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## **MBCx - Energy Efficiency Solution**

### 2010 Energy Efficiency - Portal to Profitability

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# Agenda

- How is Monitoring Based Commissioning (MBCx) different?
- How is MBCx implemented?
- What do we find?
- Where does this work?

# Common problems we hear from clients

You probably have explored many avenues to improve efficiency. And maybe you've run into some of these familiar barriers...

## Resources & Workflow

- Do you have the **adequate resources** to continuously watch over your energy usage?
- How much of your time do you spend on **reactive comfort and maintenance calls**?
- Do you have an **organized workflow** focused on Energy Efficiency?

## Technology

- Are your Metering and Building Management Systems **integrated**?
- Do you have the data to **view and analyze all of your energy cost drivers**?
- What is the length of your **feedback cycle** from changes you implement?

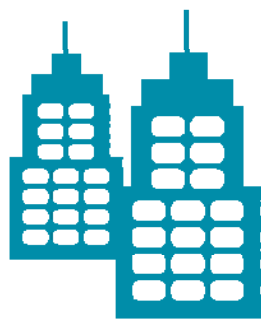
# MBCx Goes Beyond Retro-Commissioning

Unlike retro-commissioning, which heavily depends on a 'boots-on-the-ground' approach, MBCx focuses on **technological innovation to generate value.**

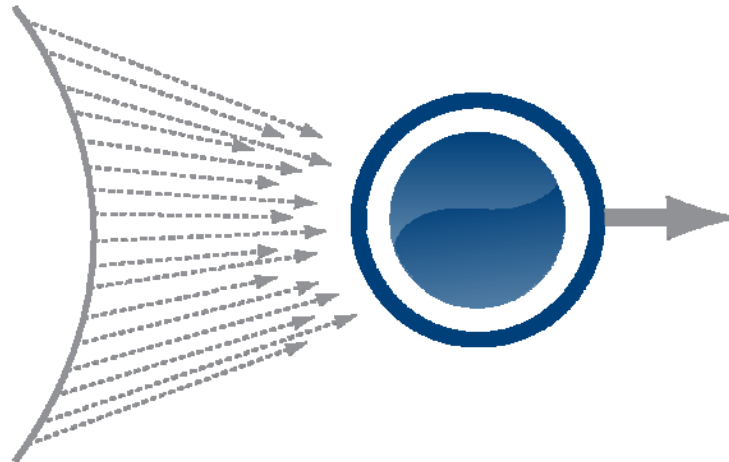
	Retro-Commissioning	MBCx
Energy Savings	One-time effort No M&V beyond Commissioning	Constant Commissioning Integrated M&V
Operational Impact	Popped tiles, sensors, dirty boots	One time walkthrough and audit, then all remote
Data Set	Temporary Samples	Permanent & Exhaustive
Energy Visibility	None	Integration with meter data, full campus visibility for workflow prioritization

# MBCx: Data Driven Energy Efficiency

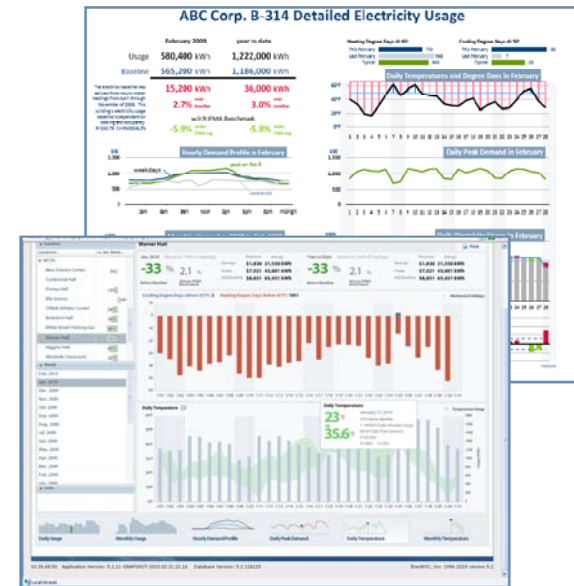
Data is captured at the meter and behind the meter, then software continuously looks for equipment-level savings opportunities.



Thousands of data points from throughout your facility...



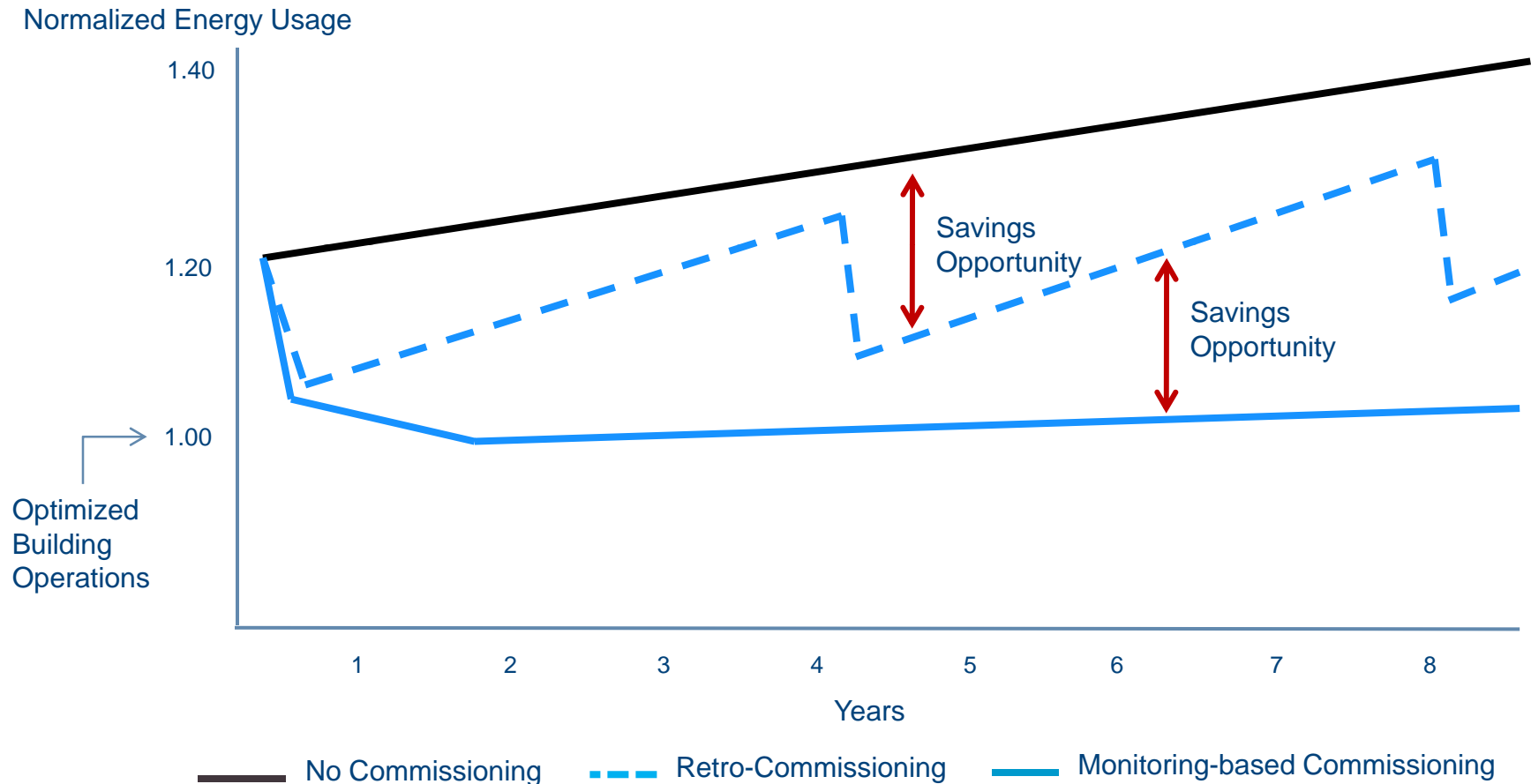
.... are collected and analyzed by...



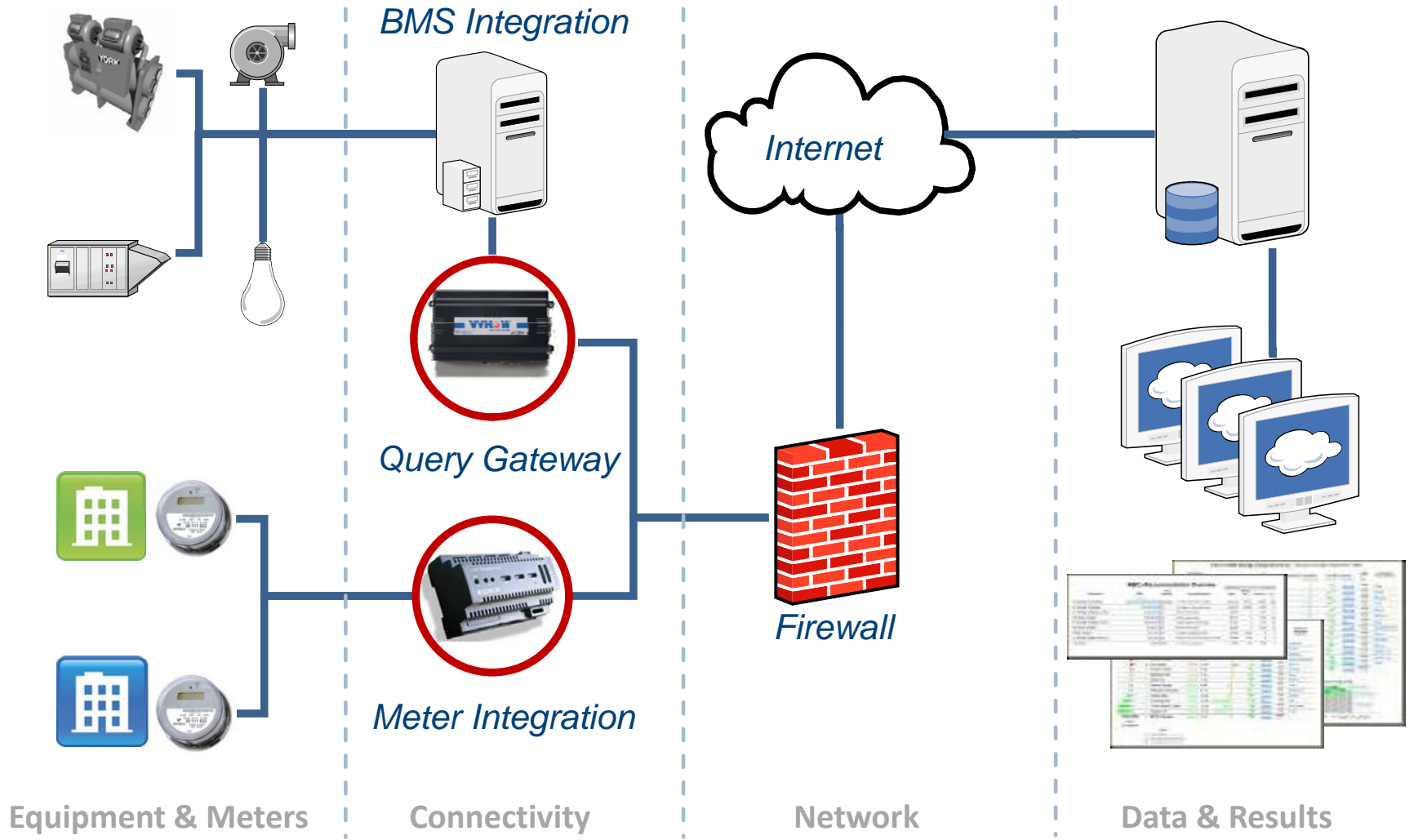
... and delivered in detailed energy dashboards and scorecards with savings recommendations

# MBCx sustains optimum performance

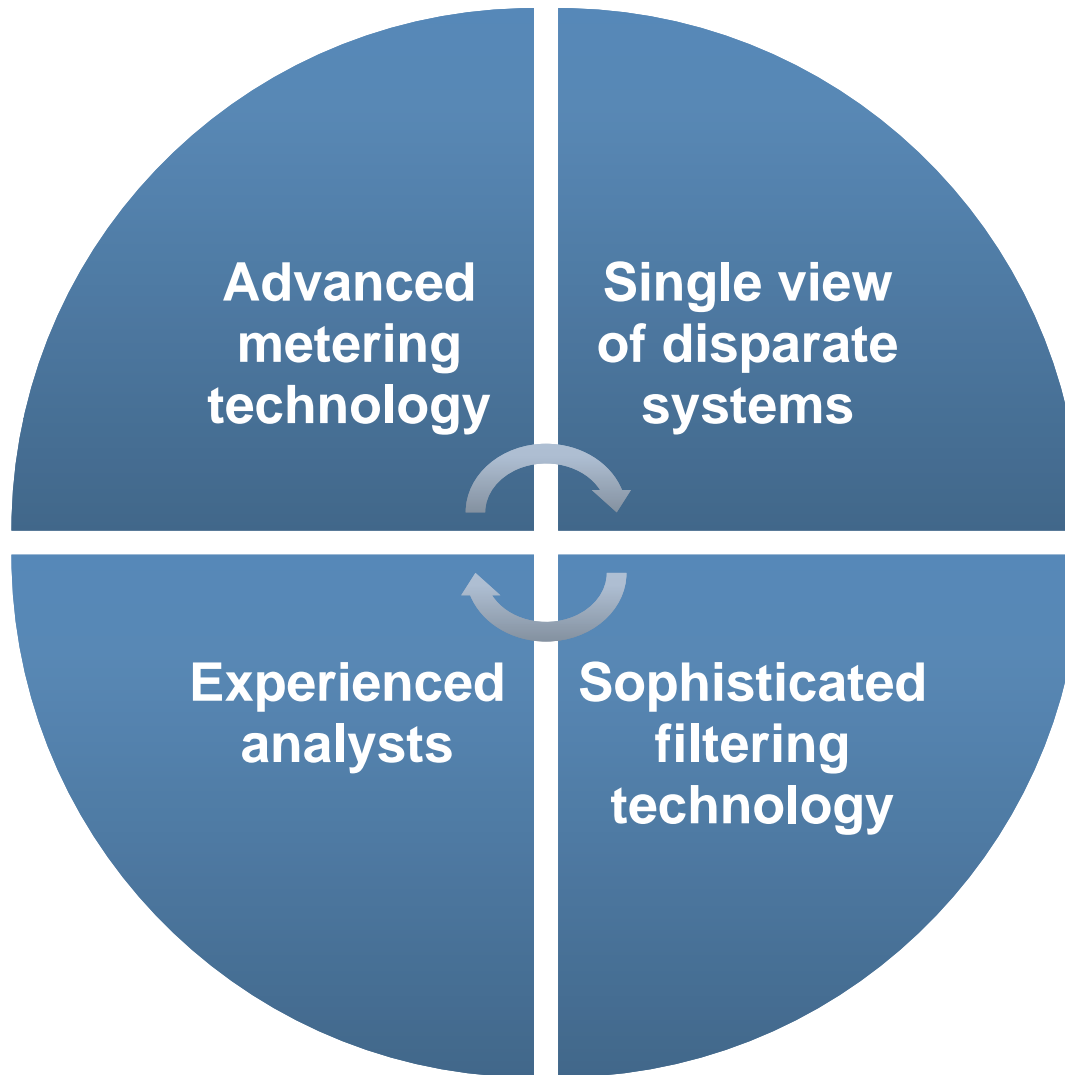
Building performance naturally degrades over time. MBCx uses building data and powerful algorithms to identify savings opportunities.



# MBCx Connectivity



# MBCx's Essential Components



# MBCx and the facility team drive results together

- Common picture of **overall energy use**
- **Actionable insight** for the on-the-ground team
- Ready identification of **energy efficiency opportunities**
- **Management of all measures** to completion or disqualification
- **Continuous M&V** of all measures



Reduce energy consumption  
Prioritize maintenance issues  
Enhance occupant comfort

MBCx can continuously collect and store data on a five minute basis, filter the data using standard technology, and serve it to energy analysts for assessment.

### Global Fault Detection & Tracking

- Set-point Error Tracking
- Sensor range checking
- Operating parameter out of range
- Pinned or flat-lined sensor
- Actual vs. Intended Schedule Analysis
- Equipment Manual Override Detection

### Cooling Plant

- Chiller Performance analysis - kW/Ton
- Optimum Chilled Water Supply Temperature
- Optimum Staging
- Optimum Condenser Water Supply Temperature
- Cooling Tower Fan Efficiency
- Low/High Temperature Differential Analysis
- Optimum Flow analysis
- Optimum Pump Utilization
- Optimum Thermal Storage Utilization

### Air Handling Units

- Economizer Operation
- Simultaneous Heating and Cooling
- Excessive or inadequate ventilation
- Demand Ventilation
- Air starvation
- Static pressure analysis
- Heating/Cooling Coil Efficiency
- Leaking Valve
- Optimum Start/Stop Analysis
- Air Filter Analysis- Dirty Filter

### Zones

- Set-point Analysis
- Heating Setback
- Cooling Set-forward
- Air Starvation Analysis Zone Comfort Analysis
- Indoor Air Quality Analysis

### Heating Plant

- Boiler Sequencing Optimization
- Boiler Combustion Controls
- Boiler Economizer
- Boiler Combustion Efficiency
- Boiler Burners Performance
- Boiler Blowdown
- Low/High Temperature Differential Analysis
- Boiler Efficiency Optimum Pump Utilization

### Terminal Units

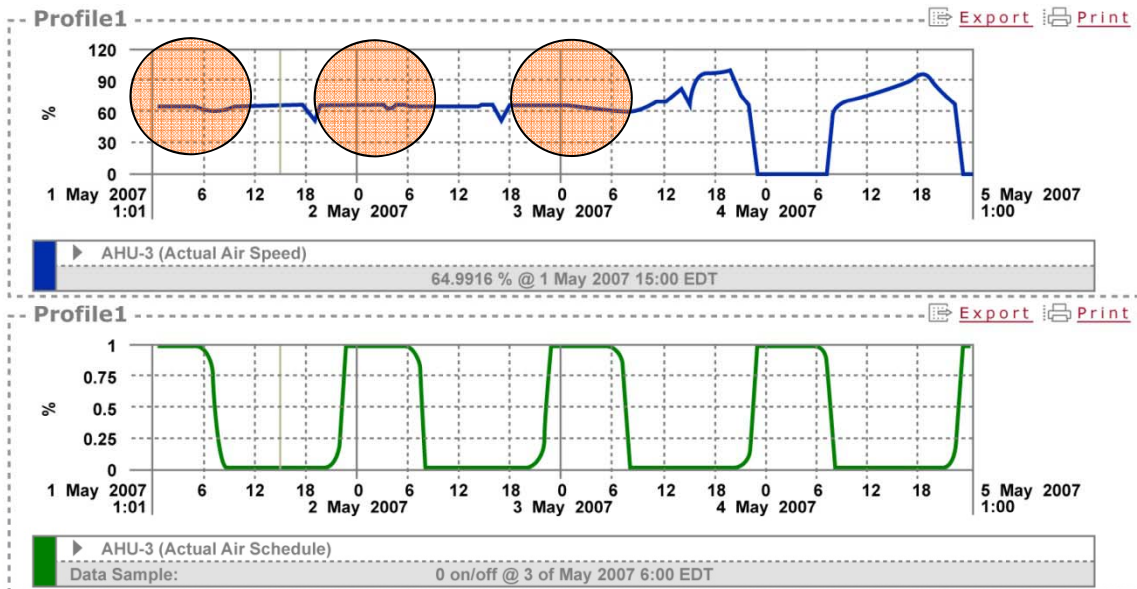
- Variable Air Volume Analysis
- Zone Reheat
- VAV Box Damper Modulation
- Excessive Cycling Analysis

# A Story about Operational Energy Savings



# Example: Air Handling Schedules

Facility managers often don't have the time to identify maintenance issues like equipment operating during off-hours. Increased costs are an undetected result.



The AHU schedule (green) shows a regular daily schedule. MBCx found that actual operation (blue) was in constant over-ride.

## Change in Schedule

Annual savings = \$21,000  
CO<sub>2</sub> avoidance = 102 tonnes

## Savings Category

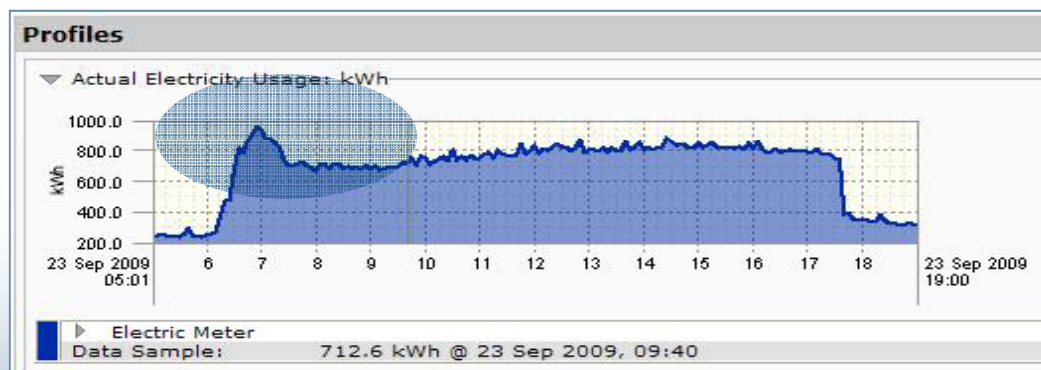
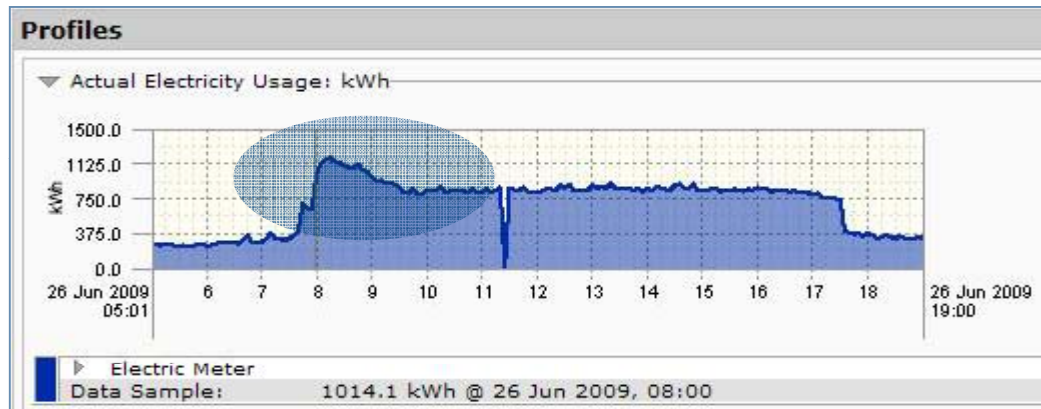
No cost

## Action Recommended

Enable auto-control. This unit was habitually overridden, but from continuous monitoring, each incidence was caught with minimal loss in energy savings. As a result of this measure new protocols were established for requesting off-hours usage to further limit this issue from re-occurring.

# Example: Demand Management

Peak charges are often ignored when equipment schedules are set up.



## Savings Category

No cost

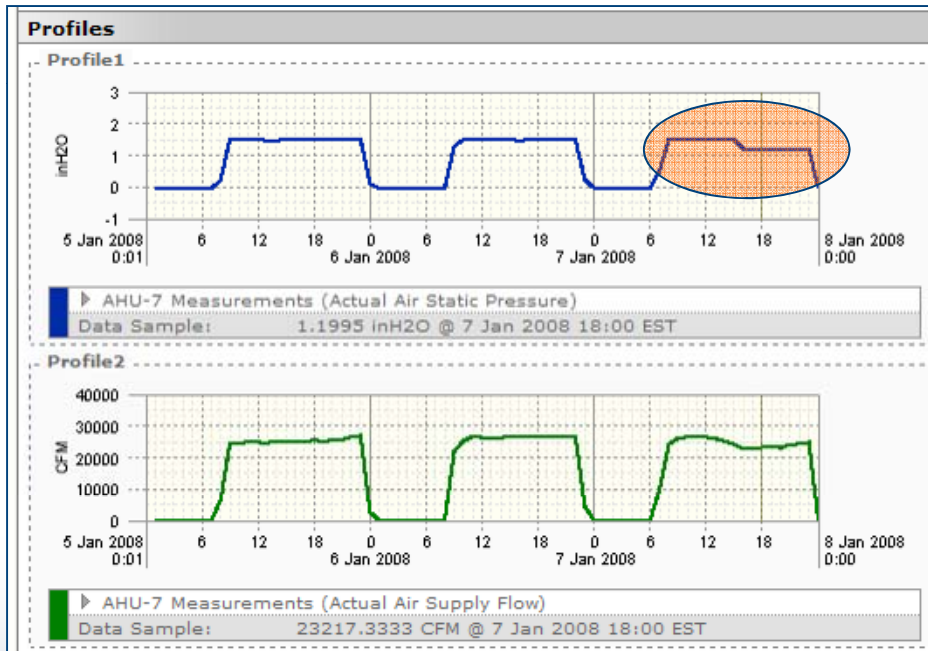
## Action Recommended

Analysts noticed that one customer's peak demand occurred just after 8 am when peak period pricing began.

A new sequence of operation which shifted the peak load to off peak, and reduced the peak by over 10%.

# Example: Static Pressure Reset

Supply air static pressure is often used to control fans and ensure adequate air flow. When pressure is too high actual air flow and fan power usage is higher than needed.



## Reduced Static Pressure

Annual savings = \$4,800  
CO2 avoidance = 22 tonnes

## Savings Category

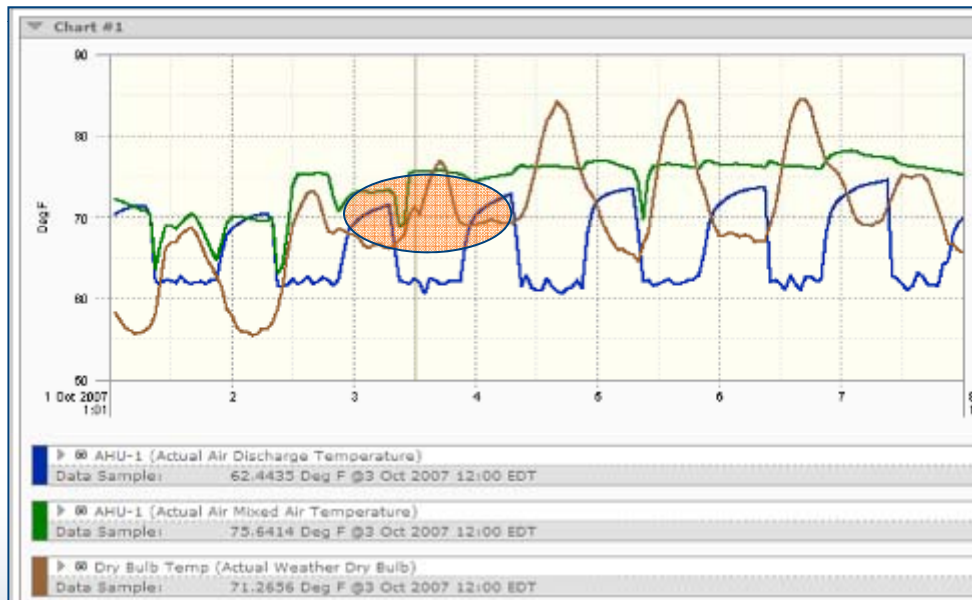
No cost

## Action Recommended

Based on continuous monitoring associated with small changes in static pressure, it was determined that a 20% reduction in set-point would work without impacting comfort. Actual savings was less than 'Fan-Laws' at 29% of previous usage.

# Example: Sub-Optimal Economizer

Often Mixed Air Temp (MAT) doesn't vary with Outside Air Temp, resulting in a higher than optimal MAT. Faulty damper action can cause the use of excessive Return Air Temp (RAT) resulting in higher energy usage.



## Repair damper

Annual savings = \$2,300

CO2 avoidance = 11 tonnes

## Savings Category

Low cost

## Action Recommended

Repairing the damper linkage control resulted in proper Economizer operation reducing energy usage.

# Value across all types of buildings

MBCx monitoring-based commissioning has delivered savings in all settings

	Addressable Spend	Delivered Savings	Savings as % of spend	Savings / sq ft
<b>Campus</b>	\$1,930,000	\$403,000	21%	\$0.30
<b>Office</b>	\$719,000	\$134,000	19%	\$0.27
<b>Hospital</b>	\$2,427,000	\$291,000	12%	\$0.35
<b>Technical Facility</b>	\$448,000	\$43,000	10%	\$0.28

# The Baseline in action in MBCx Dashboards

Unlike utility views, MBCx data is real-time and normalized for weather and occupancy.



The summary ribbon ties all the charts together in real time

Upper charts show usage with respect to the MBCx Baseline

Lower chart has usage and the MBCx Baseline

# MBCx Example Scorecard

Opportunities are summarized in a monthly report so that the user can focus on the highest value opportunities that fit into the capital budgeting process

These measures have been accepted and are currently being developed for implementation.

## Energy Efficiency Measures - In Progress

	Recommendation	Equipment	Net Present Value <small>10 Years @ 12% discount rate</small>	Estimated Cost	Payback <small>years</small>	Cost Category	Annual Savings			
							Value <small>\$/yr</small>	Electricity <small>kWh/yr</small>	Natural Gas <small>therms/yr</small>	CO <sub>2</sub> <small>tons/yr</small>
EEM 10	Re-enable AHU Night and Weekend Setbacks	AHU - 6	\$29,193	\$0	0.0	No cost	\$4,390	772	4,112	22
EEM 11	Waterside Economizer: Utilize Plate and Frame Heat Exchanger	Chiller 3	\$23,501	\$7,500	1.6	Capex	\$4,662	94,557	-	79
EEM 15	Optimize Chiller #3 Chilled Water Temperature Delta	Chiller 3	\$9,528	\$100	0.1	Low cost	\$1,448	29,366	-	24
EEM 16	Install Destratification Fan in Loading Dock and Remove Heater	HS-00378	\$8,367	\$2,000	1.3	Capex	\$1,559	-	1,473	8
EEM 8	Re-enable AHU Night and Weekend Setbacks	AHU - 1	\$8,203	\$0	0.0	No cost	\$1,234	292	1,152	6
EEM 9	Re-enable AHU Night and Weekend Setbacks	AHU - 2	\$7,595	\$0	0.0	No cost	\$1,142	283	1,066	6
EEM 17	De-lamp T8 Lamp Fixtures in Hallways and Offices	Hallway and Office Overhead Lamps	\$5,639	\$1,000	1.0	Capex	\$998	20,250	-	17
EEM 18	Lower Compressed Air Pressure	AHU - 1	\$4,583	\$100	0.1	Low cost	\$704	14,285	-	12
EEM 19	Replace T12 with T8 Fixtures in East and West Mechanical Rooms	East and West mechanical rooms Overhead Lamps	\$509	\$0	0.0	No cost	\$77	1,553	-	1
<b>All In Progress Measures</b>			<b>\$97,119</b>	<b>\$10,700</b>			<b>\$16,213</b>	<b>161,358</b>	<b>7,803</b>	<b>175</b>

What comes next: In the scorecard review meeting, tell us about upcoming plans for implementation. Let us know if you need more information or clarification.

# LEED 2009

## MBCx contributes to 8 credits in the Energy & Atmosphere category....

- SC-Zero is a concise document that summarizes all aspects of your building's operations

EAp1: Best Management Practices

Pre-Req

- The main focus of the MBCx service is on optimizing your energy efficiency performance

EAp2: Minimum Energy Efficiency Performance

Pre-Req

- The main focus of MBCx is to optimizing your energy efficiency performance

EAc1: Optimize Energy Efficiency Performance

1-18

- Monthly Scorecards continue to identify Energy Efficiency Measures

EAc2.1: Cx: Investigation & Analysis

2

- Implemented measures are continuously monitored and savings accumulate

EAc2.2: Cx: Implementation

2

- Continuous monitoring based Cx continually identifies new measures and ensure old measures persist

EAc2.3: Cx: Ongoing Commissioning

2

- Extensive information is gathered about your BAS and documented in SC-Zero

EAc3.1: Building Automation System

1

- Whole building emissions and emissions reductions are continuously calculated in ongoing Scorecards

EAc6: Emissions reduction reporting

1

## ... and 2 additional credits in the Innovation in Operations category

- MBCx service monitoring-based commissioning goes beyond standard energy management

IOc1:  
Exemplary  
Performance

1

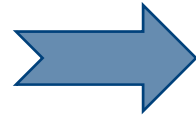
- MBCx is delivered by multiple LEED Accredited Professionals

IOc2:  
LEED APs

1

# Quantifying MBCx

Customer Vertical



Office



Health Care



Education

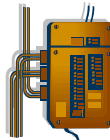
Customer Energy Spend



% of Load Managed by BMS



BMS Specs



## BACnet Compliant BMS required:

- Siemens Apogee
- Johnson Controls Metasys
- Honeywell EBI
- Alerton (native BACnet)
- Automated Logic (native Bacnet)

# Key Customer Benefits of MBCx

## Economic

- Energy Bill – persistent electric and heating bill savings
- Operations and Maintenance – systems that run more efficiently cost less to repair, maintain, and replace
- Utility Credit – utilities have incentive programs that can offset capital expenditures associated with MBCx

## Vocational

- OJT - staff are provided access to the tools that analyst uses to deliver savings. Technical training benefits are significant using real-time and historical data for each piece of equipment mapped from the BMS
- Lower Turnover – MBCx lessens the burden on existing staff, putting the team in “proactive management” vs. “reactive repair” mode

## Environmental

- LEED Points – MBCx generates six core points toward LEED certification (and up to five related points)
- Renewable Energy Certificates – many states are allowing efficiency measures to be counted as REC's – another source of income for MBCx

## Client Comfort

- Equipment Calibration – systems that run more efficiently create a healthier and more productive environment for occupants
- Reduced Hot and Cold Calls – many tactics to calibrate HVAC equipment increase client comfort and reduce hot and cold calls.