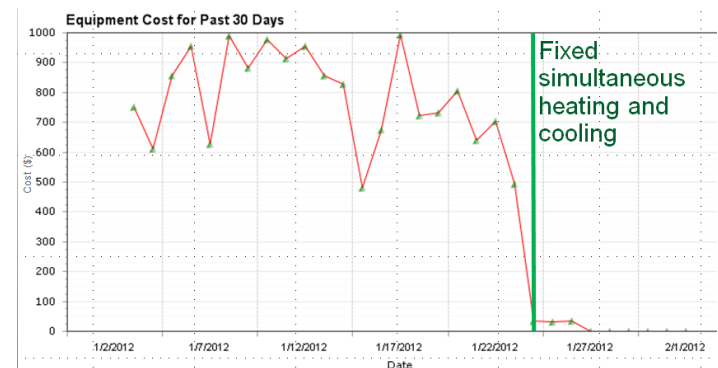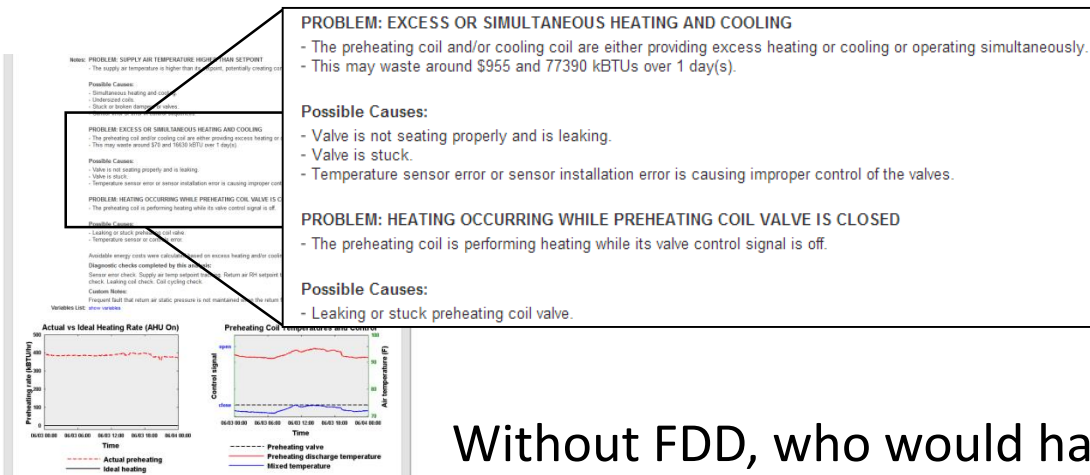
$$HCDAT - CCDAT > 5 \quad \& \quad CCV < 0.05$$

Alone, a rule is a lot like an alarm.

Most likely, you have a lot of alarms already.

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Hierarchical, rule-based FDD is another approach

Logic + rules with many variables = = root cause + corrective action

i.e. the FDD should connect the dots for you.

Credit: Pacific Northwest National Laboratory, Outdoor Air Economizer Diagnostician

Ultimately, FDD must deliver actionable information

- Failed pilot-positioner on a pre-heat valve
- FDD identified & calculated cost impact ~$900 per day
- Marked as high priority on dashboards and via email
- Valve was fixed within 2 weeks (parts, shutdown, contractors)
- Demonstrated savings from the repair visible immediately

Building	Equipment	Analysis	Start Date	Notes Summary	Cost	E	C	M	Actions
13	M13_AH1 (Air Handler)	AHU Coils	4/1/2013	No supply temp reset. Simultaneous heating and cooling. Heating & cooling valve issues.	$955	10	0	6	▼

PROBLEM: EXCESS OR SIMULTANEOUS HEATING AND COOLING
- The preheating coil and/or cooling coil are either providing excess heating or cooling or operating simultaneously.
- This may waste around $955 and 77390 kBTUs over 1 day(s).

Possible Causes:
- Valve is not seating properly and is leaking.
- Valve is stuck.
- Temperature sensor error or sensor installation error is causing improper control of the valves.

PROBLEM: HEATING OCCURRING WHILE PREHEATING COIL VALVE IS CLOSED
- The preheating coil is performing heating while its valve control signal is off.

Possible Causes:
- Leaking or stuck preheating coil valve.

Equipment Cost for Past 30 Days

Fixed simultaneous heating and cooling

Without FDD, who would have noticed? When?
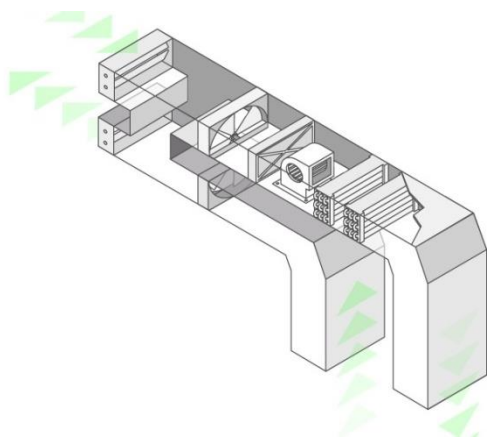
KGS BUILDINGS

Realizing ongoing energy & cost savings

Fault detection in a research laboratory ventilation system

$286k
annual savings

saved from fault detection in a research laboratory ventilation system

PROJECT AT A GLANCE
Location
Massachusetts
Facility
Research lab (450,000 sq. ft.)
Monitored Systems
Central and zone ventilation system
Setup Cost
$23,190
**Maintenance Cost (annual)**
$35,407
Projected Annual Savings
At least $286,000

CUSTOMER BENEFITS
- **Assurance that system maintenance achieves the desired objectives**
- **Investment protection to secure and track investments over the long term**
- **A digital history of building performance**
- **An information front-end to consolidate building data and make it accessible to all vendors**

Based on Building Analytics findings, the following work has been performed:

- 84 VAV boxes were re-commissioned.

- 52 VAV box reheat valves were replaced.

- 12 VAV box actuators were replaced.

- An air handler chilled water valve was rebuilt.

- Multiple controls adjustments were made.

KGS BUILDINGS

Modular Software Architecture with new features built continuously:
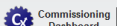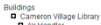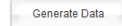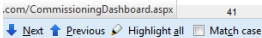
Provide Persistence: Platform for Ongoing Cx Services

<u>Case study</u>:

- Heating coil recovery sequences and simultaneous heating & cooling on AHU's: $198,000 of avoidable waste on one air handler over 4 months
- Leaking reheat valves on 86 VAV's: $86,000 in savings
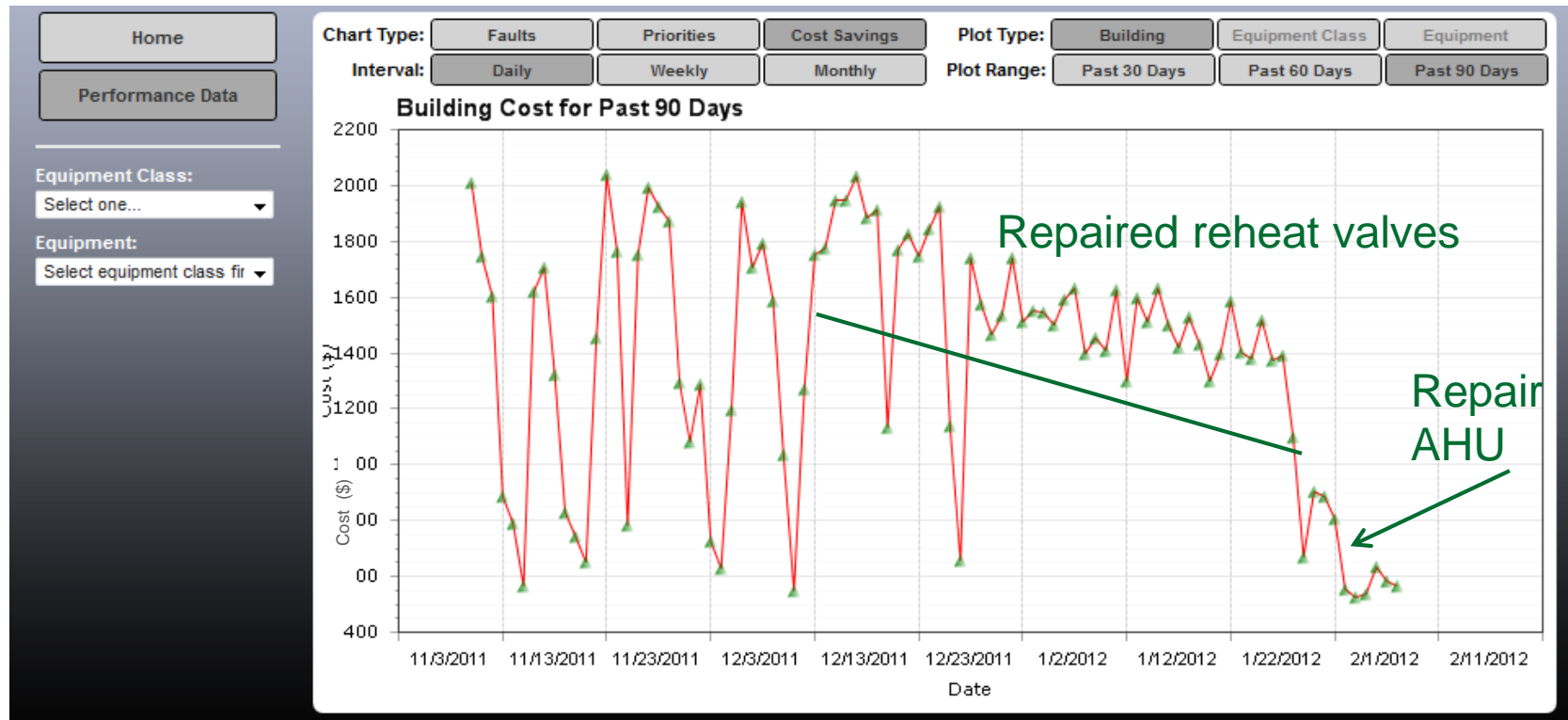
Data-Driven EBCx

Spend less time finding problems and more time identifying solutions

- Complete library of Diagnostics to perform root cause analysis

Building	Equipment Class	Equipment	Analysis	Start Date	Notes Summary	Cost ($)	C	E	M	
46	Air Handler	M46_AHU01	AHU coil analys...	12/1/2011	Heating and cooling valve issues. Simultaneous heating and cooling.	24194	0	10	6	
46	Air Handler	M46_AHU03	AHU coil analys...	12/1/2011	Heating and cooling valve issues. Simultaneous heating and cooling. Supply temp off setpoint.	10919	0	10	6	
46	Air Handler	M46_AHU07	AHU coil analys...	12/1/2011	Heating and cooling valve issues. Simultaneous heating and cooling.	3163	0	4	6	
46	Air Handler	M46_AHU06	AHU coil analys...	12/1/2011	Heating and cooling valve issues. Simultaneous heating and cooling.	1499	0	2	6	
46	Terminal Unit	M46_Rm6169	VAV box analysi...	12/1/2011	Room temp off setpoint. Supply flow off setpoint. Leaky reheat valve.	525	10	10	4	
46	Group	M46_AH09_VAVsystem	VAV system stat...	12/1/2011	Low damper position. No static pressure reset. Static pressure off setpoint.	290	0	3	6	

Prioritize time on site with diagnostic results.

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Diagnostics Details

Notes: **PROBLEM: COOLING OCCURING WHILE COOLING COIL VALVE IS OFF**

- The cooling coil is performing cooling while the cooling coil valve control signal is off.

Possible Causes:

- Leaking or stuck cooling coil valve.

PROBLEM: EXCESS OR SIMULTANEOUS HEATING AND COOLING

- The preheating coil and/or cooling coil are either providing excess heating or cooling or operating simultaneously.
- This may waste around $395 and 31920 kBTUs over 1 day(s).

Possible Causes:

- Valve is not seating properly and is leaking.
- Valve is stuck.
- Temperature sensor error or sensor installation error is causing improper control of the valves.

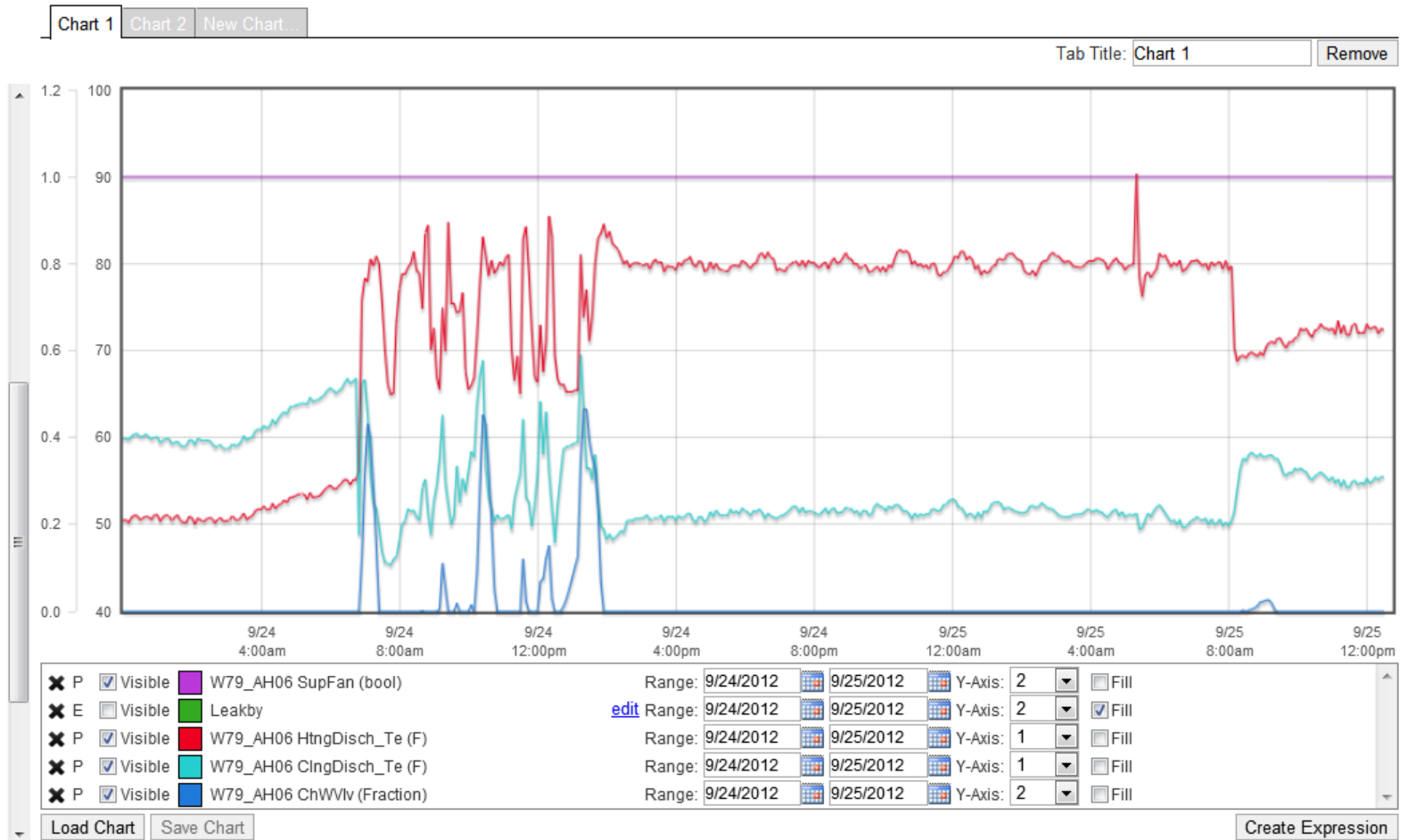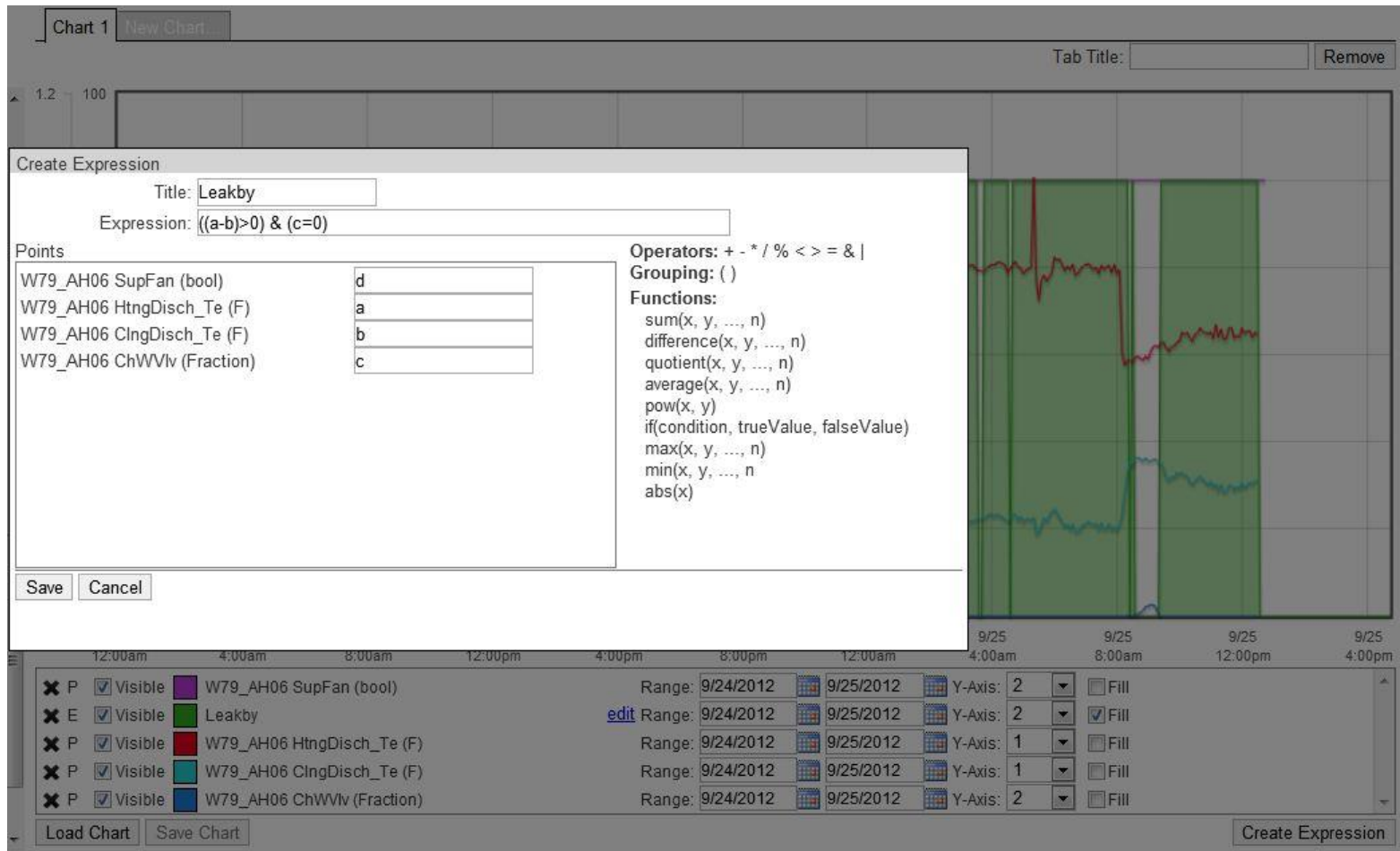Explore results through plain text and informative graphics

Actual vs Ideal Preheating Rate (AHU On)

Actual vs Ideal Cooling Rate (AHU On)
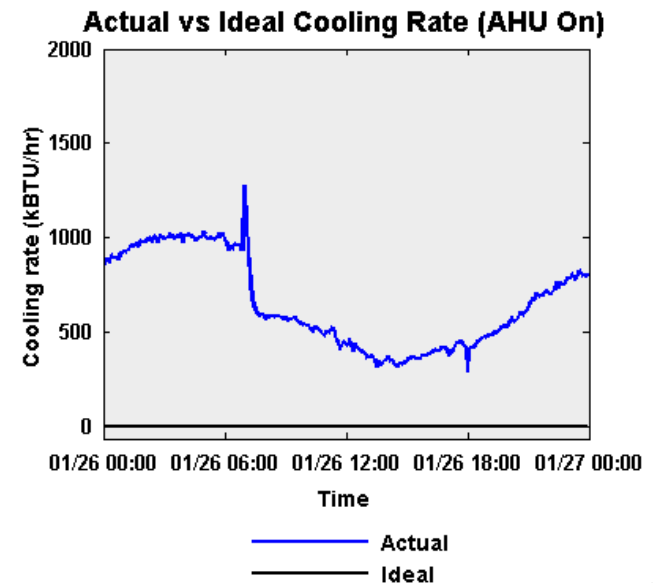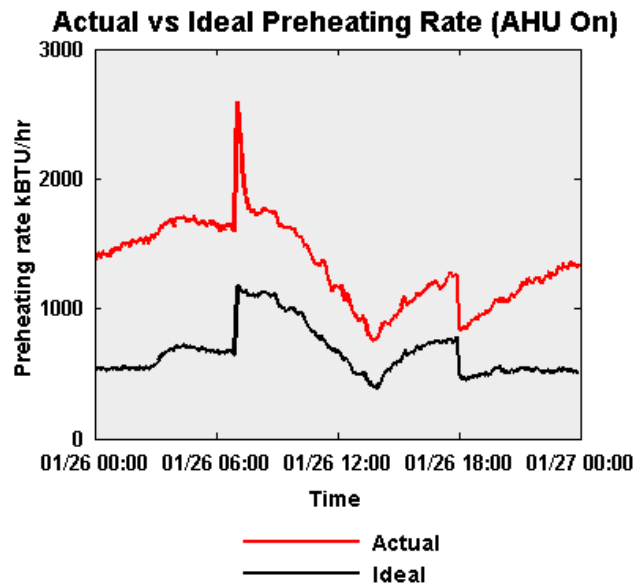
Remove the pain of trend analysis:

Instant online access to graph and apply
equations to 1000's of trends
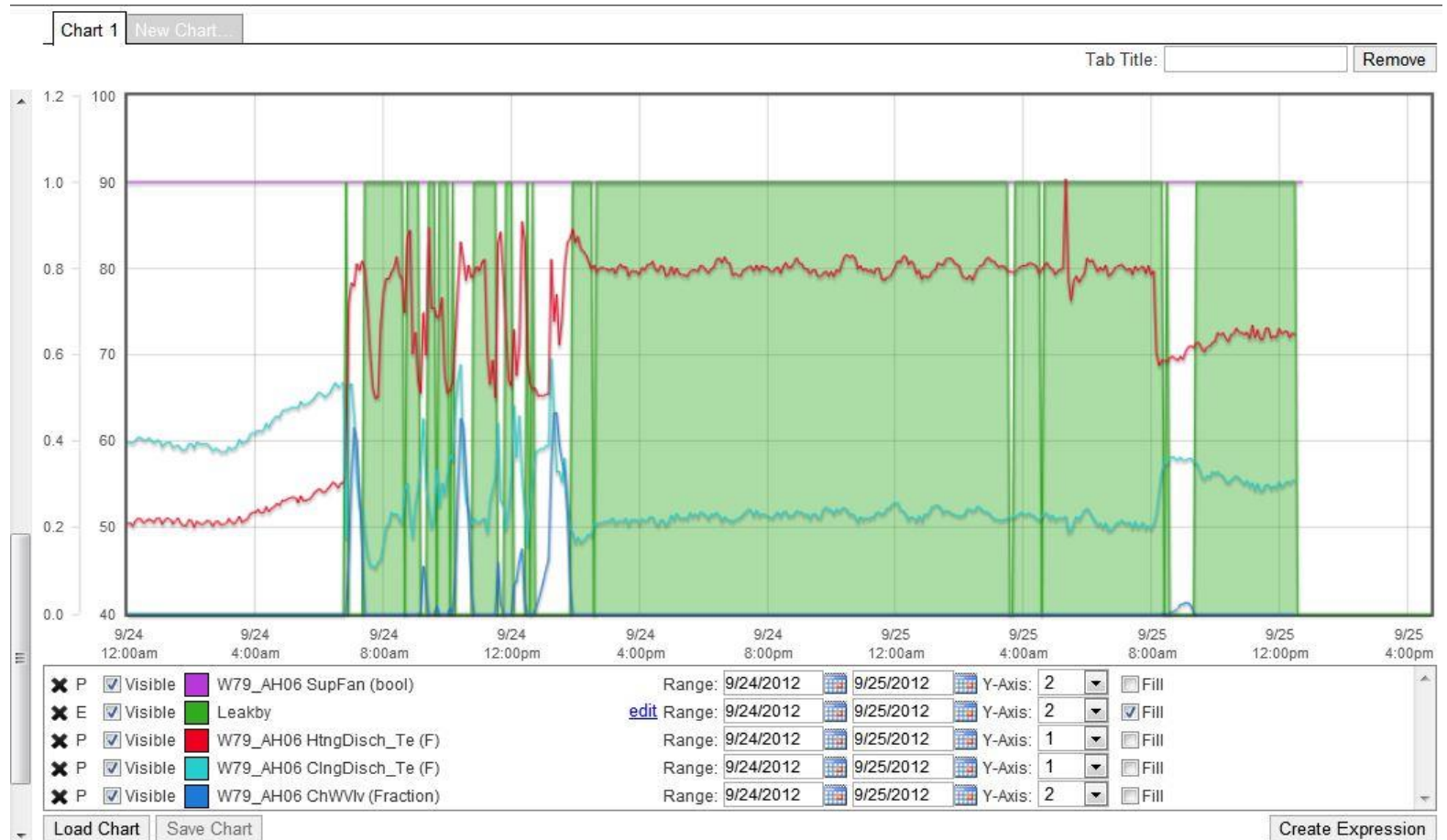
KGS BUILDINGS

Analysis Builder

Analysis Builder

Analysis Builder

Case Study: Clockworks in a 450K sqft laboratory

- Clockworks access to all stakeholders
  - Facilities managers
  - Repair and Maintenance managers
  - Controls and HVAC technicians
  - Commissioning agent
  - Controls provider

- Identified >$286k/yr in opportunities
  - Leaking reheat valves
  - Simultaneous heating and cooling
  - Suboptimal economizer operation
  - Heat recovery loop controls

KGS BUILDINGS

Case Study

- Clockworks driven work orders issued to address:

  - Heating Coil Recovery Sequences AHU's: $137,000 of avoidable waste on one air handler over 4 months
  - Leaking Reheat Valves on 86 VAV's: $86,000 in savings
  - Simultaneous Heating & Cooling in AHU: $61,000 in savings
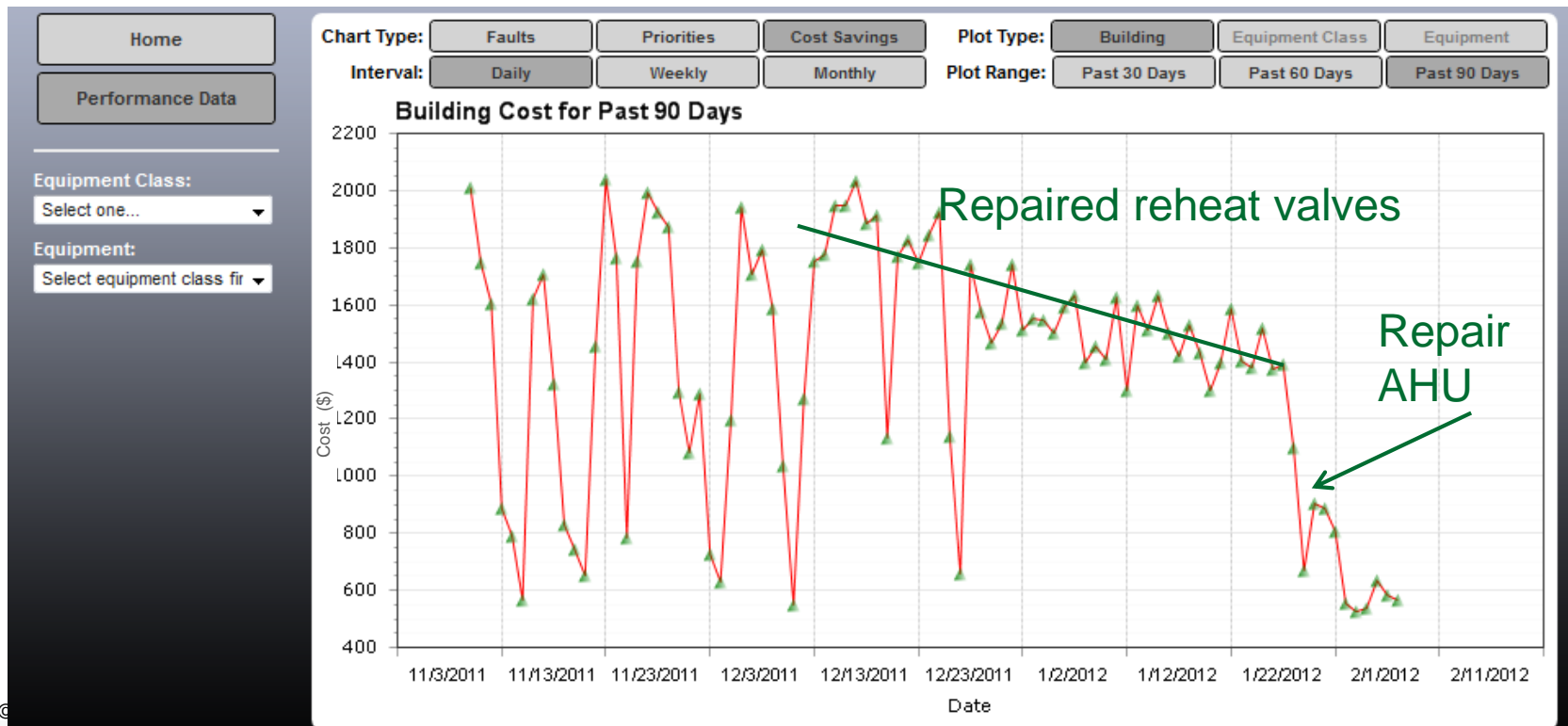
Document Storage and Organization

Documents

The documents area is used to manage all your files. You can add, edit, download, tag, and view files.

| File Browser | File Manager | File Tagger |

The file manager allows you to add, edit, replace, and remove files.

Search Criteria

Building: Building ▼

Equipment: AHU01 ▼

File Class: View all or optionally select one... ▼

File Type: Select class first... ▼

➕ Add a file

	Name	Extension	Size(MB)	File Type	Date Modified	
✏️ 📰	AH1-3-4-6-7_Sequence	.txt	8481	Equipment control sequence	10/18/2011 8:52:46 PM	✖
✏️ 📕	AHU1346UnitDetails	.PDF	396659	Equipment drawings	7/22/2011 2:20:37 PM	✖

Upload manuals, plans, logs, schedules, sequences of operation, photos, or other documents and tag them to specific equipment.

KGS BUILDINGS

Equipment Profiles

Easily access information and documents online while in the field.

Equipment Profile: Chiller1

Equipment **Chiller1** of Type **Chiller_Centrifugal** is located **Chiller Mechanical Room** in Building **Building**

Description: 400 Ton Centrifugal Chiller with VFD. Chiller 1 was rebuilt by Trane in 2011.

Details   hide details

Equipment Name:	Chiller1
Building Name:	Building
Manufacturer Name:	Trane
Model Name:	CVHF10
Serial Number:	L03K07248
Equipment Location:	Chiller Mechanical Room
Equipment Description:	400 Ton Centrifugal Chiller with VFD. Chiller 1 was rebuilt by Trane in 2011.
Equipment Class Name:	Chiller
Equipment Type Name:	Chiller_Centrifugal

Additional Details   show additional details

Equipment Variables   hide variables

AmpsOnThreshold:
Value: 0
Description: Amperage threshold at which an equipment can be considered "on"

AnnualCostThreshold:
Value: 10000
Description: The annual cost for which a fault has the highest priority.

ChillerEfficiencyPercentThreshold:
Value: .9
Description: Percent of an equipment's design efficiency under which an analysis will acknowledge a problem.

ChillerHeatBalancePercentThreshold:
Value: 0.05
Description: Percent deviation of a chiller's heat balance from ideal, over which an analysis will acknowledge a problem.

Profile Selection

*Building: Building
*Equip. Class: Chiller
*Equipment: Chiller1

Documents go ← Documents

Reports go ← Data

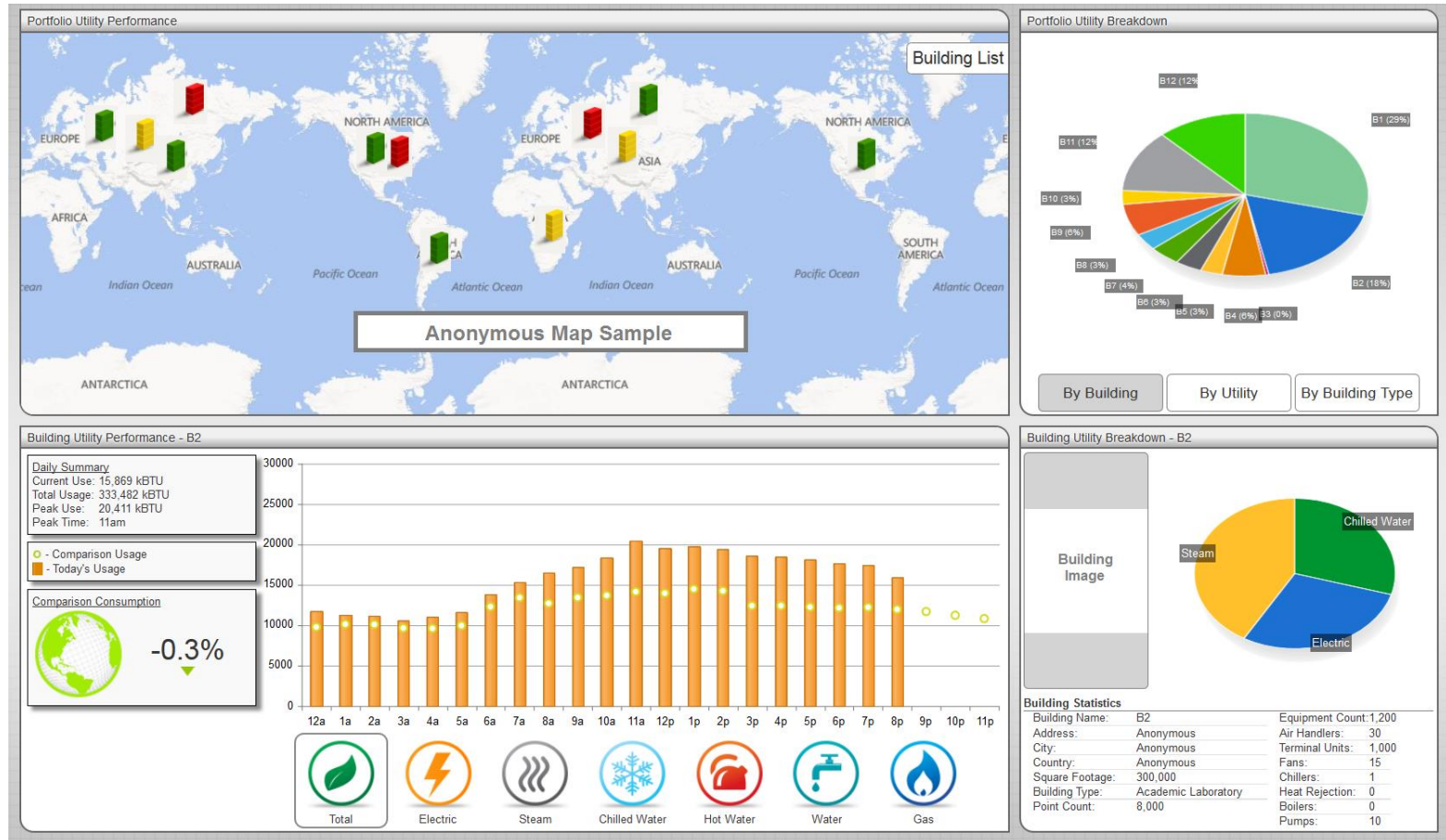**External Links** ← Links

No external links provided.

CLOCKWORKS-CONNECT

Chiller1 Building

QR Codes

KGS BUILDINGS

Kiosk – Utility Tracking

Performance Dashboard – normalized utility comparisons
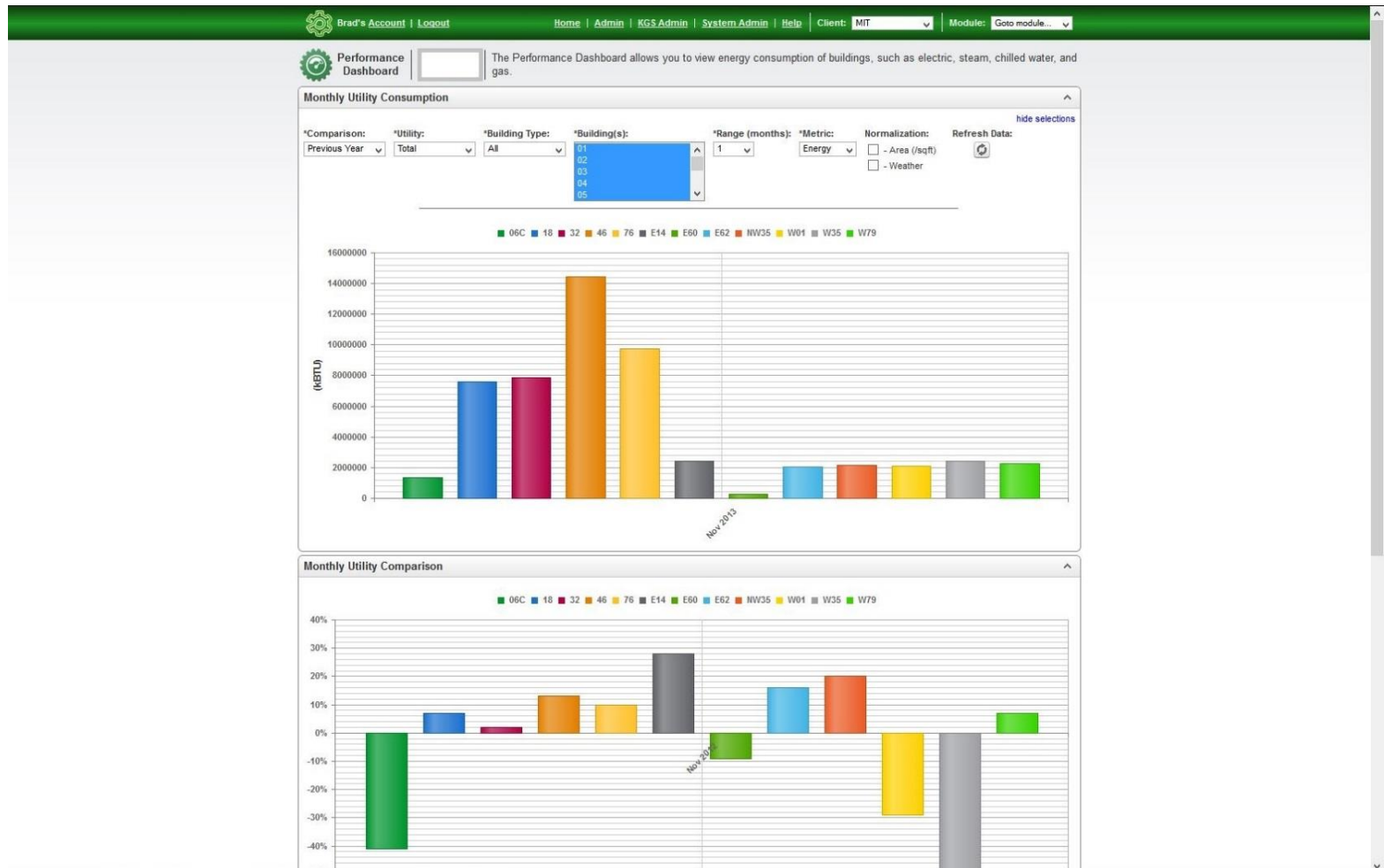
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Utility Programs

Currently Engaged with:

1) National Grid – 25 building pilot
2) NSTAR – submitting data driven EEM's under MOU
3) Comed – MBCx program
4) SDG&E – Emerging Technologies Program pilot

Biggest Drivers:

- Greater savings from ongoing MBCx delivery
- Persistence

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