Making Existing Buildings Smart



Improve Tenant Satisfaction
Increase Energy Efficiency
Reduce Maintenance Effort
Enable Demand Response
Gain LEED Points

CYPRESS ENVIROSYSTEMS™

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Cypress Envirosystems: Problems We Solve…

Pneumatic Thermostats

Dial Gauges

Need to save energy & improve uptime, but hindered by outdated facility?

Steam Traps

Standalone Transducers, LED/LCD Displays

Manual Instrumentation, Not Programmable, No Diagnostics…
Equals: Wasted Energy, Higher Downtime, More Labor Required

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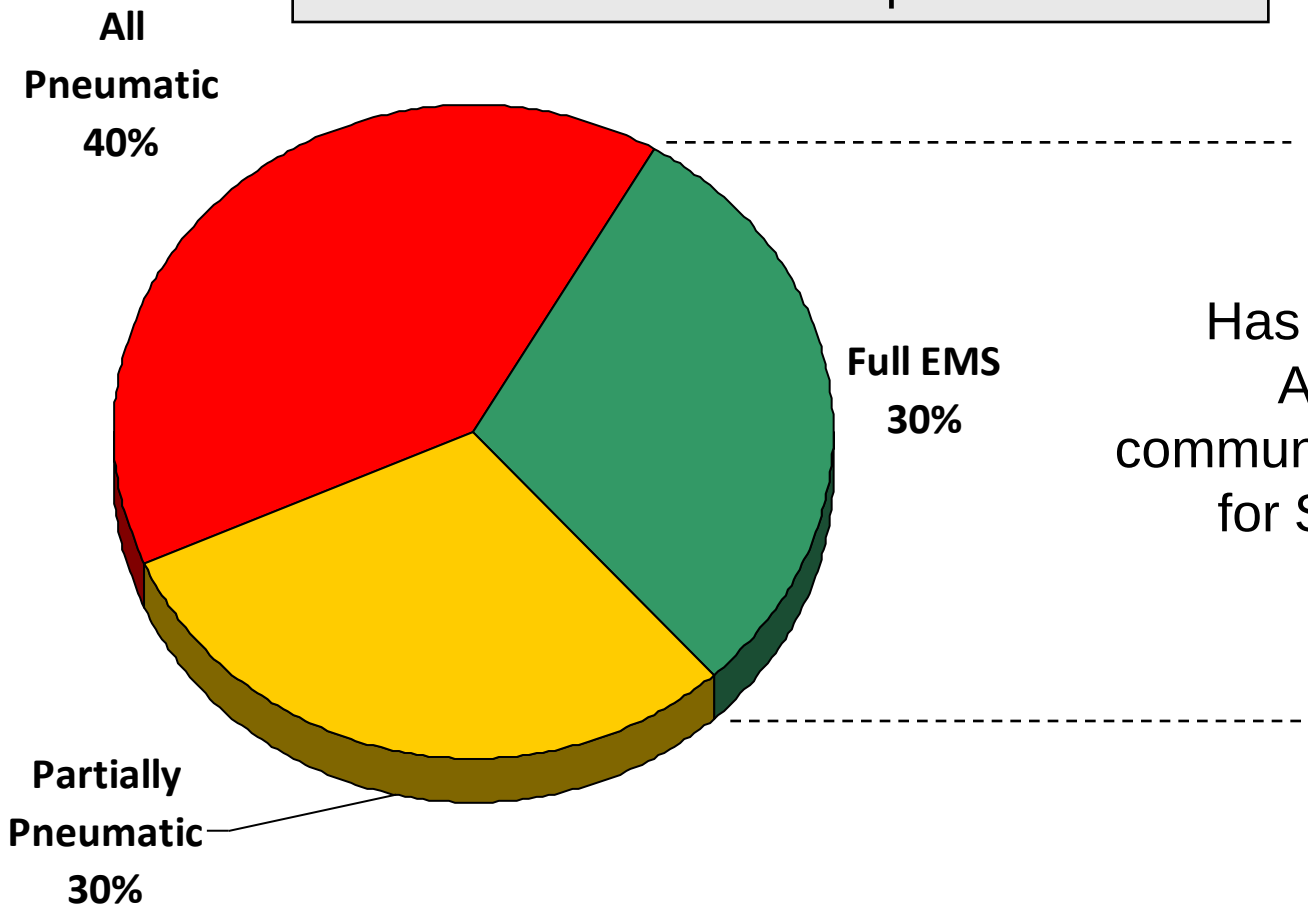
Only 30% of Buildings Ready for Analytics, Smart Grid

Non-Residental Buildings in N. America
70 billion sq-ft



Has full data for Analytics, communicating devices for Smart Grid.

Challenges We Hear

- **Tenant Satisfaction** – Hot and Cold Calls. Facilities team is unaware till tenant complains. Space looks dated.
- **Maintenance** – fewer heads managing more sq-ft, older systems requiring high labor. Hard to troubleshoot.
- **Energy use** – higher per sq-ft energy use than newer buildings. Can't communicate with Smart Grid.
- **LEED points** – LEED v4 requires continuous commissioning – how to accomplish for existing buildings
- **Cannot disrupt tenants for upgrades** – space is occupied, may have asbestos, cannot disturb

What is our Solution?

WIRELESS PNEUMATIC THERMOSTAT

"Go from Pneumatic to DDC in minutes"

WIRELESS GAUGE READER

"Remotely Read Gauges in minutes"

NETWORK CONTROLLER

WIRELESS STEAM TRAP MONITOR

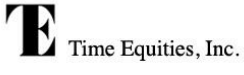
"Avoid Expensive Steam Leaks"

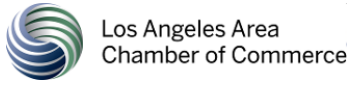
WIRELESS TRANSDUCER READER

"Remotely Read Transducers – No Wires"

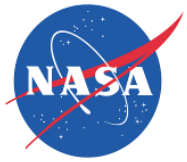
Non-invasive, easy retrofit, energy and labor savings, payback under one year

Commercial Real Estate Customers



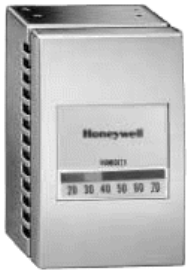


Government Customers - Examples



Zone Control with Wireless Pneumatic Thermostat (WPT)

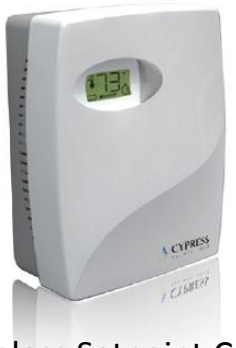
EXISTING LEGACY STAT



- Manual Setpoint Control
- No Remote Readings
- No Diagnostics
- Manual Calibration Required
- Cannot support Demand Response strategies

DDC in 20 Minutes!

CYPRESS ENVIROSYSTEMS
WIRELESS PNEUMATIC THERMOSTAT



Air Conditioning | Heating | Refrigeration
the NEWS
THE HVACR CONTRACTOR'S WEEKLY NEWSMAGAZINE SINCE 1926

Gold Award 2010

BUILDING OPERATING management 2010 Top Products Award

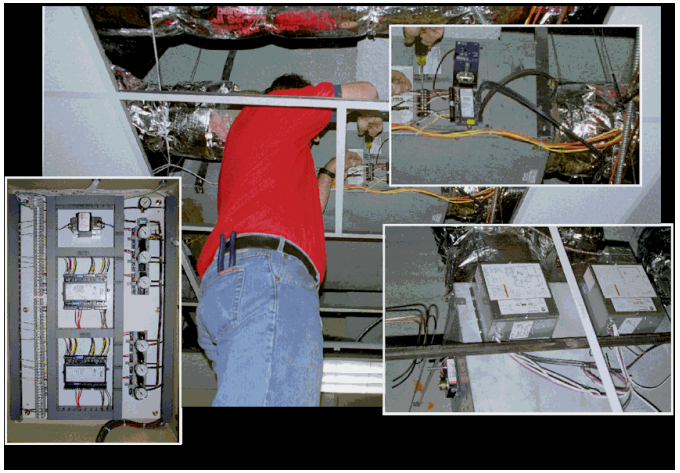
Building Operating Management 2012 Top Product

- Remote Wireless Setpoint Control
- Remote Monitoring of Temperature & Pressure
- Pager/Cell Notification of Excursions
- Automatic Self-calibration
- Programmable Temperature Setbacks
- Occupancy Override
- Enables Demand Response strategies
- BACnet Interface to BMS
- Compatible With Existing Johnson, Honeywell, Siemens, Robertshaw
- Battery life of 3 – 5 years
- Standalone operation with power failure

WPT Installation

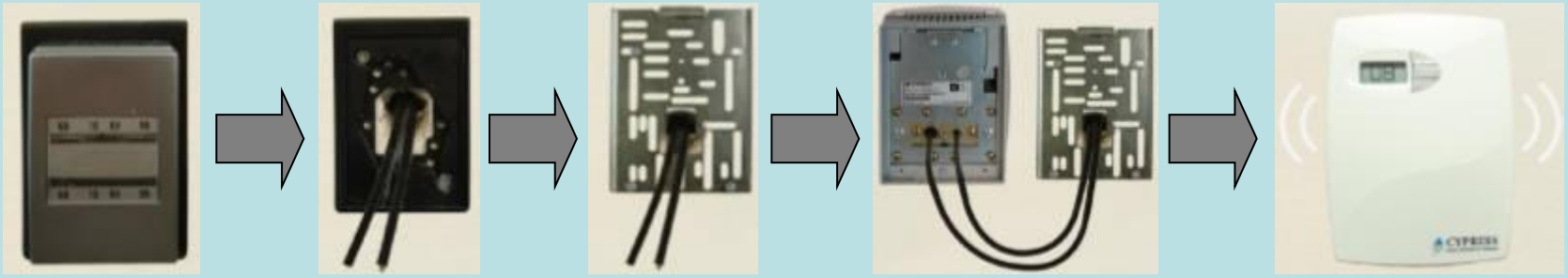
- Opening walls and running wire drive up traditional DDC retrofit costs
- Occupants do not want to be disrupted by projects
- The WPT provides benefits of DDC zone control
  - ✓ 20-minute retrofit
  - ✓ 80% lower cost
  - ✓ Minimal disruption

Traditional DDC Retrofits are Invasive



The Wireless Pneumatic Thermostat Provides (WPT) DDC Zone Control without Disruption

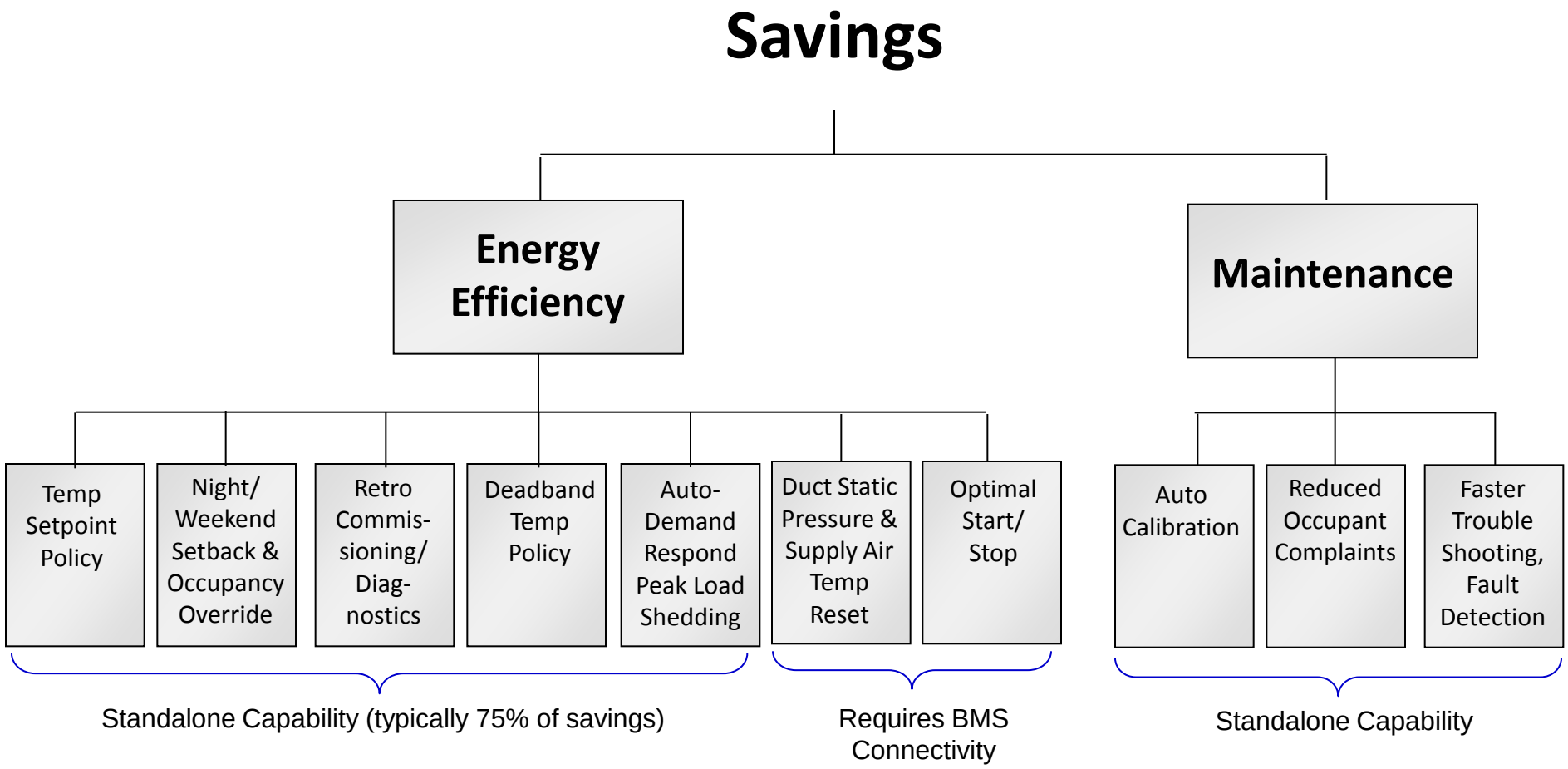
Step 1	Step 2	Step 3	Step 4	Step 5
Identify pneumatic thermostat type	Remove thermostat and backplate	Install WPT backplate to wall	Attach pneumatic pipes to WPT	Hang on wall and integrate with BAS



Post Installation Benefits

- Increased Energy Efficiency
- Improved Tenant Satisfaction
- Reduced Maintenance Effort
- Enable Demand Response Load Mgm’t
- Gain LEED Points

Wireless Pneumatic Thermostat Savings



Same Benefits as Direct Digital Control – but at a Fraction of the Price and Disruption

Oakland Shines: Quantified case studies from three commercial buildings in Oakland, California

Building Profiles

CIM

- CIM Properties
- 1333 Broadway
- 287 thermostats
- 238,000 square feet

$0.20/sq-ft savings/yr

Savings

- ✓ 249,271 kWh/year
- ✓ 10,045 therms/year
- ✓ 139 kW
- ✓ Simple Payback: 5 months

ROTUNDA

Beauty in the heart of Oakland

- The Oakland Rotunda
- 300 Frank Ogawa Plaza
- 261 thermostats
- 352,000 square feet

$0.19/sq-ft savings/yr

- ✓ 419,445 kWh/year
- ✓ 3,835 therms/year
- ✓ 98 kW
- ✓ Simple Payback: 1.4 years

METROVATION

One of a kind, always the best

- Metrovation
- 2201 Broadway
- 290 thermostats
- 192,893 square feet

$0.16/sq-ft savings/yr

- ✓ 175,063 kWh/year
- ✓ 2,686 therms/year
- ✓ 133 kW
- ✓ Simple Payback: 2.8 years

"The wireless thermostat project has given 1333 Broadway the ability to look several layers deep into the performance of the building and make adjustments for tenant comfort, all the while greatly lowering utility costs."

-Bob Woltz, Chief Engineer

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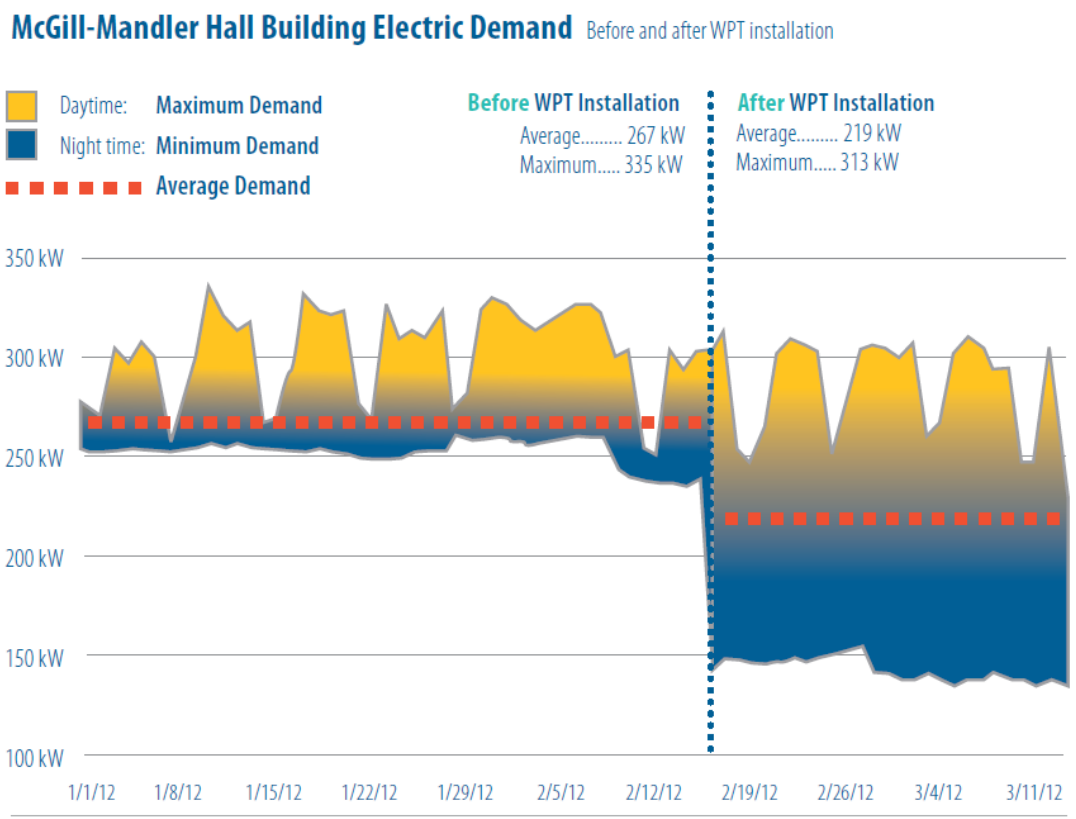
UC San Diego – California Energy Commission Data



Source: Energy Solutions Inc. under contract to California Energy Commission

PROJECT DATA

SAVINGS:
27% Electrical
51% Gas
0.2 yrs Payback

PROJECT SUMMARY

Site: McGill-Mandler Hall
Location: UC San Diego
Project area 112,500 square fe
Built: 1970

ENERGY INFORMATION

Annual electricity use before retrofit: 2,561,477 kWh
Annual natural gas use before retrofit: 111,983 therms
Annual electricity savings: 538,901 kWh
Annual natural gas savings: 56,944 therms

PROJECT ECONOMICS

Annual utility cost savings: $94,931
Total project cost: $295,655
Utility & CEC incentives:

- SDG&E UC Partnership Program Rebate – $186,280
- Energy Technology Assistance Program Rebate – $94,749

Simple payback: 0.2 years

EQUIPMENT INSTALLED

- 250 Cypress Envirosystems Deadband Wireless Pneumatic Thermostats
- 3 Cypress Envirosystems Green Box Controllers
- 25 Cypress Envirosystems "Wall Powered" or "24VAC Powered" Repeaters

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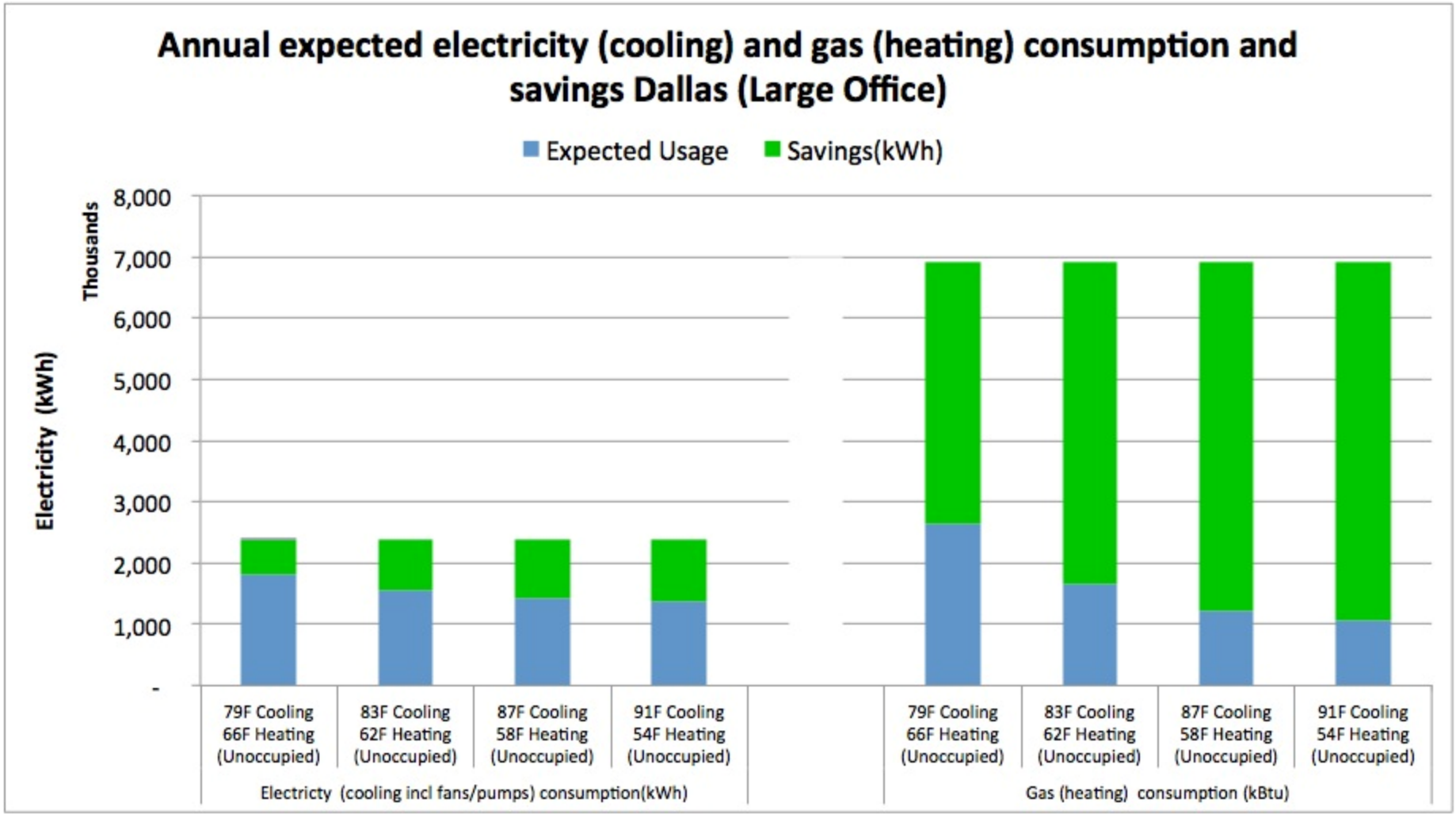
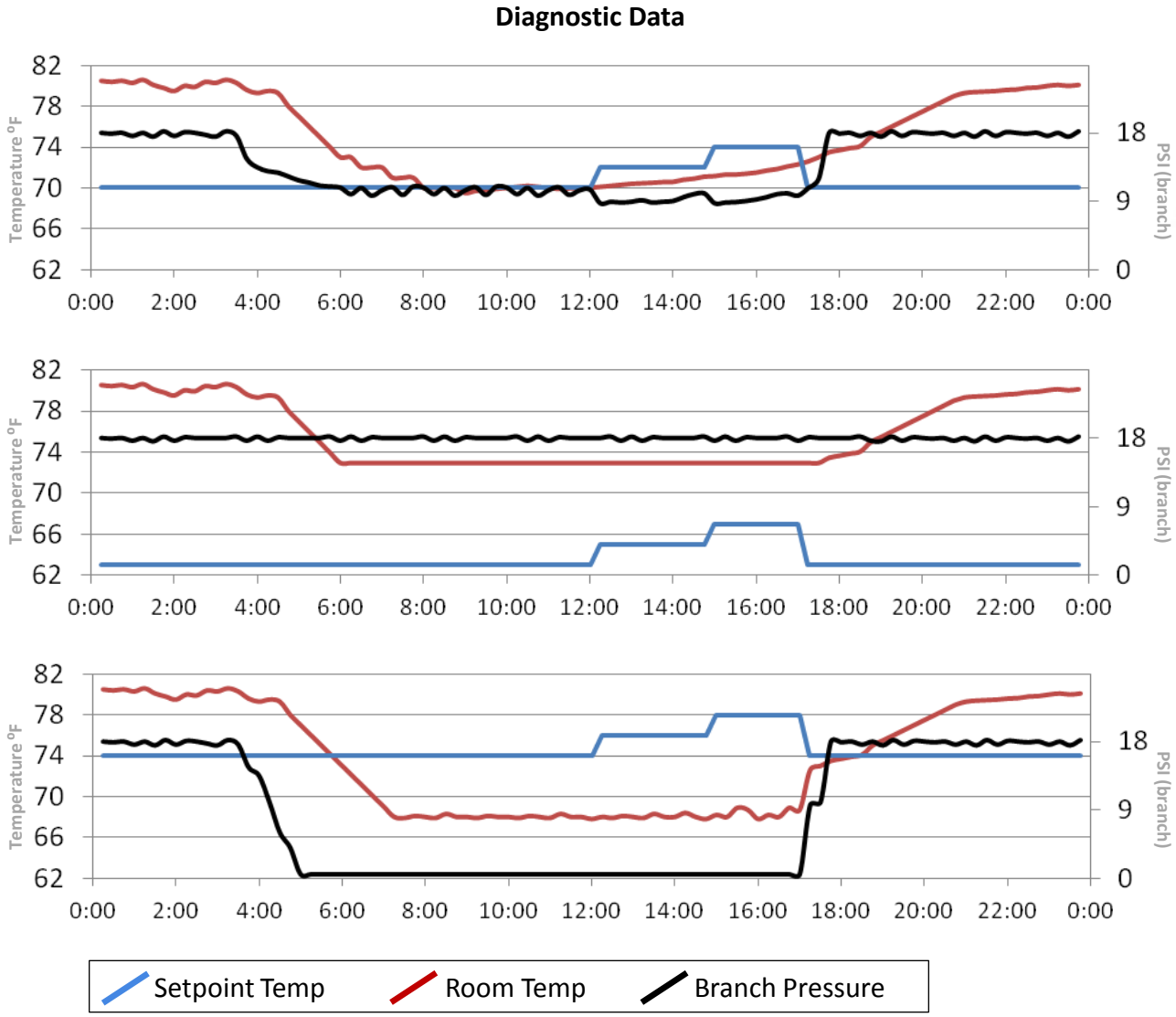
Oak Ridge National Labs – 2014 Report



Preliminary only – final report to be published Q2 2014

The WPT's diagnostic data enable retro and ongoing commissioning to improve maintenance costs and save energy



Alarm	Possible Faults
	• None
	• Faulty Reset Velocity Controller • Stuck damper • Broken spring • Undersized cooling capacity design
	• Faulty Reset Velocity Controller • Electric reheat and AC on • VAV Box Fault • Adjacent Zone Overcooling

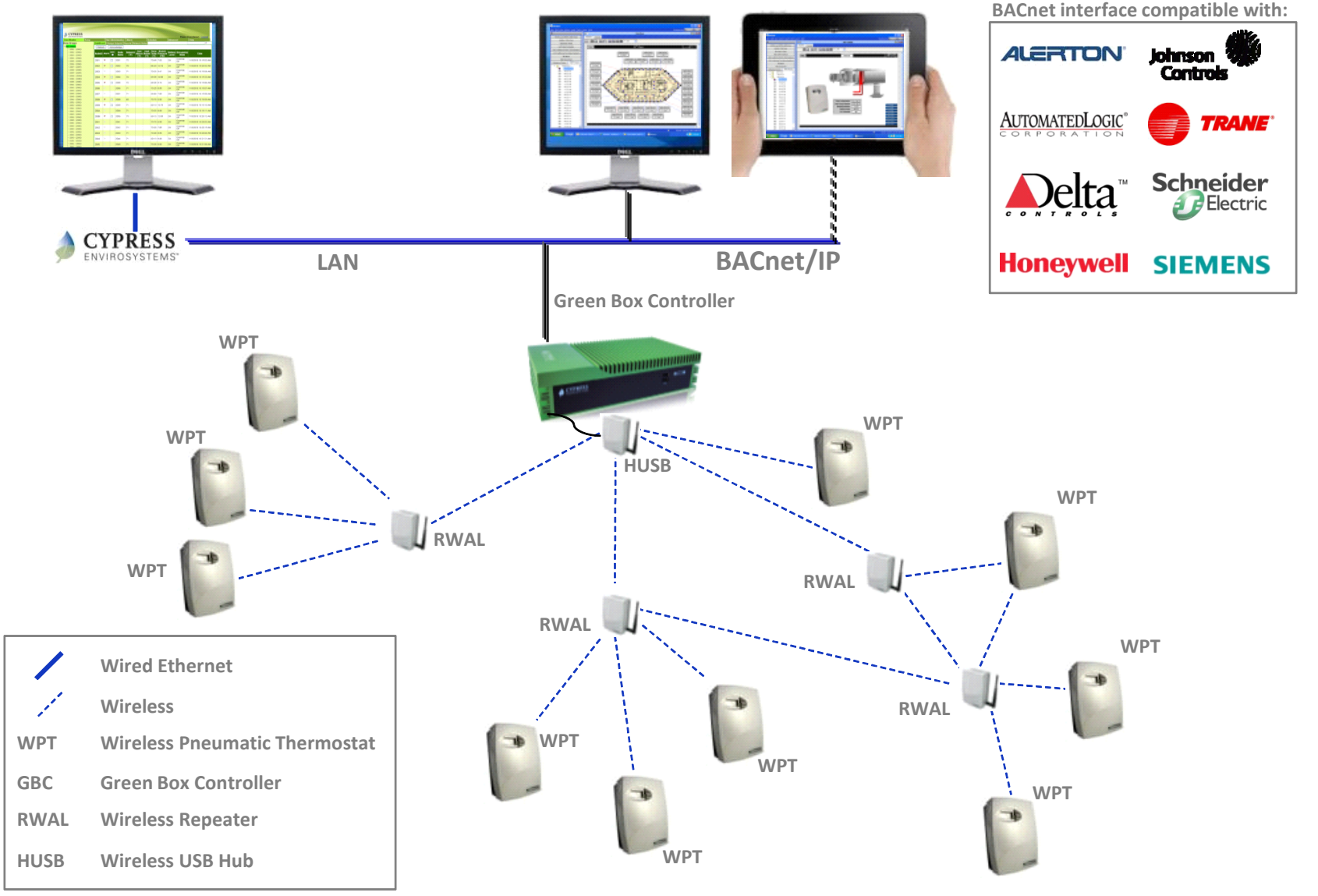
LEED Credits

LEED for Existing Buildings: Operations & Maintenance
Registered Project Checklist

			Energy & Atmosphere, continued			
			Existing Building Commissioning			
			Credit 2.1	**Investigation and Analysis**	✓	2
			Credit 2.2	**Implementation**	✓	2
			Credit 2.3	**Ongoing Commissioning**	✓	2
			Performance Measurement			
			Credit 3.1	**Building Automation System**	✓	1
			Credit 3.2-3.3	**System Level Metering**		1 to 2
				Credit 3.2 40% Metered		1
				Credit 3.3 80% Metered		2

Tenant Comfort and Satisfaction, Ability to Attract Top Tier Tenants, and Lower Lease Churn Rates Are Incremental to Energy Savings Benefits

The WPT system can be integrated with existing Building Automation Systems through BACnet/IP



BACnet interface compatible with:

ALERTON · Johnson Controls · AUTOMATEDLOGIC CORPORATION · TRANE · Delta CONTROLS · Schneider Electric · Honeywell · SIEMENS

Built-in Web Interfaces and Cloud Connectivity

CYPRESS ENVIROSYSTEMS

Demo User(demo) Logout

Zone Monitor | Setup | User Administration | Alarm | Schedule | Advanced | Help

Zone Groups

- ALL Zones
  - 2001 - (2001)
  - 2002 - (2002)
  - 2003 - (2003)
  - 2004 - (2004)
  - 2005 - (2005)
  - 2006 - (2006)
  - 2007 - (2007)
  - 2008 - (2008)
  - 2009 - (2009)
  - 200A - (200A)
  - 200b - (200B)
  - 200E - (200E)
  - 2041 - (2041)
  - 2042 - (2042)
  - 2043 - (2043)
  - 2044 - (2044)
  - 2045 - (2045)
  - 2046 - (2046)
  - 2051 - (2051)
  - 2052 - (2052)
  - 2061 - (2061)
  - 2062 - (2062)
  - 2063 - (2063)
  - 2064 - (2064)
  - 2065 - (2065)
  - 2081 - (2081)
  - 2082 - (2082)
  - 2083 - (2083)
  - 2091 - (2091)
  - 2092 - (2092)
  - 2093 - (2093)
  - 2101 - (2101)
  - 3001 - (3001)
  - 3002 - (3002)

DashBoard | Change Setpoint | Reports | Network Status

Refresh | Acknowledge

NodeID	Alarm	ACK	Node Name	Setpoint (°F)	Cool Above (°F)	Heat Below (°F)	Zone Temp (°F)	Branch Pressure (PSI)	Battery Level	Occupancy State	Time
2001			2001	72			70.48	7.63	OK	Override Off	11/3/2010 10:19:02 AM
2002			2002	75			66.43	14.74	OK	Override Off	11/3/2010 10:20:02 AM
2003			2003	71			70.03	9.47	OK	Override Off	11/3/2010 10:19:04 AM
2004			2004	74			69.35	16.58	OK	Override Off	11/3/2010 10:19:22 AM
2005			2005	72			69.35	9.74	OK	Override Off	11/3/2010 10:19:06 AM
2006			2006	71			70.25	8.95	OK	Override Off	11/3/2010 10:19:07 AM
2007			2007	71			69.80	7.89	OK	Override Off	11/3/2010 10:19:08 AM
2008			2008	60			70.70	0.00	OK	Override Off	11/3/2010 10:19:09 AM
2009			2009	71			69.13	10.79	OK	Override Off	11/3/2010 10:19:10 AM
200A			200A	71			70.03	8.68	OK	Override Off	11/3/2010 10:19:11 AM
200B			200b	73			69.13	12.89	OK	Override Off	11/3/2010 10:20:12 AM
2041			2041	71			70.70	6.58	OK	Override Off	11/3/2010 10:20:02 AM
2042			2042	71			70.03	7.89	OK	Override Off	11/3/2010 10:20:19 AM
2043			2043	71			70.48	8.95	OK	Override Off	11/3/2010 10:20:04 AM
2044			2044	71			69.13	8.68	OK	Override Off	11/3/2010 10:21:21 AM
2045			2045	71			70.25	5.00	OK	Override Off	11/3/2010 10:21:06 AM

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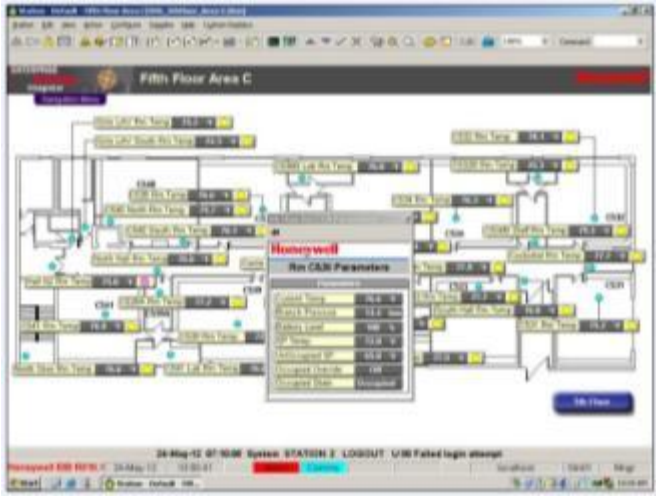
Direct Integration into BMS Headend via BACnet/IP

Cypress Envirosystems GBC Interface

WPTs in Schneider's StruxureWare

WPTs in Honeywell's EBI



WPTs in JCI's Metasys

Sample WPT Commercial Installations

GSA Green Proving Ground 2012 Selectee

PRELIMINARY TECHNOLOGY ASSESSMENT

Wireless Pneumatic Thermostat

What is this Technology?

The Wireless Pneumatic Thermostat provides standard pneumatic thermostats with networked Direct Digital Control (DDC) functionality. Wireless Pneumatic Thermostats can operate as a stand-alone system or integrate with an existing Building Automation System.

Why is GSA Interested?

Heating and cooling equipment represents roughly 35% of total energy consumed by GSA buildings. A preliminary assessment found that approximately 40% of GSA facilities still incorporate some pneumatic thermostats. This technology promises to cost-effectively deliver energy and costs savings by improving the controllability of these thermostats.

ENERGY EFFICIENCY Transitioning from pneumatic to DDC thermostats has been shown to reduce HVAC energy use by between 18% and 30%.

COST EFFECTIVENESS The Wireless Pneumatic Thermostat is designed to be cost effective when compared against a retrofit that will require invasive hard-wiring, especially in cases where asbestos is an issue. The expected payback is less than 3 years. In comparison, a wired whole-building DDC system has a typical payback of 8 years.

Customer Satisfaction

In 2011, the US Federal GSA commissioned Dun and Bradstreet to perform a survey of Cypress Envirosystems customers as part of the process to include us on GSA schedule.

We scored 91 out of 100 in overall performance rating.

Open Ratings

Dun & Bradstreet

Date: 03/08/11

Past Performance Evaluation℠

D-U-N-S Number for this company: **82-851-2033**

2. SUPPLIER PERFORMANCE RATINGS

Open Ratings calculates supplier performance scores using a sophisticated algorithm that takes into account the amount of information available on a supplier, the recency of the information, and the accuracy of the raters. Ratings range from 0 to 100, however, this is not a percentile score.

Overall Performance Rating 91

Indicative of likely overall performance

SIC Level Quintile

Bottom — Top

SIC: 8711/Engineering Services

Detailed Performance Ratings

		0 25 50 75 100
RELIABILITY: How reliably do you think this company follows through on its commitments?	92	
COST: How closely did your final total costs correspond to your expectations at the beginning of the transaction?	90	
ORDER ACCURACY: How well do you think the product/service delivered matched your order specifications and quantity?	88	
DELIVERY/TIMELINESS: How satisfied do you feel about the timeliness of the product/service delivery?	90	
QUALITY: How satisfied do you feel about the quality of the product/service provided by this company?	88	
BUSINESS RELATIONS: How easy do you think this company is to do business with?	94	
PERSONNEL: How satisfied do you feel about the attitude, courtesy, and professionalism of this company's staff?	97	
CUSTOMER SUPPORT: How satisfied do you feel about the customer support you received from this company?	91	
RESPONSIVENESS: How responsive do you think this company was to information requests, issues, or problems that arose in the course of the transaction?	92	

CYPRESS ENVIROSYSTEMS™

Industry Partners

Appendix
Additional Non-Invasive Solutions

What is our Solution?

WIRELESS PNEUMATIC THERMOSTAT

"Go from Pneumatic to DDC in minutes"

WIRELESS GAUGE READER

"Remotely Read Gauges in minutes"

NETWORK CONTROLLER

WIRELESS STEAM TRAP MONITOR

"Avoid Expensive Steam Leaks"

WIRELESS TRANSDUCER READER

"Remotely Read Transducers – No Wires"

Non-invasive, easy retrofit, energy and labor savings, payback under one year

Wireless Steam Trap Monitor (WSTM)

Leaking Traps Waste Energy

Typical Steam Trap

CYPRESS ENVIROSYSTEMS WIRELESS STEAM TRAP MONITOR

- Necessary part of the steam distribution system, usually hundreds of units per site
- 15-20% average failure rate; leaks steam
- Failed traps lose $5,000 per year (1/8” orifice)
- Manual inspection typically done annually – labor intensive, do not catch problems in timely manner
- Solution: Wireless steam trap monitor detects faults and alarms on error, avoiding expensive leak loss
- Non-invasive installation: no breaking seals, wireless, integrates with BMS
- Battery life of 3+ years at typical sample rates
- IP65/NEMA 4 rated for outdoor use
- One year payback on investment

Save Energy and Time Locating Faulty Steam Traps

CYPRESS ENVIROSYSTEMS™

WSTM Payback Matrix

WSTM Payback Calculator[2] (years)

WSTM Installed Cost[3]:

$850 per unit

Your Steam Cost:

$20 per 1,000 lbs.

Inspection Frequency[4]:

1 times/year

Inspection Costs[5]:

$5 per trap

Facility Uptime:

365 days/year

Failure Rate[6]:

15% per year

Steam Trap Orifice Diameter[1]

Steam Pressure PSI (gauge)	1/32"	1/16"	3/32"	1/8"	5/32"	3/16"	7/32"	1/4"	9/32"	5/16"	11/32"	3/8"	13/32"	7/16"	15/32"	1/2"
5	76.4	28.9	14.2	8.3	5.4	3.8	2.8	2.2	1.7	1.4	1.2	1.0	0.9	0.8	0.7	0.6
10	67.1	23.8	11.5	6.7	4.4	3.1	2.3	1.8	1.4	1.1	1.0	0.8	0.7	0.6	0.5	0.5
15	59.7	20.3	9.7	5.6	3.7	2.6	1.9	1.5	1.2	1.0	0.8	0.7	0.6	0.5	0.5	0.4
25	49.0	15.7	7.4	4.2	2.8	1.9	1.4	1.1	0.9	0.7	0.6	0.5	0.5	0.4	0.4	0.3
50	33.9	10.0	4.6	2.6	1.7	1.2	0.9	0.7	0.6	0.5	0.4	0.3	0.3	0.3	0.2	0.2
75	25.9	7.3	3.4	1.9	1.3	0.9	0.7	0.5	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2
100	20.9	5.8	2.7	1.5	1.0	0.7	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1
125	17.6	4.8	2.2	1.3	0.8	0.6	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1
150	15.2	4.1	1.9	1.1	0.7	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1
175	13.3	3.6	1.6	0.9	0.6	0.4	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
200	11.9	3.2	1.5	0.8	0.6	0.4	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
225	10.7	2.9	1.3	0.8	0.5	0.4	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
250	9.8	2.6	1.2	0.7	0.5	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
275	9.0	2.4	1.1	0.6	0.4	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
300	8.3	2.2	1.0	0.6	0.4	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Payback Period

0 - 2 Years | 2 - 8 Years | 8+ Years

1. Orifice diameter should not be confused with pipe diameter. Consult the steam trap manufacturer if orifice size is not known.
2. Calculations are theoretical estimates and actual results will vary. Payback calculation includes avoided lost steam and inspection labor. Benefits from avoided damage resulting from blocked traps are not included in model. The formula used for steam loss in this model is: L=24.24*Pa*D2. Where L=pounds/hour, Pa=Pgauge + Patm , D=orifice diameter.
http://www.energy.rochester.edu/efficiency/steam.pdf
3. Actual WSTM installed cost will vary based on volume and integrator.
4. Refers to the manual inspections of steam traps that are currently being done at the facility. The frequency determines the potential avoided failure time when using the WSTM.
5. The frequency and cost of inspection determine the labor savings enabled by the WSTM.
6. The failure rate per year should be based on historical data from the facility. 15-20% failure rates per year are typical. In unmaintained facilities, the failure rate can be much higher:
http://www1.eere.energy.gov/femp/pdfs/om_combustion.pdf

WSTM Executive Summary Report

CYPRESS ENVIROSYSTEMS

Readings | Graph | Table | Reports | Alarm History | Status | Configuration | Site Settings | Help

WSTM Executive Summary Report

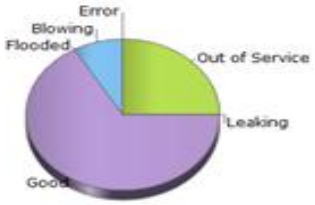
Overview

Total Number of Traps: 12		
Health Status	**Count**	**% of Total**
Nodes with low battery	0	0.00
Nodes with poor RF signal strength	0	0.00

Energy Summary

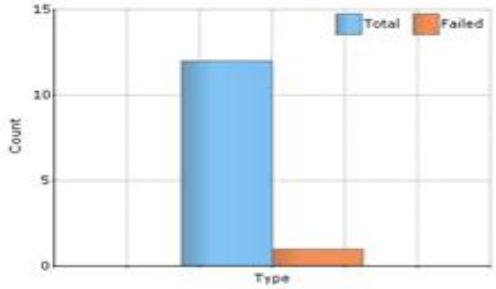
Steam loss (lbs/hr)	35.70
Dollar loss ($/yr)	4,691.38

Condition Summary



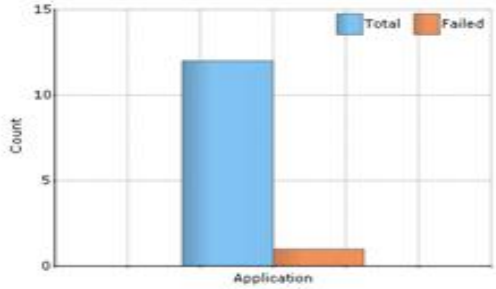
Condition	Count	% of Total
Good	8	66.67
Out of Service	3	25.00
Blowing	1	8.33
Error	0	0.00
Flooded	0	0.00
Leaking	0	0.00

Type Summary



Type	Total Count	% of Total	Failure Count	Out of Service Count	% of In Service Failure
Bucket	12	100.00	1	3	11.11
Totals:	**12**	**100.00**	**1**	**3**	**11.11**

Application Summary



Application	Total Count	% of Total	Failure Count	Out of Service Count	% of In Service Failure
Drip	12	100.00	1	3	11.11
Totals:	**12**	**100.00**	**1**	**3**	**11.11**

CYPRESS ENVIROSYSTEMS™

Comprehensive Reports with Energy Summary for Analysis and Auditing of All Traps

What is our Solution?

WIRELESS PNEUMATIC THERMOSTAT

"Go from Pneumatic to DDC in minutes"

WIRELESS GAUGE READER

"Remotely Read Gauges in minutes"

NETWORK CONTROLLER

WIRELESS STEAM TRAP MONITOR

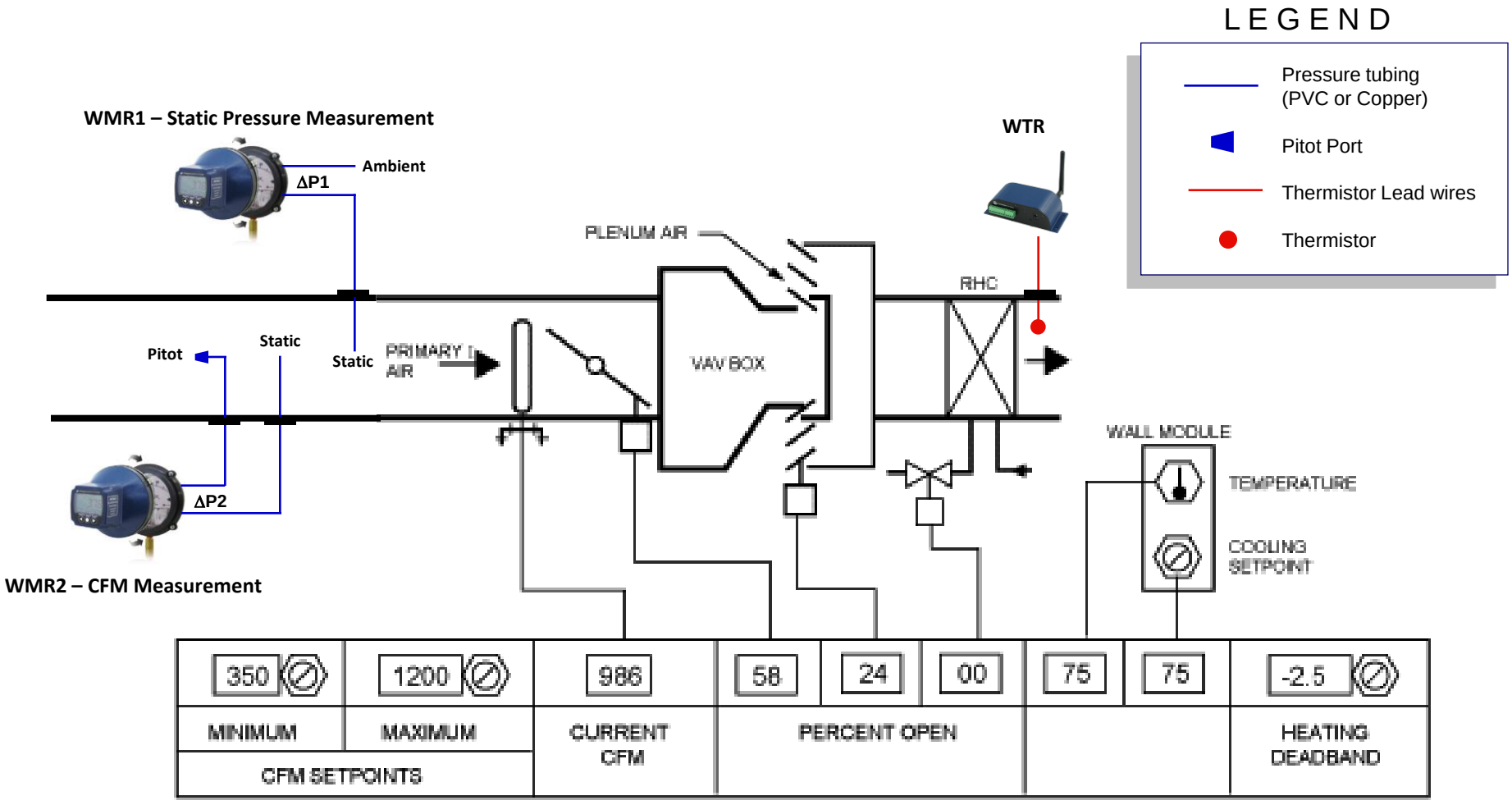
"Avoid Expensive Steam Leaks"

WIRELESS TRANSDUCER READER

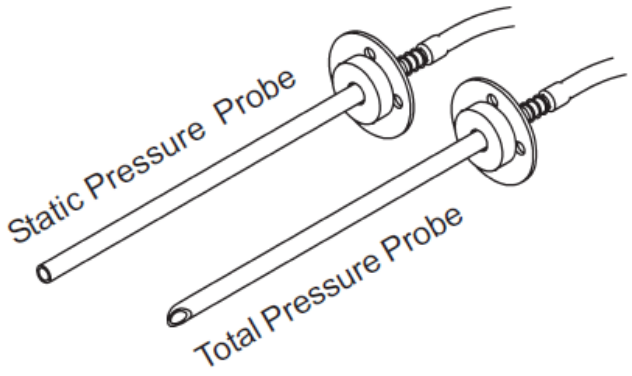
"Remotely Read Transducers – No Wires"

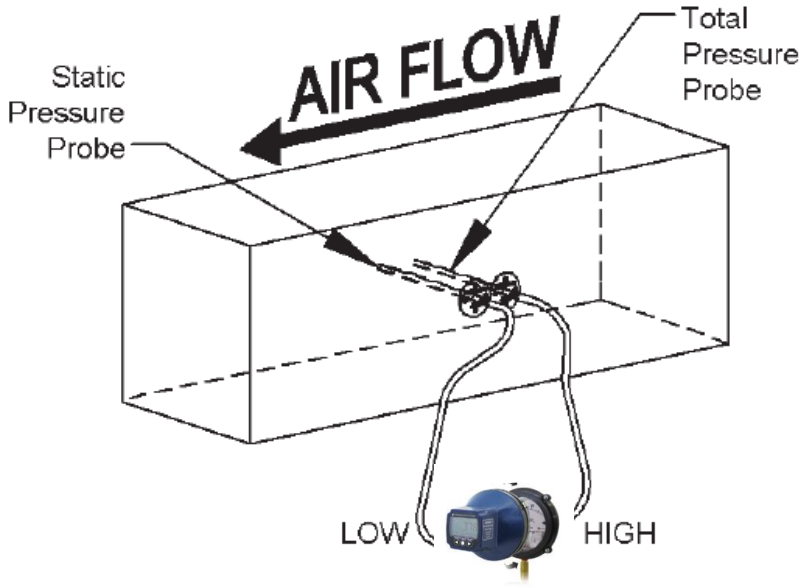
Non-invasive, easy retrofit, energy and labor savings, payback under one year

Duct/VAV Box Measurements



Detailed View – WMR2 Connections (Airflow)





WMR2

Duct/VAV Measurements – Cont'd

Static Pressure at Given Point in Duct:

$\Delta P1$ = Static Pressure in Duct – Ambient Pressure

Air Flow in Duct:

$\Delta P2$ = Dynamic Pressure in Duct – Static Pressure

$\Delta P2 = ½ * \rho * v^2$

(where ρ is density of air, v is duct velocity)

Volumetric Air Flow (Q) = v * A * k

(where A = cross section area of duct,
k = flow profile correction for laminar flow ~ 1)

$Q = (2 * \Delta P2 / \rho)^{½} * A * k$

Duct Air Temperature:

T = Thermister Reading

All of these readings are converted to engineering units (i.e. in-H2O, CFM, and deg F) and exposed via BACnet via the Green Box Controller