



**GovEnergy**  
[www.govenergy.gov](http://www.govenergy.gov)

The Premier Energy Training Workshop  
and Trade Show for Federal Agencies

# A River of Energy Solutions

Facility Audits and Evaluations: What I Have, What  
I Need, and Where am I Going?

Jamey Bedenbaugh  
Servidyne

# Servidyne Company Profile



- Founded in 1925 with 30+ years experience in energy efficiency & optimizing building performance
- Nine time United States EPA ENERGY STAR® Partner of the Year
- 150 ENERGY STAR Certifications to-date
- 14 LEED Certified Projects
  - 2 Platinum, 9 Gold, 2 Silver, and 1 Certified
- Mission: helping customers maximize value of portfolio through:
  - Lowering energy & operating costs
  - Reduce environmental impact
  - Enhance occupant satisfaction

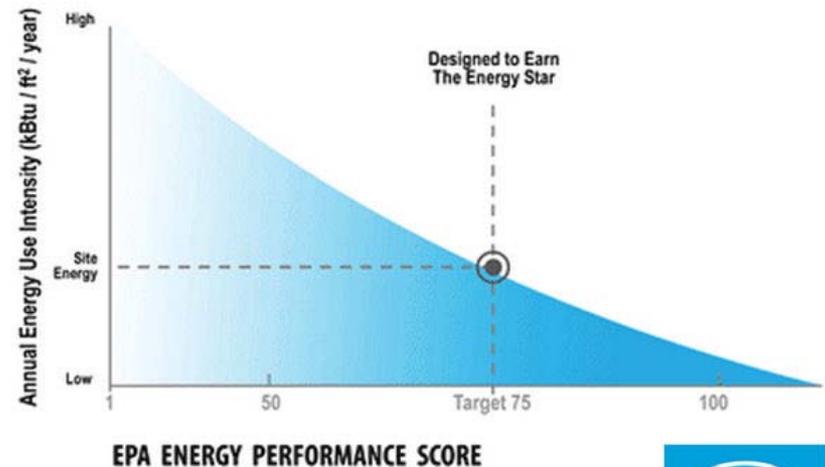
# Learning Objectives

1. Creatively **Establish Benchmarks** for Your Facility
2. **Uncover Potential** Energy Savings Projects
3. **Prioritize Energy Savings** Projects

# Establish Benchmarks

## Evaluate Your Buildings

- **Benchmarking**  
To study, in order to improve the performance of one's own company\*
- ENERGY STAR  
[Target Finder Tool](#)

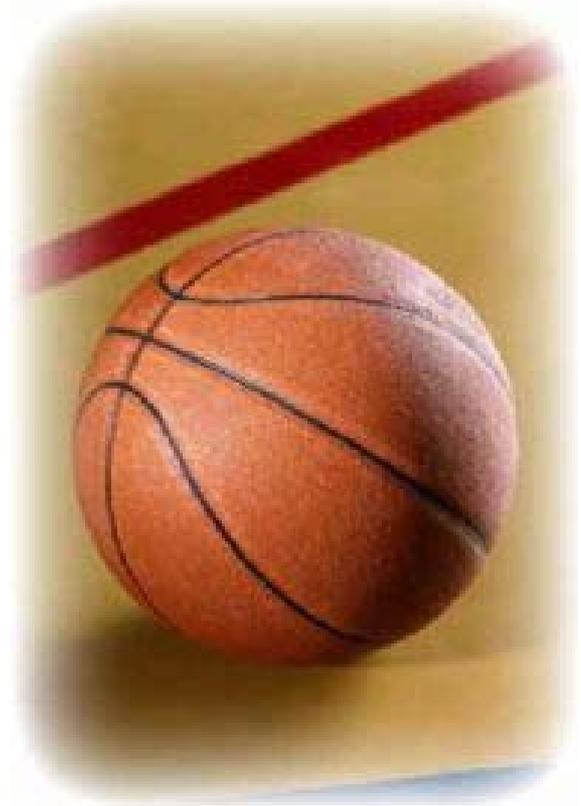


\*Merriam Webster Dictionary

# Establish Benchmarks

## Creating a Baseline

- Develop an initial set of critical observations or data to use for comparison or a control while establishing your benchmarks



## Establish Benchmarks

# Find out what you have

- Discover what consumption and costs are
- Work for WAGES  
(**w**ater, **a**ir, **g**as, **e**lectricity, and **s**tream)
  - Don't overlook "WAS"!! (water, air, and steam)
  - You could have a central chiller/steam plant causing building's baseline electric cost to seem very low... Metering opportunity
- Determine Consumption, Demand, and Cost for WAGES

# Establish Benchmarks

## Utility Bill Analysis

### Utility Analysis

6/19/2009

Electric Account:

Gas Account:

R&D

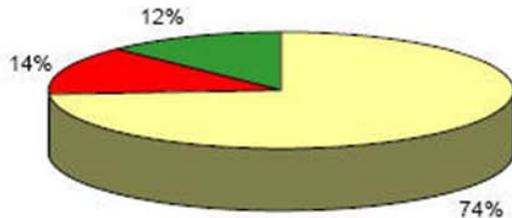
Carrollton, TX

293000 SqFt

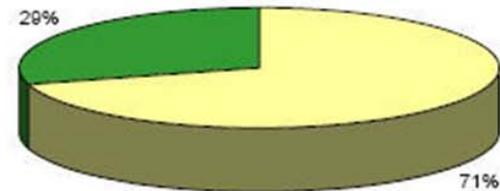


Month	Electric Summary									Natural Gas Summary				Degree Days		
	kWh Total	Elec. MBTU's	Demand kW	Load Factor	Bill Days	kWh Charge	Demand Charge	Total Cost w/Tax	Avg. Unit Cost	MCF	Gas MBTU's	Bill Days	Cost	Unit Cost	HDD	CDD
Jan-2008	699,061	2,386	2,346	29	43%	\$62,338	\$12,892	\$81,316	\$0.116	1,086	1,118.6	30	\$10,932	\$10.066	569	15
Feb-2008	626,756	2,139	2,293	29	39%	\$55,892	\$12,908	\$74,362	\$0.119	1,071	1,103.1	29	\$10,730	\$10.02	331	18
Mar-2008	657,591	2,244	2,219	30	41%	\$58,641	\$12,672	\$77,082	\$0.117	1019	1,049.6	29	\$9,612	\$9.43	182	66
Apr-2008	671,149	2,291	2,296	31	39%	\$59,850	\$12,947	\$78,685	\$0.117	1193	1,228.8	32	\$13,837	\$11.60	59	111
May-2008	833,318	2,844	2,768	31	40%	\$74,306	\$14,801	\$96,306	\$0.116	1,055	1,086.7	29	\$12,171	\$11.54	3	385
Jun-2008	845,329	2,885	2,629	32	42%	\$96,822	\$14,322	\$120,165	\$0.142	770	793.1	29	\$10,672	\$13.86	0	652
Jul-2008	796,014	2,717	2,763	29	41%	\$99,553	\$14,760	\$123,594	\$0.155	1,504	1,549.1	34	\$24,601	\$16.36	0	753
Aug-2008	800,424	2,732	2,697	30	41%	\$90,582	\$10,604	\$109,381	\$0.137	892	916.8	29	\$14,850	\$16.65	0	679
Sep-2008	774,661	2,644	2,722	29	41%	\$87,348	\$14,905	\$110,536	\$0.143	824	848.7	32	\$11,001	\$13.35	0	410
Oct-2008	791,311	2,701	2,637	31	40%	\$89,225	\$14,616	\$112,257	\$0.142	880	906.4	29	\$10,665	\$12.12	0	171
Nov-2008	666,084	2,273	2,563	31	35%	\$58,990	\$14,275	\$79,168	\$0.119	808	832.2	34	\$9,906	\$12.26	197	44
Dec-2008	547,018	1,867	2,315	34	29%	\$48,451	\$12,830	\$66,212	\$0.121	912	939.4	30	\$10,144	\$11.12	499	9
	6,708,716	29,723	30,248	366		\$681,996	\$162,530	\$1,129,063	\$0.1296	12,014	12,374	366	\$149,123	\$12.41		

Cost



Mbtu's



# Establish Benchmarks

## Metering

- [Current Monitoring](#)
- Power/Energy
- Pressure
- Flow
- Leak Detection
- Air Quality
- [Temperature](#)
- [Setpoint detection](#)
- [On/Off Metering](#)



Air Quality



Current Monitoring



Flow



Humidity



Leak Detection



Lighting Control



Network Integration



Power/Energy Monitoring



Power Sources



Pressure



Relays



Setpoint Devices



Temperature



Test Equipment



Accessories

# Establish Benchmarks

## Prioritize Facility for Best IRR

- Gather utility history
- Issue initial site surveys
- Benchmark facility WAGES
- Analyze preliminary data and apply “rule of thumb” economics
- Rank properties to focus initial efforts

# Uncover Potential Energy Savings Projects

- Not Investment grade audits but Preliminary Survey to determine Feasibility
- Send out **Site Data Collection Forms**
- Consult with reputable Building Performance Experts “building doctors” to develop Energy Management Road Map “the prescription”

# Uncover Potential

## Preliminary Feasibility Site Survey

- Preliminary Site data collection form [Example](#)
- Completed by facility manager or contractor



HVAC Controls/EMS Survey

**Contact Information**

Company Name: \_\_\_\_\_  
 Site Contact Name: \_\_\_\_\_  
 Contact Title: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 City: \_\_\_\_\_ State: \_\_\_\_\_ ZIP: \_\_\_\_\_  
 Phone: ( ) \_\_\_\_\_ Cell: ( ) \_\_\_\_\_ Fax: ( ) \_\_\_\_\_

**General Site Information**

Building Name: \_\_\_\_\_  
 Building Address: \_\_\_\_\_  
 City: \_\_\_\_\_ State: \_\_\_\_\_ ZIP: \_\_\_\_\_  
 Initial Construction: Year: \_\_\_\_\_ Area (Sq Ft): \_\_\_\_\_  
 Addition: Name: \_\_\_\_\_ Year: \_\_\_\_\_ Area (Sq Ft): \_\_\_\_\_

**\*\* PLEASE PROVIDE FLOOR PLAN OR EVACUATION DIAGRAM OF THE FACILITY \*\***

**Office Occupancy**

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
On	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am
Off	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am

**Office HVAC**

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
On	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am
Off	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am

**Warehouse HVAC**

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
On	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am
Off	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am	1:00 am

Holidays Observed: \_\_\_\_\_

Night Setback Temperatures: \_\_\_\_\_ Deg F. (Heating) \_\_\_\_\_ Deg F. (Cooling)

# Uncover Potential

## Preliminary Feasibility Report

- From data collected
- Existing Conditions and Savings [Report](#)
- Prepared by facility manager or contractor

### Site Survey Report

The Corporate Campus Tower facility, part of the Lennox International business unit, is located at TX in Dallas County, is primarily used for office and administration activities. Information contained in this facility profile was submitted by Lead Engineer. Total usable floor space has been reported at approximately 162,000 SQ feet. Energy costs average \$510,232 per year placing the annual utility cost at \$3,1496 per SqFt.



### Electricity, Natural Gas, and Utility Usage Profile

Electricity purchased from TXU (account(s) # ) is billed at an average rate of \$0.1242/kWh. No gas bills were provided. These rates are of primary interest to us as any opportunity for energy savings will be in this billable range.

From the consumption data, (Jan 2008 / Dec 2008), and the size of the facility analyzed, the Energy Usage Index for Corporate Campus Tower has been determined. This cost and consumption index is valuable in comparison to other similar facilities, and in contrast to what we know to be relatively "Energy Efficient" Office facilities. This comparison/contrast confirms our initial savings projections and serves to provide direction during the detailed analyses

<b>Facility Energy Cost Index</b>	<b>\$3,1496 per Square Foot/Year</b>
<b>Facility Consumption Index</b>	<b>86,565 BTUs per Square Foot/Year</b>

Servidyne Systems, LLC.  
Proprietary and Confidential Information

Corporate Campus Tower  
Site Survey Report 1-1

# Uncover Potential What I Need...

- HELP!!! and \$\$\$\$
- Energy Audits
  - W.A.G.E.S
    - Water, Air, Gas, Electric, Steam
- Companies such as Servidyne can put this together for you at little to no cost



## Energy Savings Opportunity Assessment - Business Unit Summary

Business Unit/Opportunity	Annual Energy Cost Savings	Total Investment	Total Simple Payback
<b>Site 1</b>			
Lighting Retrofits	\$88,319	\$192,520	2.18
Compressed Air	\$25,564	\$89,473	3.50
HVAC RCx	\$62,818	\$188,454	3.00
<b>Subtotals</b>	<b>\$176,701</b>	<b>\$470,447</b>	<b>2.66</b>
<b>Site 2</b>			
Lighting Retrofits	\$803,809	\$1,583,723	1.97
Compressed Air	\$56,816	\$198,856	3.50
HVAC RCx	\$29,745	\$89,235	3.00
<b>Subtotals</b>	<b>\$890,370</b>	<b>\$1,871,814</b>	<b>2.10</b>
<b>Site 3</b>			
Lighting Retrofits	\$344,298	\$1,005,561	2.92
Compressed Air	\$71,319	\$249,617	3.50
HVAC RCx	\$28,237	\$84,712	3.00
<b>Subtotals</b>	<b>\$443,854</b>	<b>\$1,339,890</b>	<b>3.02</b>
<b>Site 4</b>			
Lighting Retrofits	\$136,977	\$407,671	2.98
Compressed Air	\$19,662	\$68,816	3.50
HVAC RCx	\$7,681	\$23,044	3.00
<b>Subtotals</b>	<b>\$164,320</b>	<b>\$499,531</b>	<b>3.04</b>
<b>Total</b>	<b>\$1,675,245</b>	<b>\$4,181,681</b>	<b>2.50</b>

## ENERGY SAVINGS OPPORTUNITY ASSESSMENT

OPPORTUNITY ASSESSMENT	Opportunity	Annual kWh Savings	Carbon Offset (Lbs)	Annual Energy Cost Savings	Total Investment	Total Simple Payback	Audit Costs*	Notes
Site 1	HVAC RCx	164,353	258,856	\$20,409	\$61,228	3.0	N/A	
	Subtotals	164,353	258,856	\$20,409	\$61,228	3.0	\$0	
Site 2	HVAC RCx	31,854	50,170	\$4,177	\$12,531	3.0	N/A	
	Subtotals	31,854	50,170	\$4,177	\$12,531	3.0	\$0	
Site 3	HVAC RCx	207,384	326,629	\$25,450	\$76,349	3.0		
	Lighting Retrofits	100,636	158,502	\$14,453	\$36,973	2.6		2,255 - 32WT8 to 28WT8; 3,380 Hours
	Subtotals	308,020	485,131	\$39,902	\$113,322	2.8	\$2,640	
Site 4	Lighting Retrofits	492,905	776,326	\$73,868	\$155,547	2.1		150 - 1000W MH; 4,368 Hours
	HVAC RCx	87,087	137,162	\$12,782	\$38,346	3.0		
	Compressed Air	174,174	274,325	\$25,564	\$89,473	3.5		
	Subtotals	754,167	1,187,812	\$112,212	\$283,366	2.5	\$14,650	
	<b>Grand Total</b>	<b>1,258,393</b>	<b>1,981,969</b>	<b>\$176,701</b>	<b>\$470,447</b>	<b>2.66</b>	<b>\$17,290</b>	
Site 5								
Site 6	Lighting Retrofits	2,906,933	4,578,419	\$250,197	\$489,122	2.0		1174 - 400W MH; 86 - T12; 3,120 Hours
	HVAC RCx	113,975	179,511	\$8,927	\$26,781	3.0		
	Compressed Air	113,975	179,511	\$8,927	\$31,245	3.5		
	Subtotals	3,134,883	4,937,441	\$268,051	\$547,147	2.0	\$28,300	
Site 7	HVAC RCx	11,622	18,305	\$1,236	\$3,707	3.0		
	Lighting Retrofits	199,500	314,213	\$17,171	\$26,523	1.5		38 - 400W MH; 7,500 Hours
	Subtotals	211,122	332,517	\$18,406	\$30,229	1.6	\$2,000	
Site 8	Lighting Retrofits	133,243	209,857	\$11,468	\$56,830	2.5		154 - 400W MH; 20 - T12; 3,120 Hours
	Compressed Air	29,634	46,674	\$2,563	\$8,970	3.5		
	HVAC RCx	7,409	11,668	\$641	\$1,922	3.0		
	Subtotals	170,285	268,199	\$14,672	\$67,722	4.6	\$3,750	

## Potential Energy Saving Opportunities

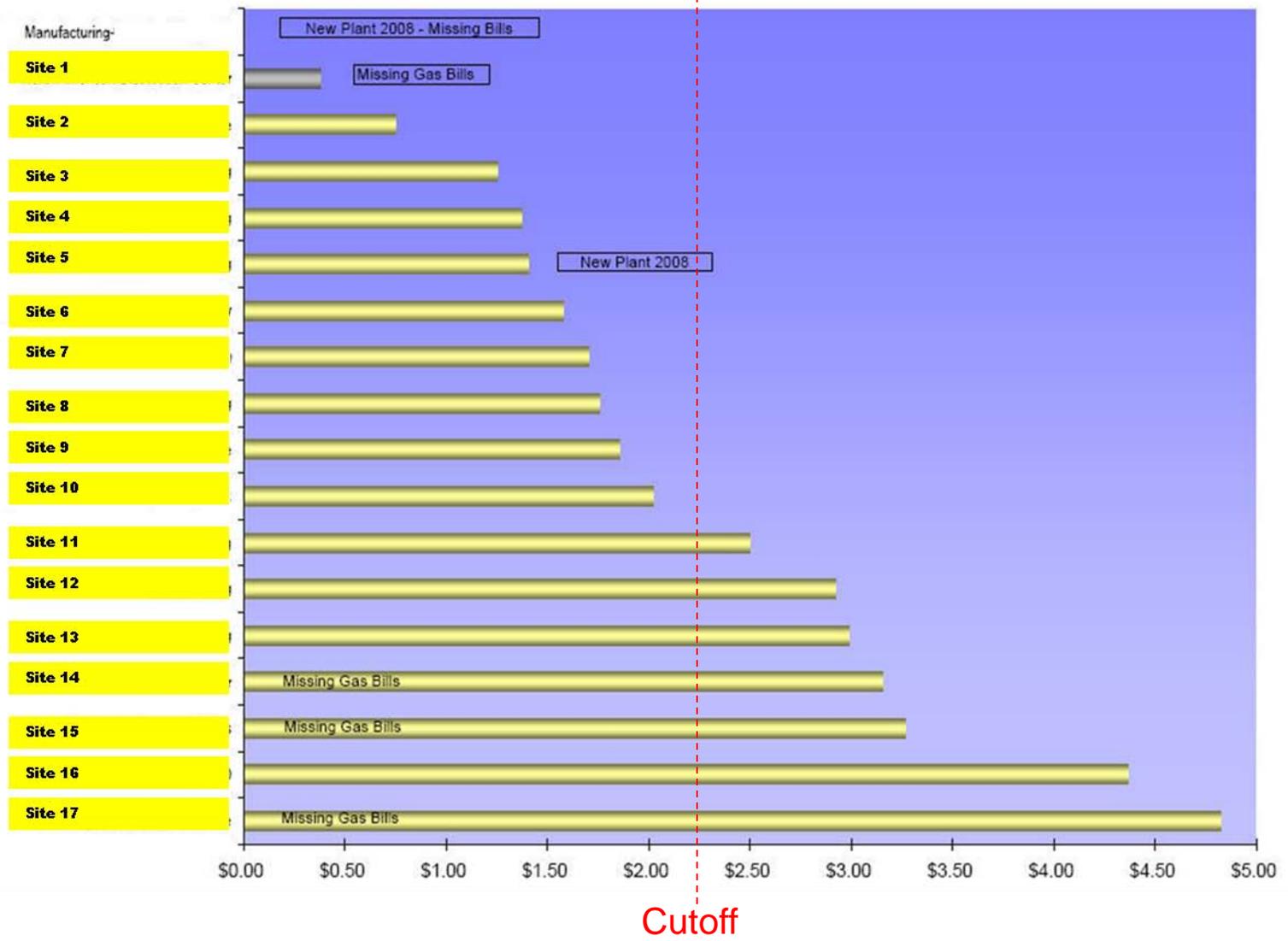
Name	Location	Lighting	Compressed Air Improvements	Compressor Plant Controls	Compressor Replacement	RCx	Motors	VFD's	Building EMS	Building Static Pressure Control	Makeup/Exhaust Air Fans	PF Correction	State & Federal Grants	Rebates
Site 1	Richardson, TX					♦		♦		♦				♦
Site 2	Richardson, TX					♦								♦
Site 3	Richardson, TX	♦				♦								♦
Site 4	Carrollton, TX	♦	♦			♦		♦		♦		♦		♦
Site 5	Orangeburg, SC	♦	♦	♦		♦	♦			♦		♦	♦	□
Site 6	Orangeburg, SC	♦				♦			♦				♦	□
Site 7	Orangeburg, SC	♦	♦	♦	♦				♦	♦		♦	♦	□
Site 8	Marshalltown, IA	♦	♦			♦	♦	♦		♦			♦	♦
Site 9	Marshalltown, IA	♦	♦			♦		♦	♦	♦		♦	♦	♦
Site 10	Grenada, MS	♦	♦	♦		♦	♦	♦	♦	♦				
Site 11	Saltillo, Mexico	♦							♦			?		
Site 12	Stuttgart, AR	♦	♦	♦		♦	♦		♦					
Site 13	Union City, TN	♦	♦	♦		♦	♦		♦				♦	
Site 14	Auburn, WA	♦				♦			♦				♦	♦
Site 15	Laval, Canada	♦	♦			♦	♦	♦	♦					
Site 16	Tifton, GA	♦	♦			♦	♦		?				♦	
Site 17	Tifton, GA	♦	?									?	♦	
Site 18	Stone Mountain, GA	♦				♦	♦					♦	♦	

Opportunity	♦
Pending Changes	□
Under Current Review	?

# Prioritize Energy Savings Potential Projects

- Go after low hanging fruit
  - A Solar PV Project may seem attractive - but... Have you done a lighting retrofit recently??
- Compare Cost and Consumption by highest users... very important to consider both C's

## Energy Cost/SqFt Comparison



# Prioritize Energy Savings

## “Low Hanging Fruit”

- Lighting retrofits and controls
- RCx
- HVAC controls
- Low or no cost opportunities
  - Change habits (turn off those lights and you won’t need Sensors!)



# Prioritize Energy Savings Measurement and Verification

- Measurement before and after an ECM has been implemented
- Verify anticipated savings are achieved
- Critical to ensure the building is operating as intended
- International Performance Measurement and Verification Protocol (IPMVP)

# Prioritize Energy Savings

## Where am I going?



# Prioritize Energy Savings Retro-commissioning (RCx)



# Prioritize Energy Savings

## Continuous Commissioning

- The Continuous Commissioning Team
  - project manager
  - one or more CC engineers
  - CC technicians
  - one or more designated members of the facility operating team
- CC implementation should start by solving existing problems



# Prioritize Energy Savings

## Automated Continuous Commissioning (ACC)

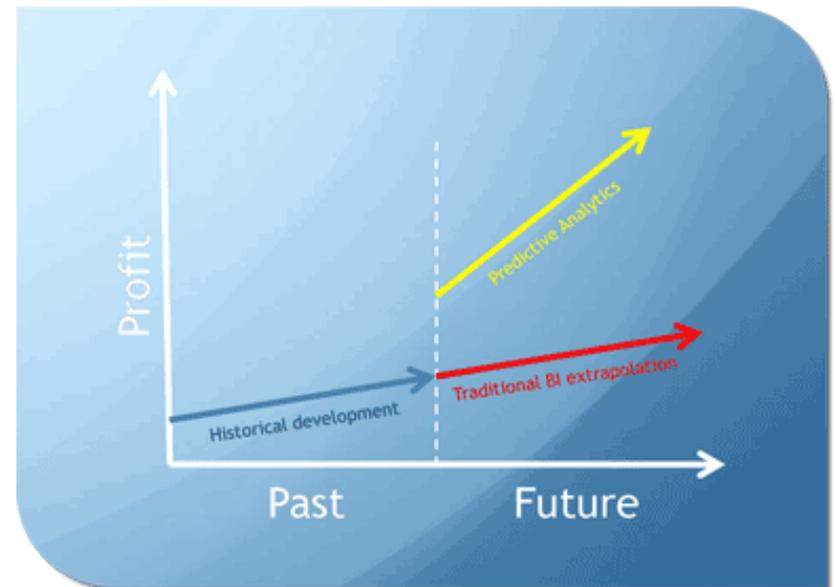
- Utilizes existing building automation system
- Scalable Platform
- Make sure partner is BAS brand neutral



# Prioritize Energy Savings

## Predictive Analytical Platforms

- EMS Pattern Recognition Technology:
  - Data collection
  - Data warehousing
  - Diagnostics
  - Work order issuance and tracking



# Prioritize Energy Savings

## A Single Low Cost Solution

- Can generate multiple capabilities
  - Site Data Collection
  - Equipment Monitoring
  - Benchmarking
  - Building Automation
  - Control
  - Measurement and Verification
  - Automated Continuous Commissioning (ACC)

# Summary

- Energy is one of the largest expenses
  - It's not fixed as some would contend
  - Increasing pressure for efficiency due to market forces
- Even with deregulation, prices are rising
  - Supply-side will remain volatile
  - Demand-side management Vigilance
- **You can't manage what you don't measure !**

# Resource List

- **Federal Energy Management Program Continuous Commissioning Guidebook:**  
[http://www1.eere.energy.gov/femp/program/om\\_guidebook.html](http://www1.eere.energy.gov/femp/program/om_guidebook.html)
- **EERE Energy.gov Introduction to Continuous Commissioning:**  
[http://www1.eere.energy.gov/femp/pdfs/ccg03\\_ch1.pdf](http://www1.eere.energy.gov/femp/pdfs/ccg03_ch1.pdf)
- **ENERGY STAR Target Finder Tool:**  
[http://www.energystar.gov/index.cfm?c=new\\_bldg\\_design.bus\\_target\\_finder](http://www.energystar.gov/index.cfm?c=new_bldg_design.bus_target_finder)
- **M&V Guidelines: Measurement and Verification for Federal Energy Projects:**  
[http://www1.eere.energy.gov/femp/pdfs/mv\\_guidelines.pdf](http://www1.eere.energy.gov/femp/pdfs/mv_guidelines.pdf)
- **International Performance Measurement and Verification Protocol (IPMVP)**  
<http://www.nrel.gov/docs/fy02osti/31505.pdf>



[www.servidyne.com](http://www.servidyne.com)



[www.servidyne.com/blog](http://www.servidyne.com/blog)



[www.twitter.com/servidyne](http://www.twitter.com/servidyne)



[www.facebook.com/servidyne](http://www.facebook.com/servidyne)



[www.youtube.com/servidyne](http://www.youtube.com/servidyne)



[info@servidyne.com](mailto:info@servidyne.com)



# Q & A



## **Jamey Bedenbaugh**

Project Development Engineer

Jamey.bedenbaugh@servidyne.com



[www.servidyne.com](http://www.servidyne.com)