

Boston Marriott Copley Place

Energy Retrofit Project
– A case Study



Project Concept

- ▶ Any 1984 Facility needs systems help
- ▶ Corporate directive to save energy
 - 25% per room over 5 years
- ▶ Pay for the project with energy savings
- ▶ Back-of-the-House Systems
- ▶ Engineering RFP Process – Sebesta Blomberg

Recommended ECM's

- ▶ ECM-1: Improved schedule (occupied /un-occupied) for HVAC systems by upgrading controls and revising control sequences.
- ▶ ECM-2: Installing VFD's on (22) air handling unit (AHU) fans.
- ▶ ECM-3: Install Carbon Dioxide (CO2) sensors in the meeting and function rooms and return air ducts.
- ▶ ECM-4: Installing new Direct Digital Controls (DDC) on Variable Air Volume (VAV) box actuators, airflow and temperature.
- ▶ ECM-5: Installing humidity sensors and new economizer damper DDC actuators to provide dual -enthalpy control.
- ▶ ECM-6: Install VFDs on the constant volume AHUs serving the ball rooms.
- ▶ ECM-7: Install VFDs on (6) chilled water pumps to vary pump capacity to match the buildings cooling load and reduce energy consumption due to over pumping.
- ▶ ECM-8: Replace (25) existing motors with premium efficiency motors on AHU's and chilled water pumps.

▶ NSTAR

1. Upgrading Building Automation System and controls
2. Installing Variable Frequency Drives (on variable volume central air handling units and CHW pumps)
3. Replacing existing motors with premium efficiency motors

ENERGY PROJECT ROI ANALYSIS

BOSTON COPLEY MARRIOTT -- ENERGY ROI PROJECTS						
Annual kWh usage = 17,182,100	Peak Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Steam Savings (Mlb)	Annual CHW Savings (Ton-hrs)	Annual Energy Cost Savings	Project Cost Estimate
Building Automation System (BAS)						
<i>New PC -front end terminal, Programming and PM</i>						\$52,510
<i>CO2 sensors & O.A. controls for AHU's 1, 2, 4, 9, 12, 13, 14, 15, 19 & 20</i>						\$157,243
<i>DDC fan speed, space temp. for (9) Fan Coil units serving 3rd floor hall</i>						\$17,415
<i>Replace (70) existing pneumatic VAV/FPT w/new DDC terminal box</i>						\$116,541
<i>Replace actuators & CHW valves on AHU's 1, 2, 4, 9, 12, 13, 14, 15, 19 & 20</i>						\$172,340
<i>CO2 sensors & O.A. damper AH-3, 6, 7, 8, 10, 11, 16, 17, 18, 22, 23, 24, 25</i>						\$161,658
<i>DDC controls for (6) H&V units, (28) Exhaust Fans & (10) Supply fans</i>						\$74,825
<i>Replace (60) existing pneumatic CV/FPT w/new DDC terminal box</i>						\$100,554
<i>DDC control of HW Pumps P-1, 2, 3, 4, & 5 w/D.P.</i>						\$15,768
<i>Convert AHU-27 & 28 and VAV system over to new BAS</i>						\$34,215
<i>Convert (3) AHU's for Ballroom CV Systems to VAV</i>						\$43,055
BAS Totals=	44	669,000	950	243,000	\$235,390	\$946,124
Variable Frequency Drives						
<i>(22) VFD's for AHU's 1, 2, 4, 9, 12, 13, 14, 15, 19 & 20</i>						\$122,536
<i>(6) VFD's for CHW Pumps 1, 2, 3, 4, 5 & 6 & New Flow meter</i>						\$36,564
<i>(6) VFD's for 3- Ballroom AHU's</i>						\$31,678
VFD's Totals=	82	873,000	0	68,000	\$182,220	\$190,778
Premium Efficiency (PE) Electric Motors						
<i>(22) PE Motors for AHU's 1, 2, 4, 9, 12, 13, 14, 15, 19 & 20</i>						\$32,150
<i>(3) PE Motors for CHW Pumps</i>						\$11,625
Motor Totals=	10	33,000	0	0	\$5,940	\$43,775
Contingencies (10%)						\$118,070
	136	1,575,000	950	311,000	\$423,550	\$1,298,747

MARRIOTT COPLEY PLACE BOSTON

ATC UPGRADE POINTS LIST FOR HVAC EQUIPMENT

HVAC Equipment	OUTPUTS								INPUTS														Notes				
	Fans S/S	Cooling Valve (convert Pneumatic to electric)	Heating Stage	Electronic Analog	Pneumatic Analog	VFD Analog (see note)	VAV Floating	Pumps stop /start	TOTAL OUTPUTS	Supply Duct Temp.	Return Duct Temp.	Mixed Duct Temp.	Duct or Pipe Static Pressure	Space or return duct Humidity	Space Temp.	Space override	VAV Box CFM sensor	VAV Box Air temp.	VAV damper position	Fan/Pump proof CT	Water temp. Status/ Speed/CO2/KW/ Alarm	Outside air temp.		Outside air Humidity	Outside Light	Utility KWH Pulse	TOTAL INPUTS
AH 1	2	1	1	5		2		11	1		2	1	2	1		0	0				6						13
AH 2	2	1	8	5		2		18	1		2	1	2	1		0	0				6						13
AH 4	2	1	1	5		2		11	1		2	1	2	1		0	0				6						13
AH 5	2	1	1	5		2		11	1		2	1	2	1		0	0				6						13
AH 9	2	1	1	5		2		11	1		2	1	2	1		0	0				6						13
AH 12	2	1	1	5		2		11	1		2	1	2	1		0	0				6	1	1	0			15
AH 13	2	1	1	5		2		11	1		2	1	2	1		0	0				6						13
AH 14	2	1	1	5		2		11	1		2	1	2	1		0	0				6						13
AH 15	2	1	1	5		2		11	1		2	1	2	1		0	0				6						13
AH 19	2	1	1	5		2		11	1		2	1	2	1		0	0				6						13
AH 20	2	1	8	5		2		18	1		2	1	2	1		0	0				6						13
AH 27	2	1	11	4		2		20	2		2	1	2	1		6	6				6						26
AH 28	2	1	11	4		2		20	2		2	1	2	1		6	6				6						26
Total No. points for AHU	26	13	47	63	0	26	0	0	175	15	0	26	13	26	13	0	12	12	0	0	0	78	1	1	0	0	197

Project Overview

- ▶ Competitive Bidding
 - Interview prospective contractors
 - Check references
- ▶ NSTAR Timeline
- ▶ ECM's for
 - Schedules
 - VFDs for fan and pump motors
 - CO2 monitoring and control
 - VAV DDC Systems
 - Enthalpy Economizer Control
 - Motor replacement
 - New CHW Valves
- ▶ Test and Balance verification
- ▶ Project Commissioning

Project Challenges

- ▶ “What’s behind THAT wall???”
- ▶ “THIS wasn’t in the scope of work”
- ▶ “But we’ve ALWAYS done it this way”
- ▶ “Oh yeah, we’ve got this other problem...”
- ▶ When can we get into THAT room?
- ▶ “How many guys you got today?”
- ▶ “Are you done yet?”

Project Outcome – Savings

- ▶ Year 2007 baseline
- ▶ 2008
 - Reduced kwh by 474,000
 - Saved \$210,000
- ▶ 2009
 - Reduced kwh by 2,915,000
 - Saved \$ 570,000
- ▶ Overall 20% electrical use reduction

Project Outcome – Summary

- ▶ Total project cost
 - Including professional services
 - LESS Utility Rebate
 - Net Cost \$ 1,102,747
- ▶ ROI 2.67 Years
- ▶ ROI Actual was within 1% of Sebesta original projections

How did we do?

- ▶ Business
 - Financials
 - Ongoing work
- ▶ Relationships
 - Business
 - Personal
- ▶ Discrepancy List
 - Valves
 - Misc items...

Project Success Factors

- ▶ Solid Scope of work documented in the RFP
- ▶ Establish procedures for daily work
- ▶ Close daily communication with Engineering
- ▶ Cooperation with all facility support groups
 - Executives
 - Housekeeping
 - AV
 - Food Service
 - Engineering
 - Ibahn – network

Alerton Envision Software by ABS: Custom Facility Scheduling Application

Envision for BACTalk - ABSYST/BMCP

Friday, 4/2/2010 4:58:55PM
 Outside Air Temp 52.3 °F
 Outside Air Humidity 59.1 %Rh
 Outside Air Enthalpy 17.9 Btu/lbs.

3rd/4th/5th Floor Scheduling

Previous

Preset Schedule Groups

0	CONTINUOUS OFF
1	CONTINUOUS ON
2	5:00am to 9:00pm
3	5:00am to 11:00am
4	5:00am to 2:00pm
5	5:00am to 6:00pm
6	10:00am to 2:00pm
7	12:00pm to 2:00pm
8	2:00pm to 4:00pm
9	3:00pm to 6:00pm
10	3:00pm to 1:00am
11	4:00pm to 8:00pm
12	6:00pm to 9:00pm
13	5:00pm to 1:00am
14	11:00pm to 6:00am

Custom Schedule Groups

15 Custom Group 15
 Custom 7:00am to 12:00am

Right Click on Pilot Light to Edit Schedules for Custom Groups

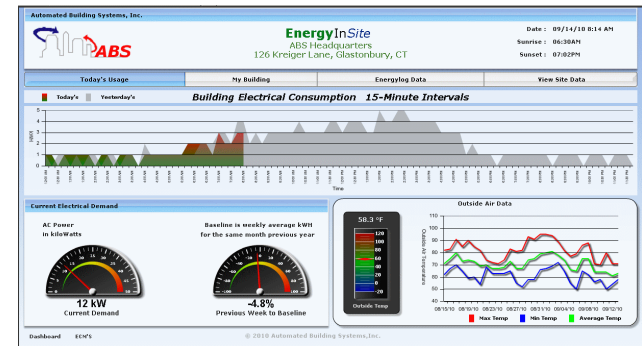
3rd Floor		4th Floor		5th Floor	
Area	Group	Area	Group	Area	Group
University Meeting Rooms		Ballroom		State Meeting Rooms	
Boston University Room	0	Salon A	0	Connecticut Room	0
Brandeis Room	0	Salon B	0	Maine Room	0
Harvard Room	0	Salon C	0	Massachusetts Room	0
MIT Room	0	Salon D	0	New Hampshire Room	0
Northeastern Room	0	Salon E AH-8	0	Rhode Island Room	0
Regis Room	0	Salon F AH-7	0	Vermont Room	0
Simmons Room	0	Salon G AH-6	0	Common Areas	
Suffolk Room	0	Salon H	0	Event Design Center	0
Tufts Room	0	Salon I	0	Pool Equipment Room	2
Wellesley Room	0	Salon J	0	Sales/Event Offices	5
Back Bay Conference Area		Salon K	0		
Arlington Room	0	EF/G Prefunction (AH-5)	0		
Berkeley Room	0	Cape Cod Meeting Rooms			
Clarendon Room	0	Falmouth Room	0		
Dartmouth Room	0	Hyannis Room	0		
Exeter Room	0	Nantucket Room	5		
Fairfield Room	0	Orleans Room	0		
Gloucester Room	0	Provincetown Room	0		
Common Areas		Vineyard + Yarmouth Rooms	0		
Service Corridor	0	Common Areas			
Foyer Outside MIT Room	0	Registration	0		
Gloucester Corridor	0	Atrium Area	0		
Atrium Area	0				
AV Room	5				
Coffee Room	0				

Comfort, Savings & Knowledge Through Innovation

Did we learn anything?

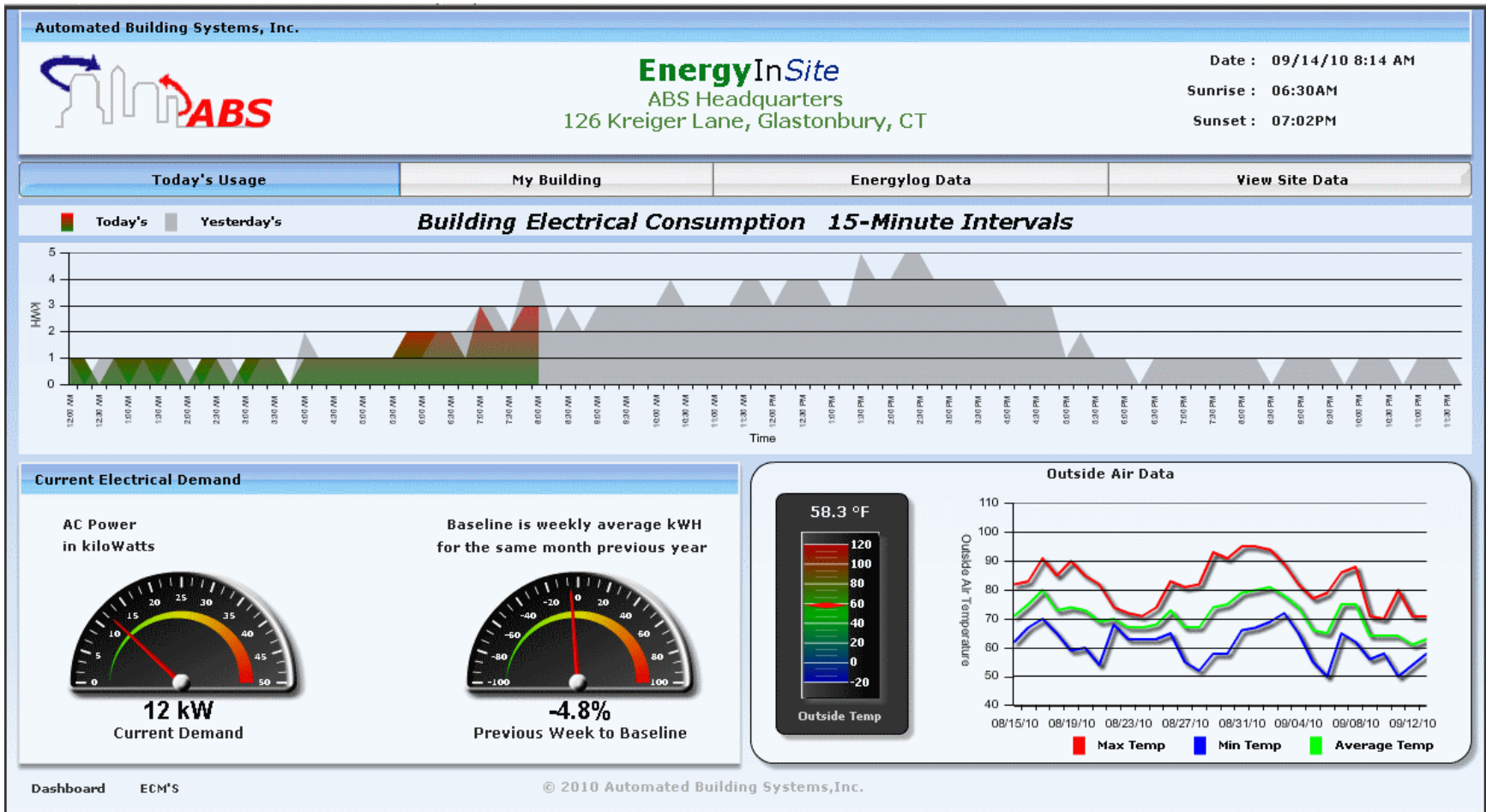
- ▶ Commissioning is key.
- ▶ Simple is better: If it ain't broke..
- ▶ Customer training for the culture change

ABS – Energy InSite™ Dashboard



- ▶ Custom display of facility energy use
- ▶ Single building or Campus
- ▶ Multiple users concurrently view, in real-time, electricity, gas, water and BTU consumption
- ▶ Measure performance of ECMs over time with integrated M&V component
- ▶ Carbon Footprint Calculator –accurate and current
- ▶ Historical reporting
- ▶ Financial Reporting, and more!
- ▶ <http://gogreen/absddc.com> for online demo

ABS – Energy InSite™ Dashboard



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