

# Achieving Operational Excellence

*Energy Efficient Operations in a Shrinking Budget Environment*

**2010 Energy/Facilities Connections Conference**

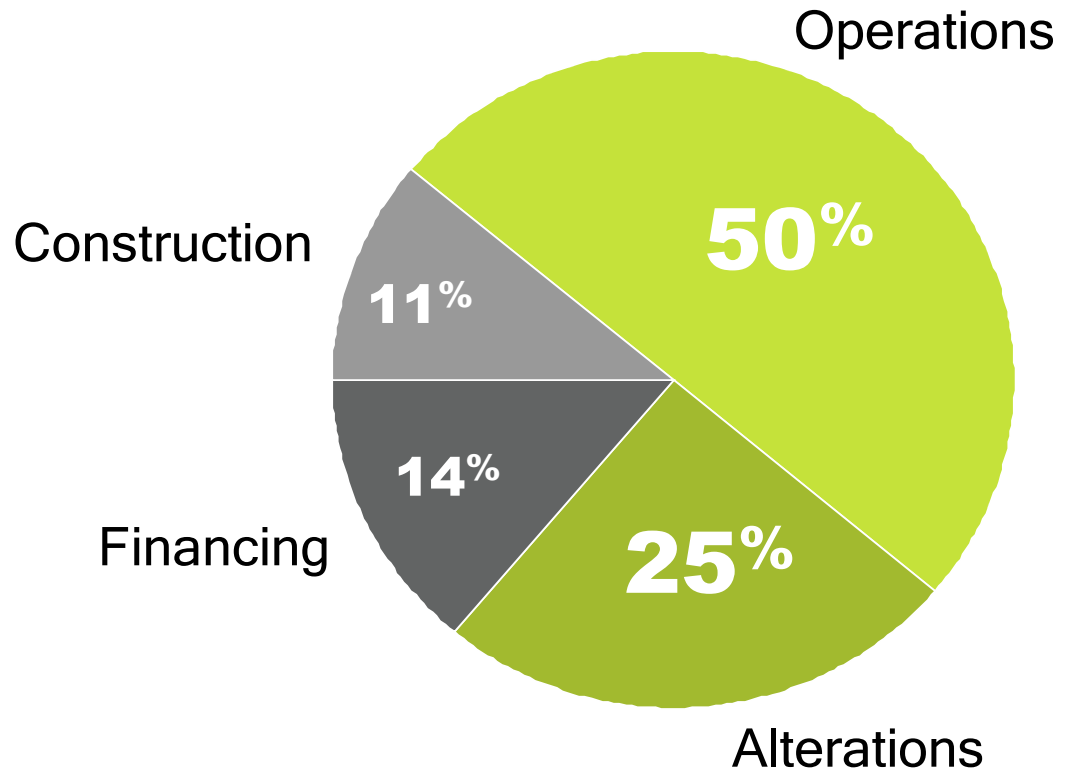
*Innovative Approaches for a New Decade*

## DID YOU KNOW?



- Nine out of ten commercial buildings fail to meet fundamental conditions for acceptable comfort and energy efficiency.
- 42% of newly LEED constructed buildings miss their energy targets.
- 70% of energy is consumed by buildings less than 200,000 sq. ft.
- With optimal energy performance, utility costs of a building can be lowered as much as 50%.
- 80% of all CO<sub>2</sub> attributed to commercial buildings comes from electricity consumption.
- Single biggest opportunity to reduce operating expense and impact on the environment is through energy efficient operations.

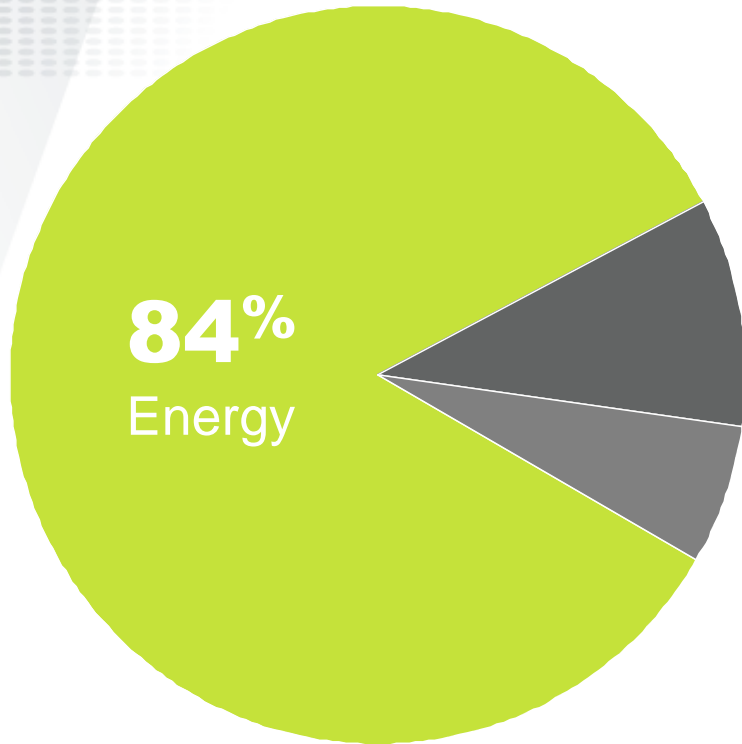
# TOTAL COST OF OWNERSHIP



**75%** of a building's ownership cost occurs after construction.

# HOW ENERGY IS USED

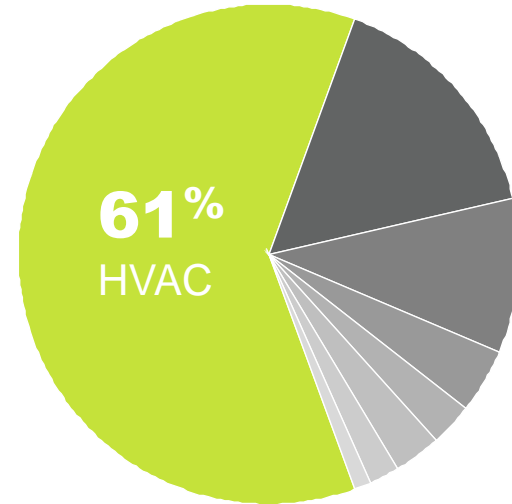
## Monthly Utility Costs



**10%** Water Sewer

**6%** Rubbish

## Energy Usage



**16%** Lighting

**10%** Plug Load

**4%** Elevators

**3%** Critical Load

**3%** Garage

**2%** Kitchen

**1%** Water Heaters & Circulation Pumps

**0%** Retail

# EFFICIENCY-FIRST PROCESS

achieving operational **EXCELLENCE**





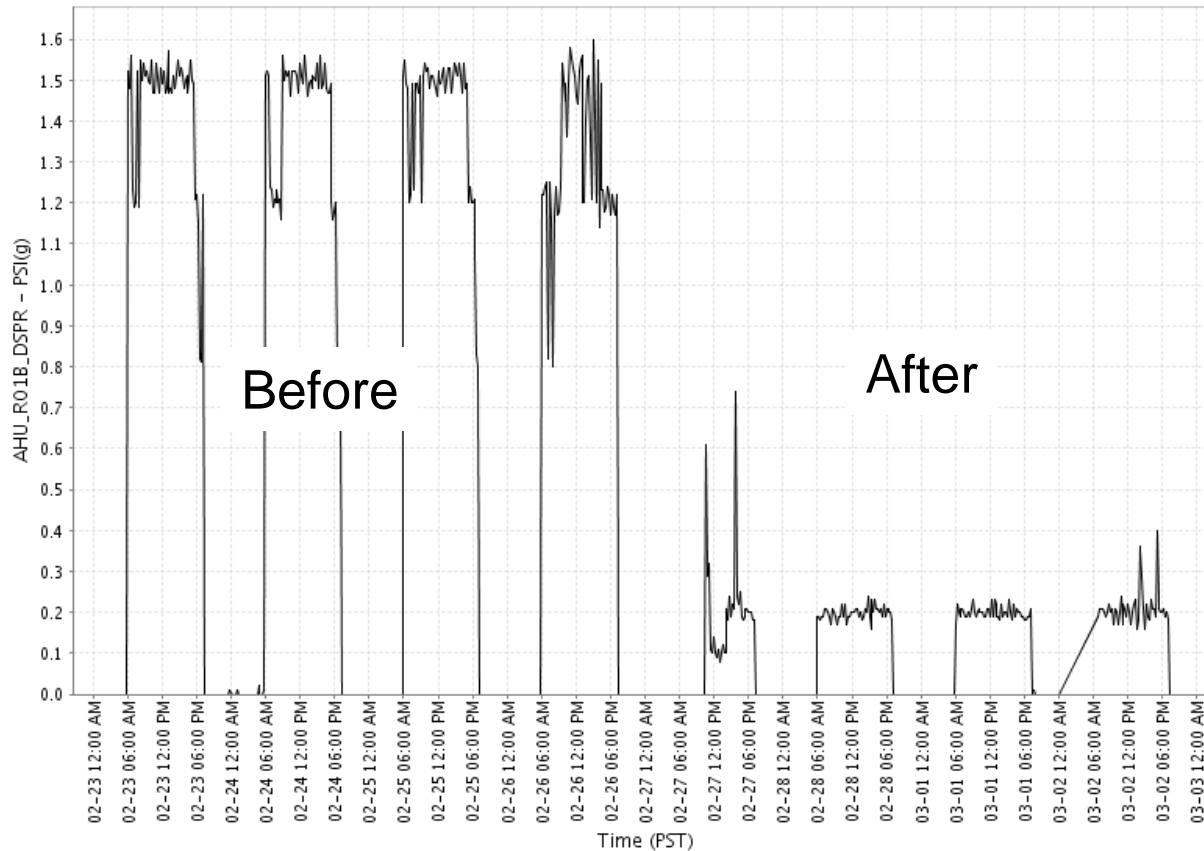
# TYPICAL FINDINGS

- Loosely defined temperature & pressure set points
- Systems fighting each other due to conflicts in schedules and sequences
- Unstable control loops
- Over ventilation
- Lack of proper economizer control
- Improper or no reset strategies
- Systems running wild
- Poor control reference locations



# EXAMPLE OF A TYPICAL SITUATION

## Air Handler Discharge Static Pressure Reset Strategy



Control change resulted in a 45% reduction in gas consumption & a 3% reduction in electricity consumption compared to same month in previous year with fewer heating degree days.

## **BELLEVUE REGIONAL LIBRARY**

- 76,000 sq.ft. regional library
- Reduced energy cost per square foot by \$0.71
- Objective-driven commissioning of systems
- Simple payback = 2.3 years
- Reduced comfort calls from 50 to fewer than 5 per year
- Average annual energy savings of \$54,921 per year
- 28.9% reduction in energy consumption



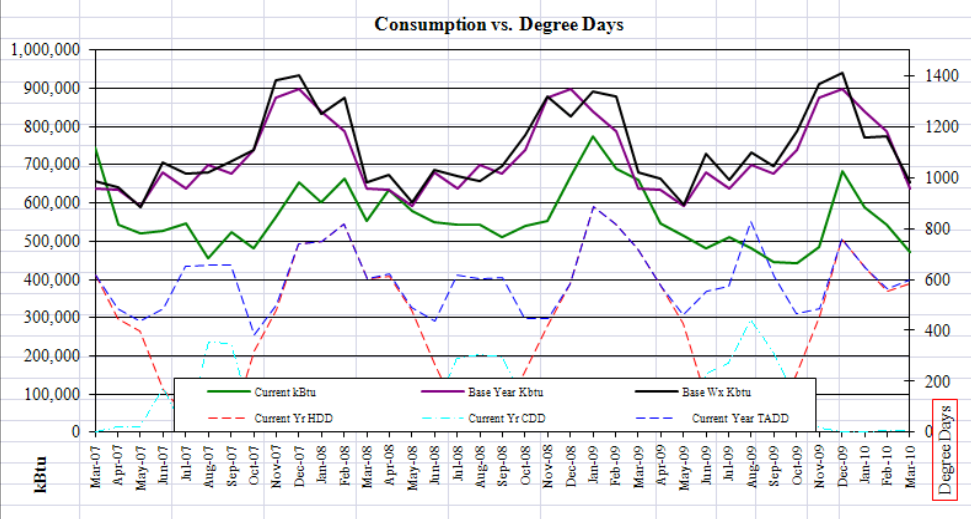
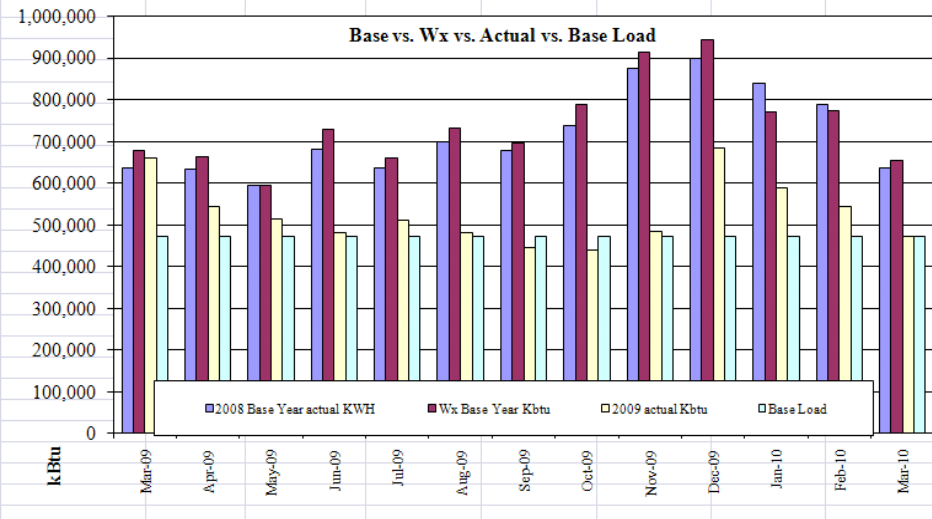
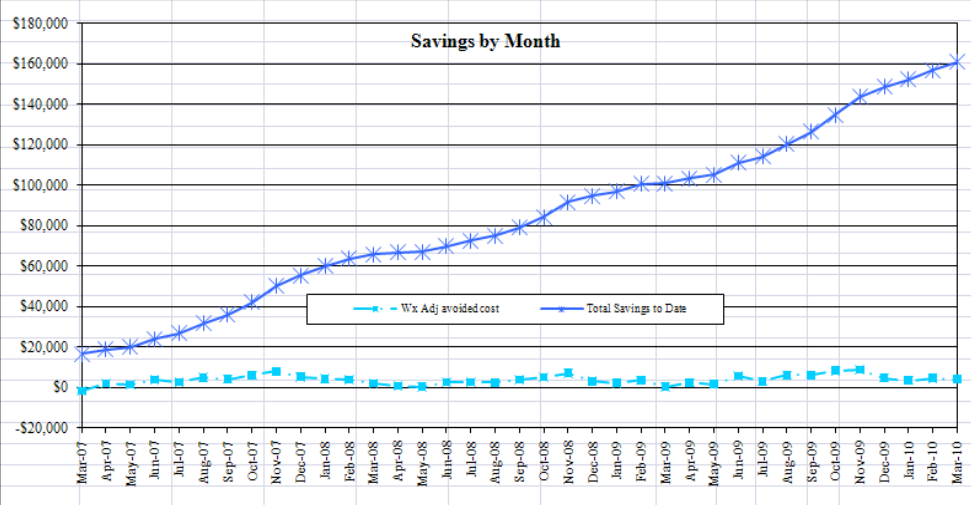
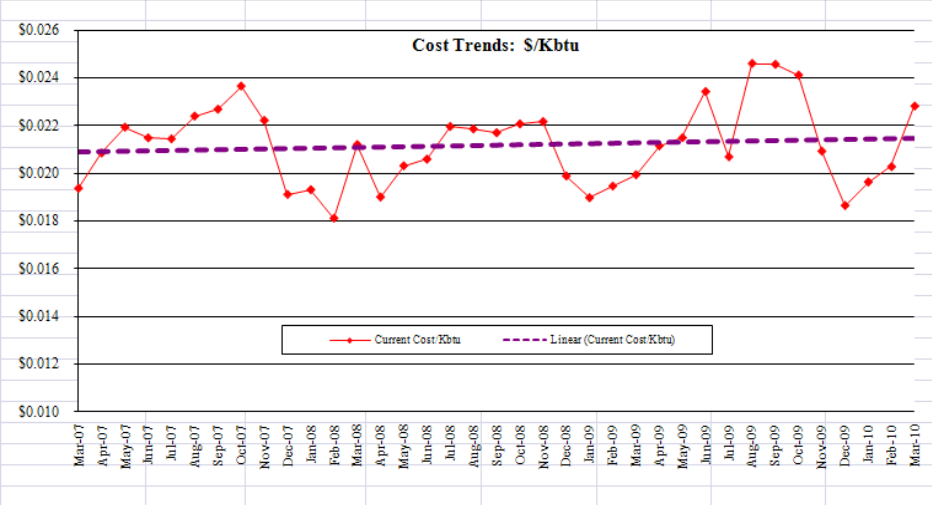


# Energy Optimization Report Card

Customer	0				Month		
Square Footage	76,950	(GROSS)			< >		
Facility Usage	Public Library				Mar-2010		
Base year period	Jan-05	Dec-05		HVAC LOAD	35.0%		



DATA	Base Y AVG	Current	Change	Load Factors (Annualized)			COST / mBtu			Financials			
EUI	113.07	80.42	33	Electrical 75.61%			Gas \$12.04			Used for tracking Energy investments			
ESR	0	0	0	Gas 24.39%			Ele \$25.41			Current			
S/SQFT	\$2.47	\$1.76	-\$0.71	Steam 0.00%			Stm \$0.00			YEARS			
S/Annual	\$190,184	\$135,263	\$54,921	Actual Savings			Weather Adjusted Avoided Cost			Projected 3Yr			
(Red) costs/savings are at current annualized energy rates.				This Month	12 Months	Annual savings	Annual Target	Annual DELTA	This Month	12 Months	Contract to Date	Projected 3Yr	
				\$3,792	\$55,043	\$54,921	\$0	\$54,921	\$4,175	\$60,026	\$161,070	Projected 3Yr	
				above projected savings							Projected 3Yr		
				0							Projected 3Yr		
				\$4,175							Projected 3Yr		
				\$60,026							Projected 3Yr		
				\$161,070							Projected 3Yr		
				\$161,070							Projected 3Yr		



## WASHINGTON MUTUAL CENTER

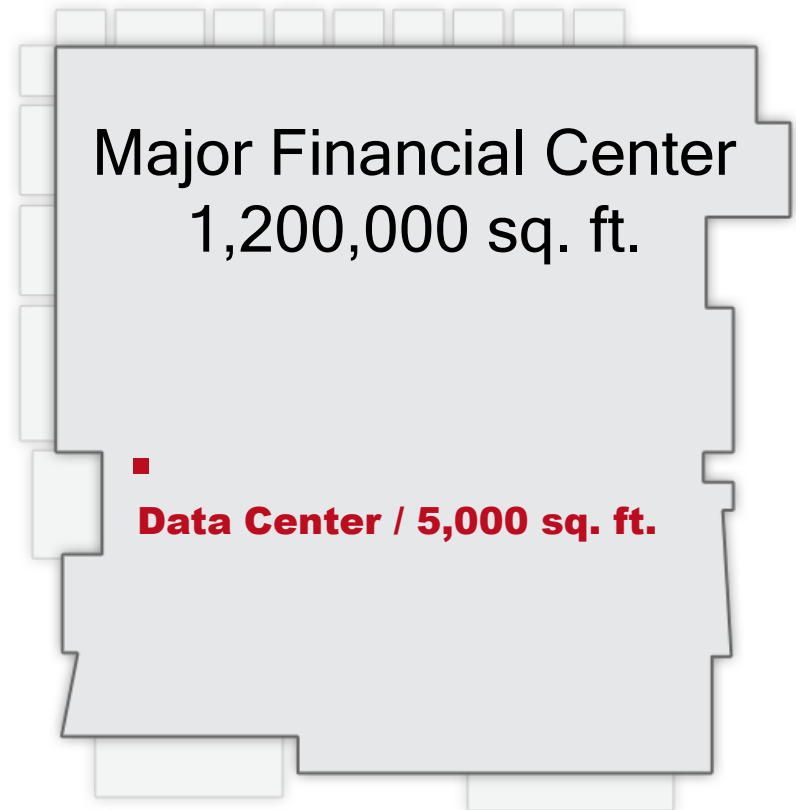
- 1.2 million sq.ft. financial office building
- Commissioned in 2006
- State-of-the-art systems were not performing optimally
- Central plant's operating parameters were for a 5,000 sq. ft. data center
- Chilled water set point  
40°F versus 52°F
- No chillers running  
4-6 Months of Year
- Carbon reduction of 2,010 tons
- Energy cost per sq.ft. = \$0.71
- **Energy Star Rating = 100**  
Certified December 2008  
First in nation



# DESIGN VERSUS LOAD-BASED CRITERIA

Central plant designed and commissioned for a 5,000 sq. ft. data center.

Load-based control strategies allowed reset of chilled water supply temperature from 40°F to 52°F without any negative effect to the data center.



# Seattle High Rise

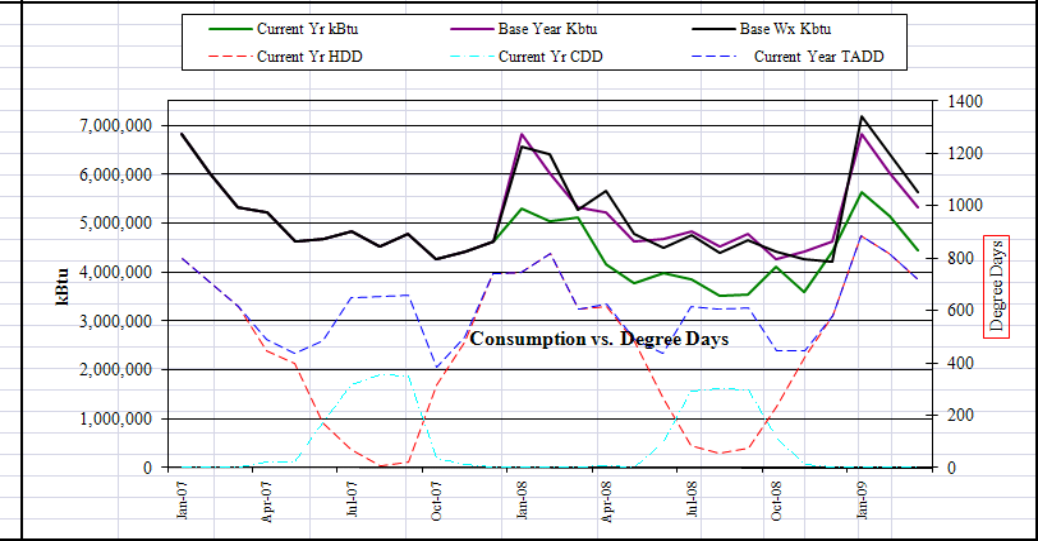
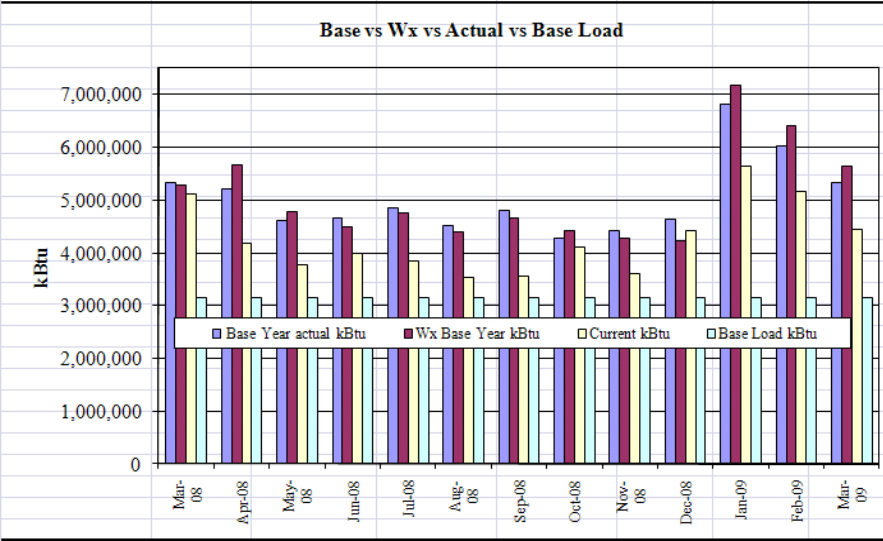
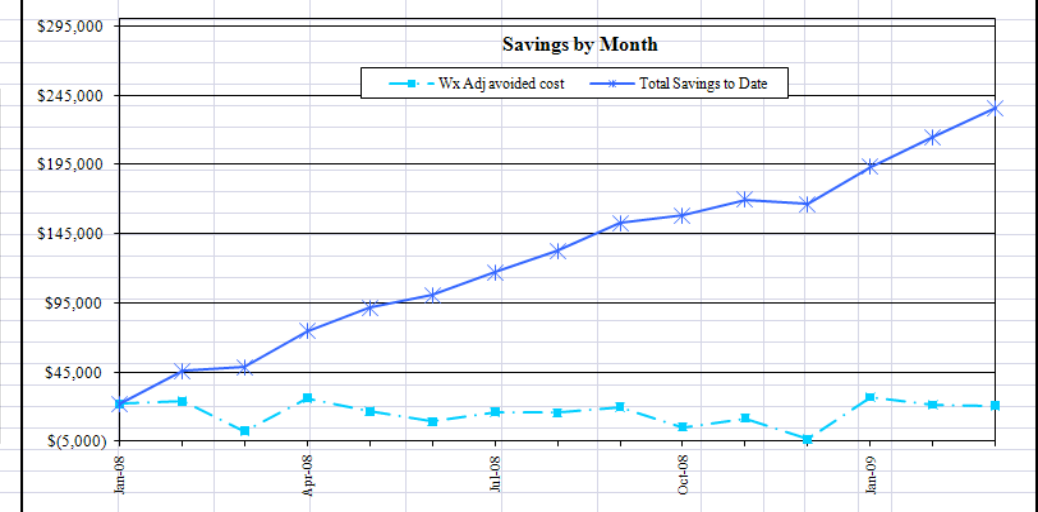
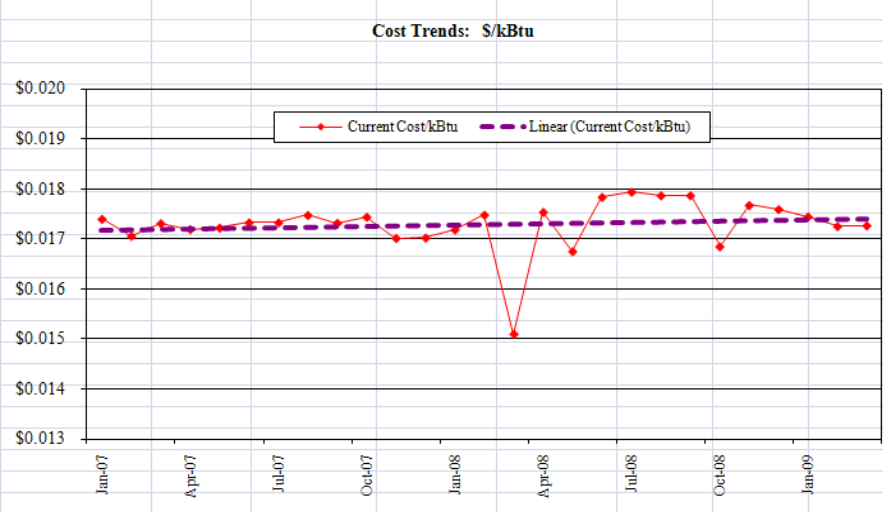
Customer: MMFS  
 Square Footage: 1,232,179 (GROSS)  
 Facility Usage: Administrative/Professional office  
 Base Year: 2007

## Energy Optimization Report Card

3/19/2008 Cut off date for billing period



ENERGY STAR	Dec-07	Mar-09	Change	Load Factors (kBtu Annualized)						COST (mBtu annualized)				Financials						
	EUI	52.56	40.75	-12	Electrical	89.75%	Gas	3.64%	Steam	6.60%	Ele	\$17.05	Gas	\$12.12	Stm	\$35.66	Used for tracking Energy investments	INV	\$0	Current
	ESR	97	100.00	+3	Actual Savings						Weather Adjusted Avoided Cost				ROI	#DIV/0!	Current			
	\$/SQFT	\$0.92	\$0.71	-\$0.20	This Month	YTD	12 Months	Annual savings	Annual Target	Annual DELTA	This Month	YTD	12 Months	Contract to Date	ROI	#DIV/0!	Projected 10Yr			
Above costs are at current annualized energy rates.				\$15,365	\$50,857	\$174,632	\$254,458	\$0	\$254,458	\$20,830	\$69,433	\$187,404	\$235,853	IRR	#VALUE!	Current				
Degree Days	12 mnth avg	Increase	0.98%	Annually			Environmental			Annually			IRR	#VALUE!	Projected 10Yr					
kBtu Usage	12 mnth avg	Decrease	-20.28%	Actual CO2 Savings	1885	Metric Tons	Avoided CO2 Savings			1903	Metric Tons									
Usage WX	12 mnth avg	Decrease	-21.34%																	
kBtu Annual	Overall Usage	Decrease	-22.46%																	





## **32001 FEDERAL WAY BUILDING**

- 110,000 sq.ft. office building
- Energy Star Rating of 87 - up 11 points
- Every invested \$1.00 has yielded a return of \$1.71
- Carbon reduction of 168 tons
- Total investment of \$23,932
- Energy consumption down 16.8%
- Objective-driven tuning of building automation system
- Adaptive set point control
- 100% reduction in comfort calls





# Office Building Federal way

# Energy Optimization Report Card

Customer: GVA Kidder Mathews  
 Square Footage: 110,511 (GROSS)  
 Facility Usage: Professional Office  
 Base year period: Jan-07 Dec-07

Month: Mar-2010



DATA	Base Y avg	Current	Change
EUI	69.25	57.61	- 12
ESR	76	87	11
S/SQFT	\$1.90	\$1.58	-\$0.32
S/Annual	\$210,469	\$175,109	\$35,360

(Red) costs/savings are at current annualized energy rates.

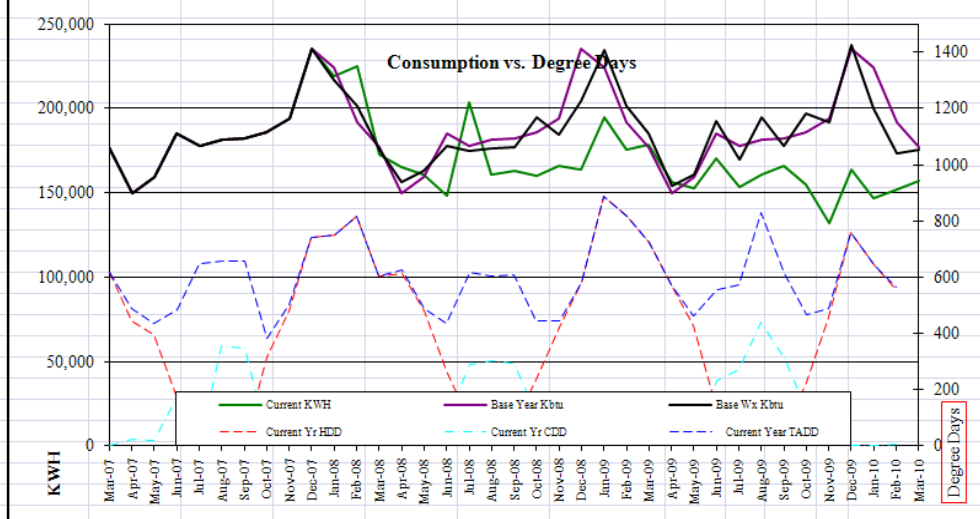
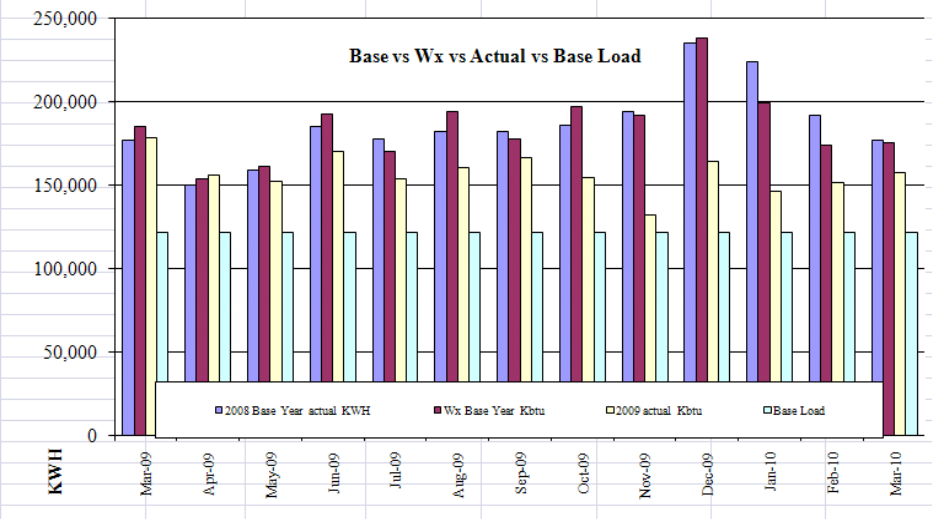
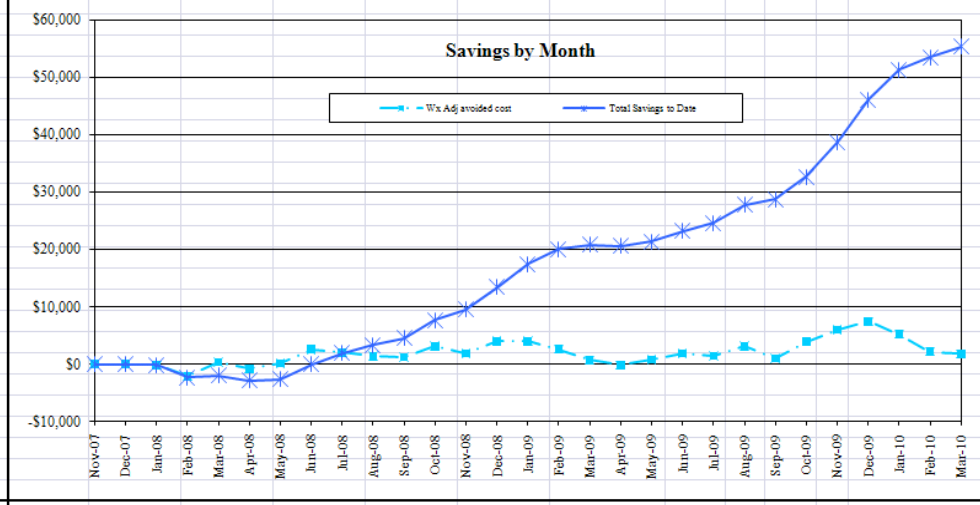
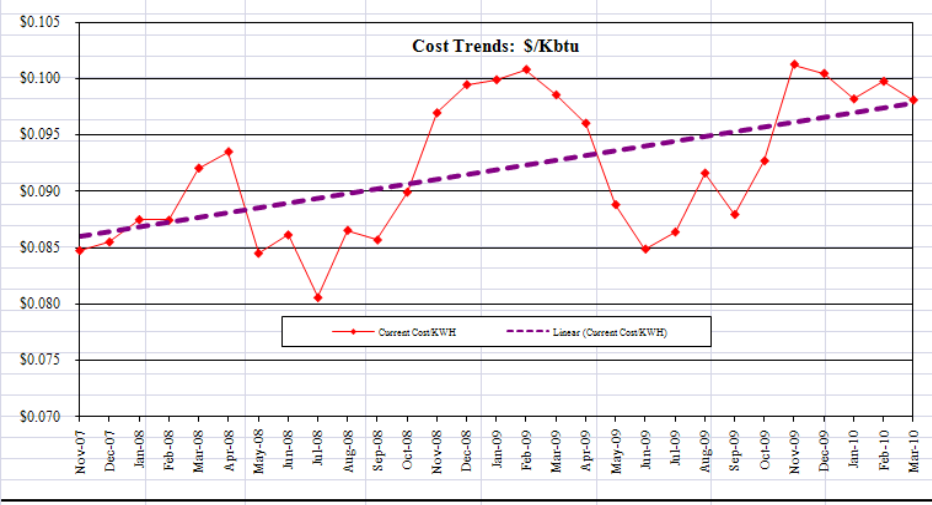
Degree Days	12 mnth avg	Increase	1.95%
Kbtu Usage	12 mnth avg	Decrease	-15.58%
Usage WX	12 mnth avg	Decrease	-15.18%
kBtu Annual	Overall Usage	Decrease	-16.80%

Load Factors (Annualized)			
Electrical	100.00%	Gas	0.00%
Steam	0.00%	Ele	\$27.45
		Gas	\$0.00
		Stm	\$0.00

Actual Savings				Weather Adjusted Avoided Cost		
This Month	12 Months	Annual savings	Annual Target	This Month	12 Months	Contract to Date
\$1,942	\$36,411	\$35,360	\$24,792	\$1,788	\$34,509	\$55,273

42.63% above projected savings

Financials		
INV	\$29,955	Current
SPB	1.19	YEARS
ROI	70.83%	Projected 3Yr
IRR	53.59%	Projected 3Yr
NPV	\$49,093	Projected 3Yr
ROI	916.74%	Projected 10Yr
IRR	82.46%	Projected 10Yr
NPV	\$299,010	Projected 10Yr



## WELLS FARGO CENTER

- 1,065,000 sq.ft. office building
- Variable speed / variable pumping conversion of central chilled water plant
- DDC system upgrade of floor by floor AHUs
- Continuous commissioning of building systems
- Energy Star rating of 92 - up 7 points
- Carbon reduction of 1,196 tons
- March 2010 annual energy cost \$0.93 sq.ft.
- Avoided cost of \$254,704 from March 08 to March 2010



# Seattle Hi-rise 2

# Energy Optimization Report Card

Customer  
 Square Footage 1,065,653 (GROSS)  
 Facility Usage Admin/Professional Office  
 Base year period Apr-2007 / Mar-2008

12/19/2009 Cut off date for billing period  
 Plot Line/Month  
 Mar-2010



DATA	Apr-08	Current	Change
EUI	65.31	53.70	- 12
ESR	85.00	92	+ 7
S/SQFT	\$1.11	\$0.93	-\$0.19
S/Annual	\$1,183,226	\$985,923	\$197,303

(Red) costs/savings are at current annualized energy rates.

Load Factors (Annualized)		
Electrical	100.00%	
Gas	0.00%	
Steam	0.00%	

COST / mBtu		
Ele	\$17.23	
Gas	\$0.00	
Stm	\$0.00	

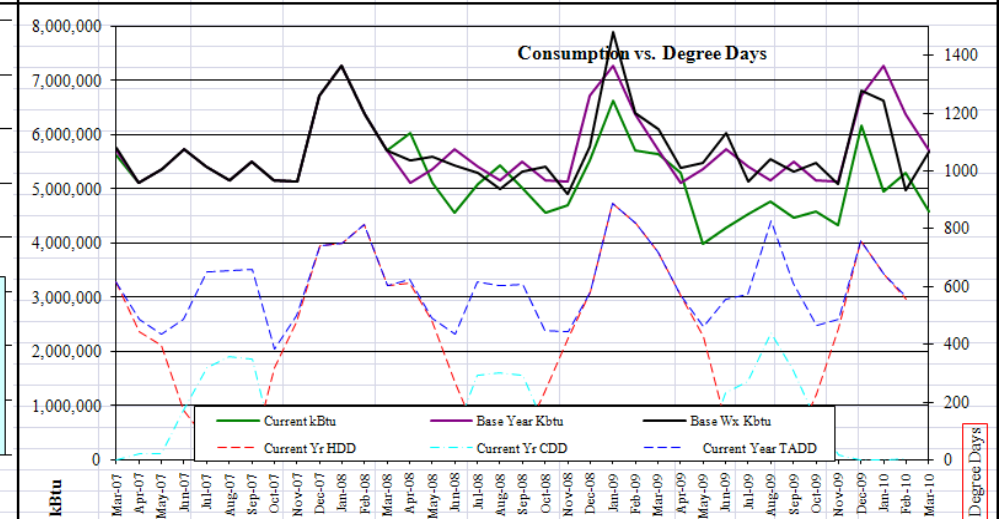
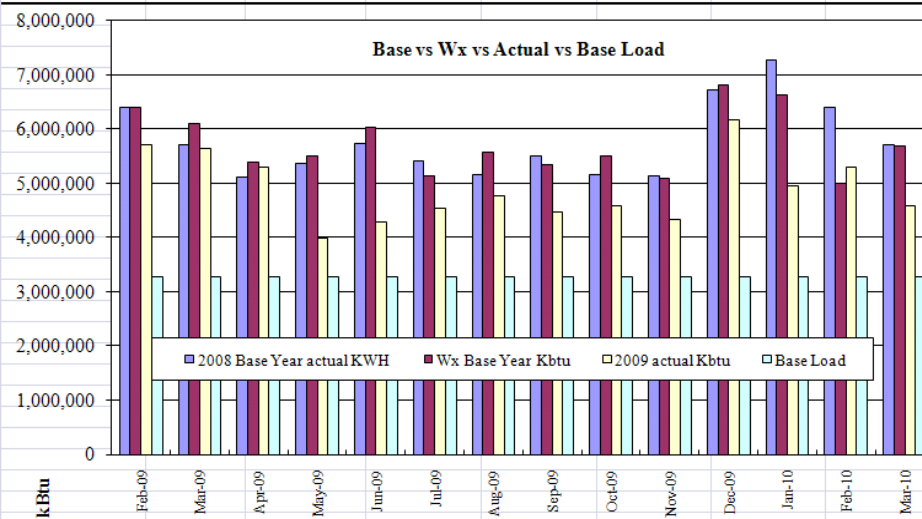
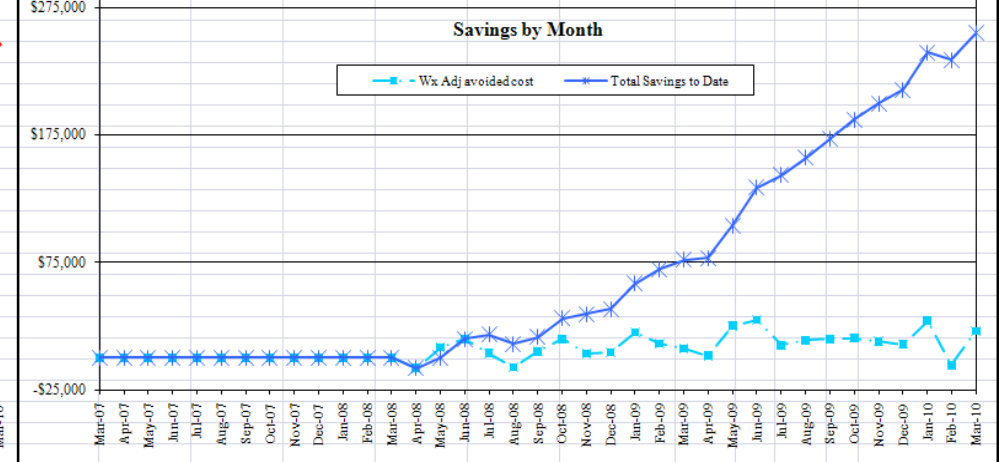
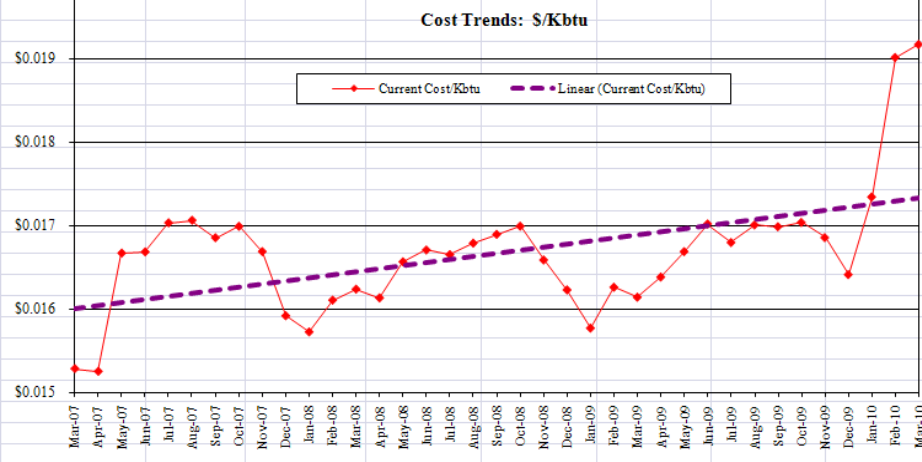
Financials		
Used for tracking Energy investments		
INV	\$752,397	Current
SPB	3.81	YEARS
ROI	-41.75%	Projected 3Yr
IRR	-20.65%	Projected 3Yr
NPV	-\$314,161	Projected 3Yr
ROI	122.35%	Projected 10Yr
IRR	16.61%	Projected 10Yr
NPV	\$920,562	Projected 10Yr

Actual Savings			
This Month	12 Months	Annual savings	Annual Target
\$21,381	\$199,351	\$197,303	\$108,084

Weather Adjusted Avoided Cost		
This Month	12 Months	Contract to Date
\$20,997	\$177,793	\$254,704

Annually			
Actual CO2 Savings	1211	Metric Tons	

Environmentally			
Annually	Annually	Annually	Annually
Avoided CO2 Savings	1196	Metric Tons	





## KEY CENTER BELLEVUE

- 518,000 sq.ft. office building
- Built in 2000
- Automation & lighting system modernization
- Objective-driven commissioning of systems
- Average of \$251,293 per year in avoided energy costs
- 27.3% reduction in energy consumption
- Energy Star rating of 98 - up 10 points
- Carbon reduction of 1,666 tons
- Total investment of \$282,051



# Bellevue Hi-rise Energy Optimization Report Card

Customer: **Unico** | Square Footage: **518,713 (GROSS)** | Facility Usage: **Office** | Base year period: **Sep-07 Oct-08** | HVAC LOAD: **35.0%** | Month: **Mar-2010**

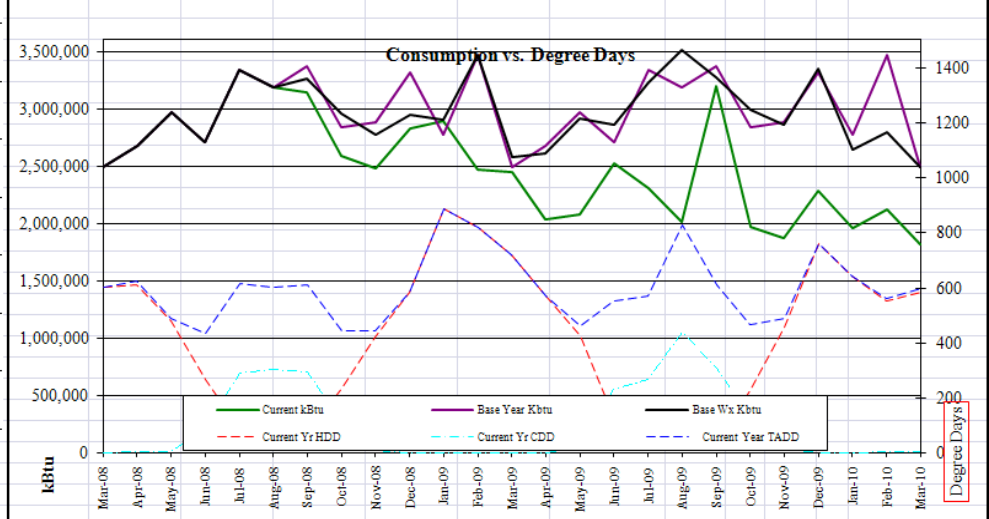
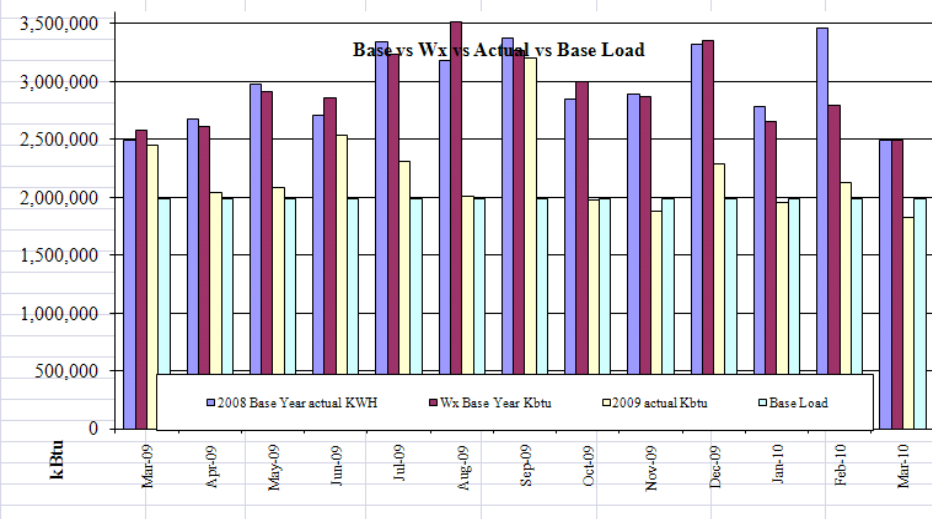
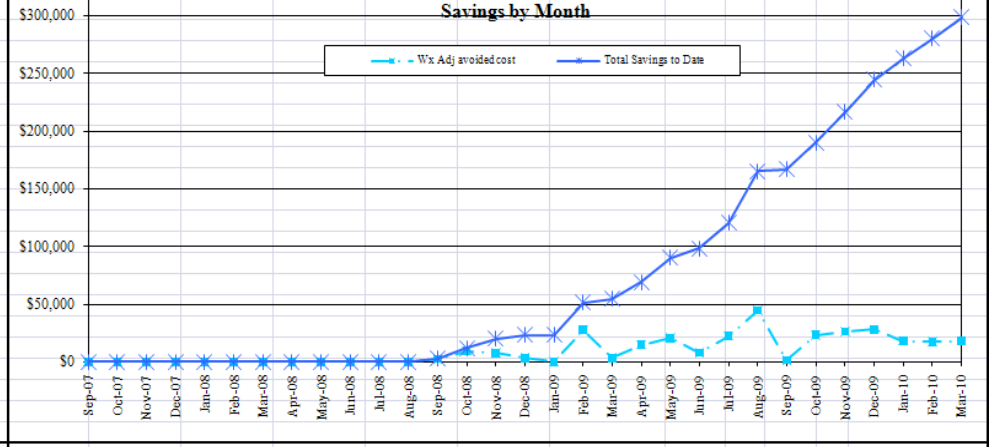
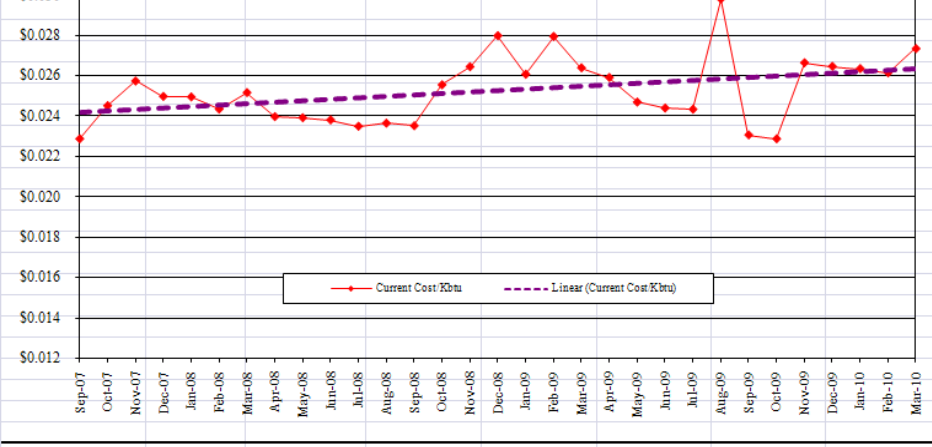


	<b>DATA</b>	Base Y avg	Current	Change	Load Factors (Annualized)			COST / mBtu			Financials				
	EUI	69.48	50.53	- 19	Electrical 100.00%	Gas 0.00%	Steam 0.00%	Ele \$25.74	Gas \$0.00	Stm \$0.00	Used for tracking Energy investments				
	ESR	88	98	10	Actual Savings			Weather Adjusted Avoided Cost			INV	\$282,051	Current		
	S/SQFT	\$1.78	\$1.29	-\$0.48	This Month	12 Months	Annual savings	Annual Target	Annual DELTA	This Month	12 Months	Contract to Date	SPB	1.21	YEARS
	S/Annual	\$921,451	\$670,159	\$251,293	\$18,290	\$255,969	\$251,293	\$66,870	\$184,423	\$18,175	\$244,096	\$298,614	ROI	127.43%	Projected 3Yr

(Red) costs/savings are at current annualized energy rates.

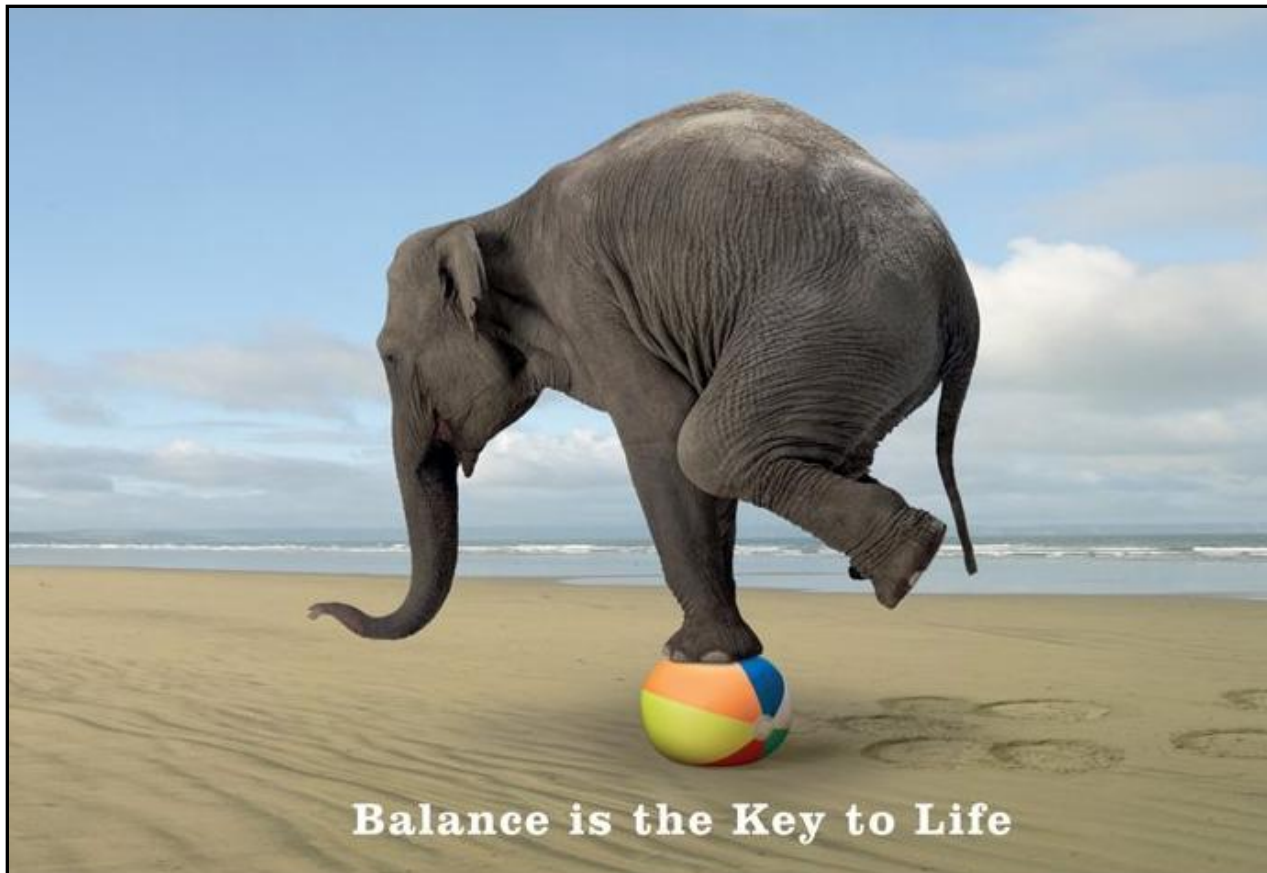
275.79% above projected savings

Degree Days	12 mnth avg	Increase	0.98%	Annually			Environmentally			Annually			IRR	55.70%	Projected 3Yr	
Kbtu Usage	12 mnth avg	Decrease	-27.09%	Actual CO2 Savings	1683	Metric Tons	Avoided CO2 Savings	1666	Metric Tons	NPV	\$275,471	Projected 3Yr	ROI	757.22%	Projected 10Yr	
Usage WX	12 mnth avg	Decrease	-26.07%	Overall Usage			Decrease			-27.27%	IRR	77.84%	Projected 10Yr	NPV	\$1,278,027	Projected 10Yr





**THE GOAL IS TO GO FROM OVERSIZED,  
OVER VENTILATED, UNCOMFORTABLE AND  
WASTEFUL TO EFFICIENTLY BALANCED!**



Balance is the Key to Life

**IS YOUR STAFF UP  
TO SPEED?**



**DO THEY UNDERSTAND  
THE COST?**







# Contact:

*MacDonald-Miller Facility Solutions*

*Web site: [www.macmiller.com](http://www.macmiller.com)*

*E-mail: [energy@macmiller.com](mailto:energy@macmiller.com)*