GPG Outbrief 02

Wireless Pneumatic Thermostats

GPG Program | U.S. General Services Administration | April 27, 2017

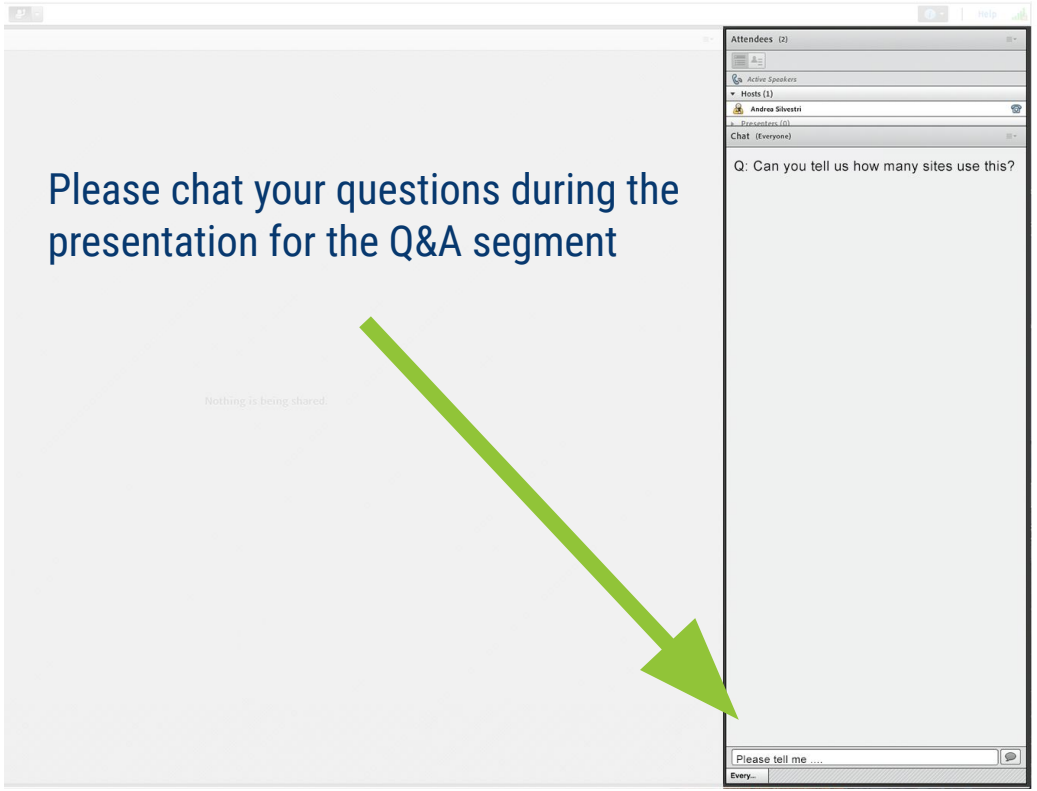
Welcome and Introductions

Michael Lowell
Project Manager, GPG

Webinar Agenda

- Webinar Logistics (5 minutes)
  Michael Lowell, GPG Program Manager
- Overview of GPG (5 minutes)
  Kevin Powell, GPG Program Director
- Wireless Pneumatic Thermostats Assessment (25 minutes)
  Dan Howett, Oak Ridge National Laboratory
- On-the-ground Feedback (10 minutes)
- Q & A (15 minutes)

How to Ask Questions



GPG Overview

Kevin Powell
Program Manager, GPG

The GPG program enables GSA to make sound investment decisions in next generation building technologies based on their real world performance.

GPG Process

Identify promising technologies at the edge of commercialization

Pilot technology installations within GSA's real estate portfolio

Partner with Department of Energy national laboratories to objectively evaluate real-world performance

Recommend technologies with broad deployment potential for GSA

Upcoming GPG Outbriefs - Thursdays, 12 PM ET

June 8 Control Optimization System for Chiller Plants

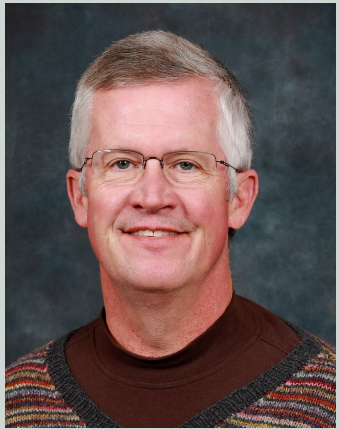
July 13 Next-Generation Chillers

Webinar Recordings

Access all webinars on GSA.gov

GSA.gov/GPG

Measurement & Verification



Daniel Howett
R&D Staff, Oak Ridge National Laboratory

GPG-020

Wireless Pneumatic Thermostats

General Services Administration
Public Buildings Service

GSA

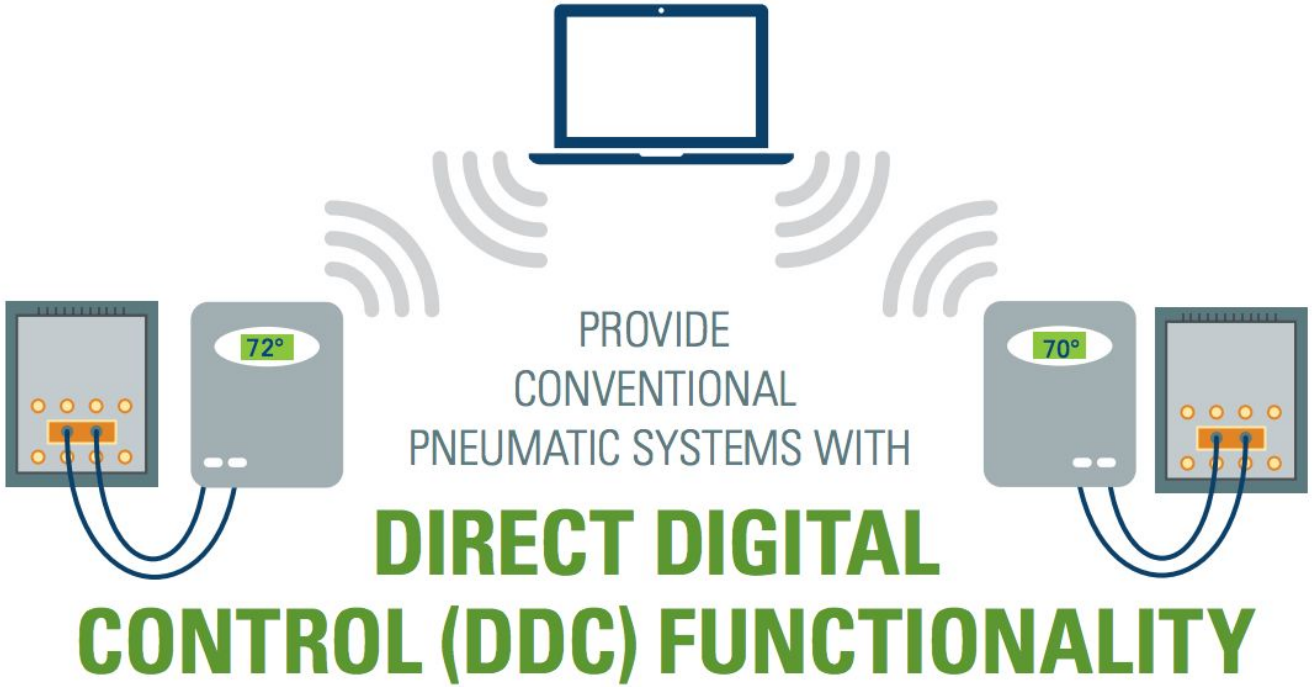
GPG-020 | MARCH 2015

WIRELESS PNEUMATIC THERMOSTATS

Wireless Pneumatic Thermostats Implement Energy Saving Control Strategies

Conventional pneumatic thermostats are typically found in larger multi-story buildings built before 1999. Such thermostats can gauge room temperature and adjust heating, ventilation, and air conditioning (HVAC) equipment. They cannot, however, communicate with a central control system, nor can they exercise more sophisticated energy-saving control strategies, such as automatically setting thermostats back when a building is unoccupied at night or on weekends. The wireless pneumatic thermostat (WPT) is a new technology that can be retrofitted to an existing pneumatic control system. WPTs give conventional pneumatic controls the energy-conserving functionality of more contemporary control systems, such as direct digital controls (DDC), but at a fraction of the cost. To put WPT to the test, GSA's GPG program commissioned the Department of Energy's (DOE) Oak Ridge National Laboratory (ORNL) to assess the technology's operational capabilities under real-world conditions at the Woodrow Wilson International Center for Scholars (Wilson

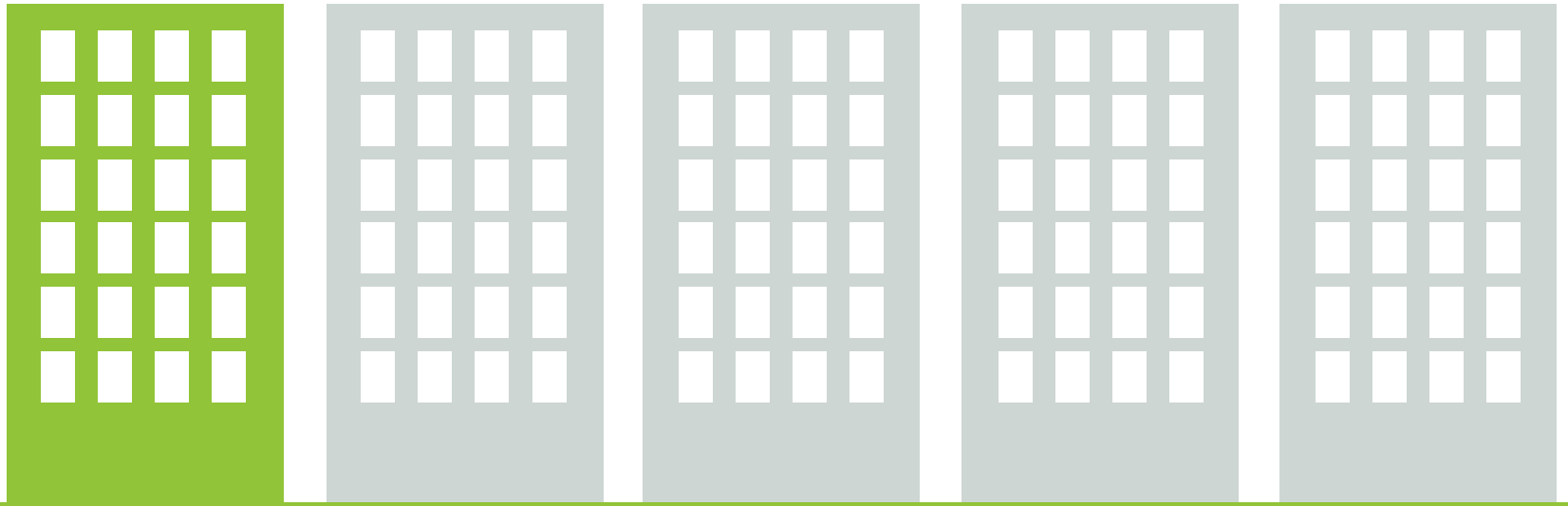
GPG-020. Wireless Pneumatic Thermostats



Opportunity

20% of GSA buildings could benefit from WPT:

PNEUMATIC SYSTEMS COMMON IN MULTI-STORY BUILDINGS > 20,000 ft^2 BUILT BEFORE 1999



Measurement & Verification - Wireless Pneumatic Thermostats

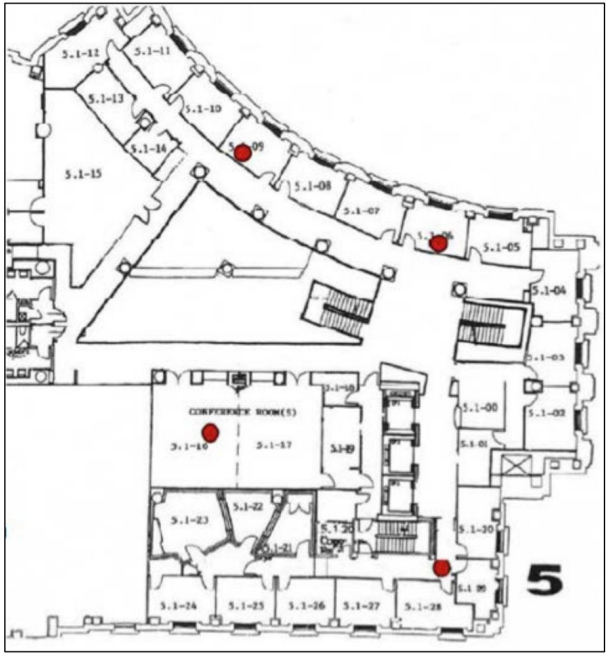
Woodrow Wilson Center, Ronald Reagan Federal Building, Washington DC

6 floors of Woodrow Wilson Center

Technology Deployment

Pre-Installation: Ensure facility's pneumatic control system is properly operating. i.e. Dry air. No leaks. Properly functioning actuators.

Step 1: Determine type of thermostats, evaluate wireless signal, and place central controller.



Locations of the Wireless Repeaters (indicated in red)

Technology Deployment

Step 2: Install wireless thermostats in place of existing pneumatic devices.

30 minutes per thermostat

installation, by a trained HVAC technician, no special skills needed.

Results

Energy Savings: WPTs offer the ability to implement a variety of energy-saving controls strategies not possible with a conventional pneumatic system. An occ/unocc schedule was tested as part of the evaluation, but it is not the only strategy available.

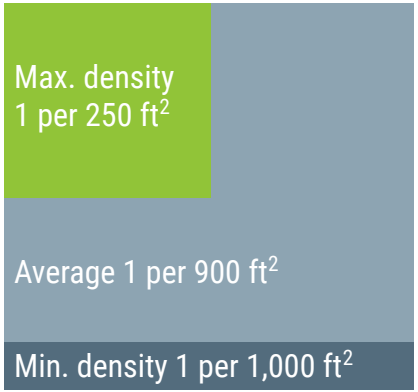
O&M: Can help with maintenance issues such as identifying air leaks using built-in pressure sensors that report to the BAS.

Cost-Effectiveness

Payback is determined by installation costs

- Costs are largely driven by total quantity of thermostats installed.
- Offices with large open spaces have fewer thermostats.
- Labor also impacts installation costs—in buildings without sheetrock, installation takes longer.

Thermostat Density Range



Modeled Payback for Unoccupied/Occupied Control Strategy*

(Other strategies can offer greater savings when optimized for site conditions.)

No deployment priority is associated with climate

Climate Zone & Location		Large Office 498,500 ft² Payback (years)		Medium Office 53,630 ft² Payback (years)		Small Office 5,500 ft² Payback (years)	
CLIMATE ZONE	CITY	LOW[1]	HIGH[2]	LOW[3]	HIGH[4]	LOW[5]	HIGH[6]
1A	Miami, FL	3.6	6.5	3.7	6.8	1.9	3.3
2A	Houston, TX	3.7	6.7	4.5	8.2	2.9	5.0
2B	Phoenix, AZ	4.6	8.2	4.0	7.3	2.5	4.3
3A	Atlanta, GA	3.0	5.4	3.5	6.4	2.6	4.5
3B-coast	Los Angeles, CA	2.8	5.1	3.7	6.8	3.7	6.3
3B	Las Vegas, NV	5.3	9.5	5.0	9.2	3.1	5.4
3C	San Francisco, CA	3.0	5.5	3.8	7.0	3.2	5.5
4A	Baltimore, MD	2.8	5.0	3.3	6.0	2.7	4.7
4B	Albuquerque, NM	5.4	9.7	6.0	10.9	3.5	5.9
4C	Seattle, WA	3.6	6.5	4.5	8.2	4.3	7.4
5A	Chicago, IL	3.1	5.6	3.8	7.0	2.8	4.8
5B	Boulder, CO	5.0	8.9	5.7	10.5	3.7	6.4
6A	Minneapolis, MN	4.6	8.3	5.7	10.5	3.7	6.3
6B	Helena, MT	3.9	7.1	4.6	8.4	3.3	5.7
7	Duluth, MN	4.3	7.8	5.3	9.7	3.7	6.3
8	Fairbanks, AK	4.2	7.6	5.2	9.5	3.1	5.3

Installation Costs by Office Size

Large	$0.50 - $0.90/ft^2
Medium	$0.60 - $1.10/ft^2
Small	$0.70 - $1.20/ft^2

*Payback assumes unoccupied setback 83° for cooling, 62° heating

Best Practices—Wireless Pneumatic Thermostats

Test Wireless Signals

Perform pre-installation tests to determine how well wireless signals can be transmitted within a building where a WPT retrofit is being considered. Certain construction types may interfere with wireless signal transmission.

Consider Issues Around Secure Areas (ex: SCIFs)

Certain federal tenants might have special areas that limit wireless signals. These must be considered when determining if WPTs are appropriate for a building.

Train Facility Operators

WPT training can be accomplished in one day.

Deployment Opportunity for Wireless Pneumatic Thermostats

Any facility with conventional pneumatic controls.

System must be already operating property with no air leaks, moisture in the system and actuators that are functioning correctly. Deployment priority should be given to facilities with high energy costs.

GSA Deployments Wireless Pneumatic Thermostats

R2: Javits, 2.8M GSF, 31 of 38 floors

- Save 2% or 5,719 million btu/yr on electric and steam $212,509 $/yr
  - Baseline 283,643 million btu/yr consumption

- Costs: $1.429 million material, $1.358 million labor, 7,396 labor hours
  - 2,152 thermostats approximately 69 per floor ($550/each)
  - 35 green boxes (data collection) 1 per floor ($3k each)
  - 352 repeaters 10 per floor ($320/each)
  - 10 8-port switches, 10 routers

- Still being connected; has already helped to identify air leaks, will provide greater visibility when connected to BMS

GSA Deployments Wireless Pneumatic Thermostats

R2: Weiss, 1M GSF

- Save: 6.8% or 6,234 million btu/yr on electric and steam, $216,561 $/yr — (mostly due to steam chiller replacement with electric chillers) and ECMs are part of new start/stop and BAS tuning
    - Baseline 67,714 million btu/yr consumption

- Costs: $443k material, $247k labor, 1,355 labor hours
    - 996 thermostats approximately 34 per floor ($550/each)
    - 10 green boxes (data collection) 1 for every 3 floors ($3k each)
    - 116 repeaters 4 per floor ($320/each)
    - 3 8-port switches, 3 routers

- Initial comments were not good because of tenant complaints but what was found was VAV boxes that were stuck in place. WPT provided visibility to identify the problems.

On-The-Ground Feedback

Ron Allard
NCR Regional Energy Branch Chief, GSA

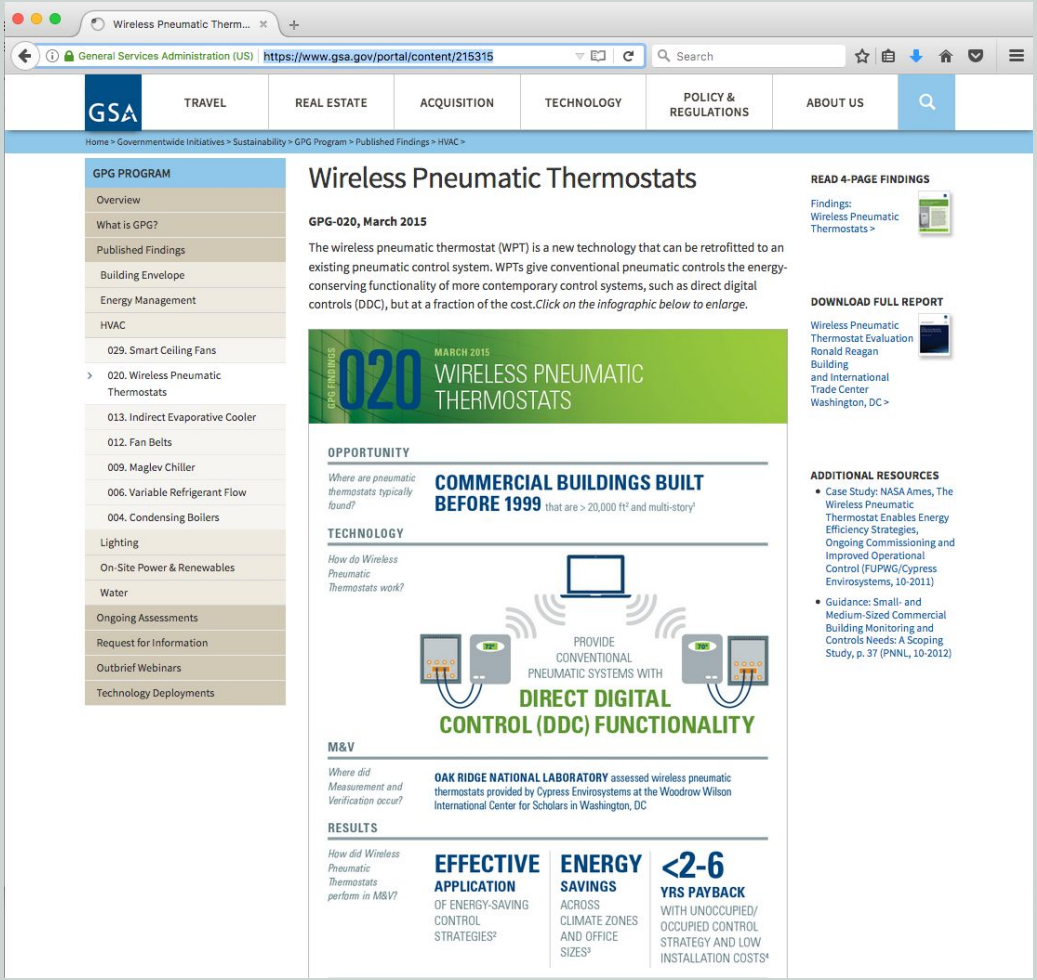
NCR Experience

Ron Allard–NCR

- Thermostats become readable points on BAS.
- Relatively easy install. Manufacturer provided good instructions. Helped to drive uncertainty out of the bid process.
- Great in a retrofit where you don't want to open up walls.
- Works really well for night-time setbacks.
- Positive experience, saves energy; better comfort control for occupants.

Reports Online

- Infographic
- 4-page Findings
- Full Report
- Additional Resources



Q & A

For more information: gsa.gov/GPG

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