

GPG Outbrief 02

Wireless Pneumatic Thermostats

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

The logo for the U.S. General Services Administration (GSA), consisting of the letters "GSA" in white on a dark blue square background.

GSA

Welcome and Introductions



Michael Lowell
Project Manager, GPG

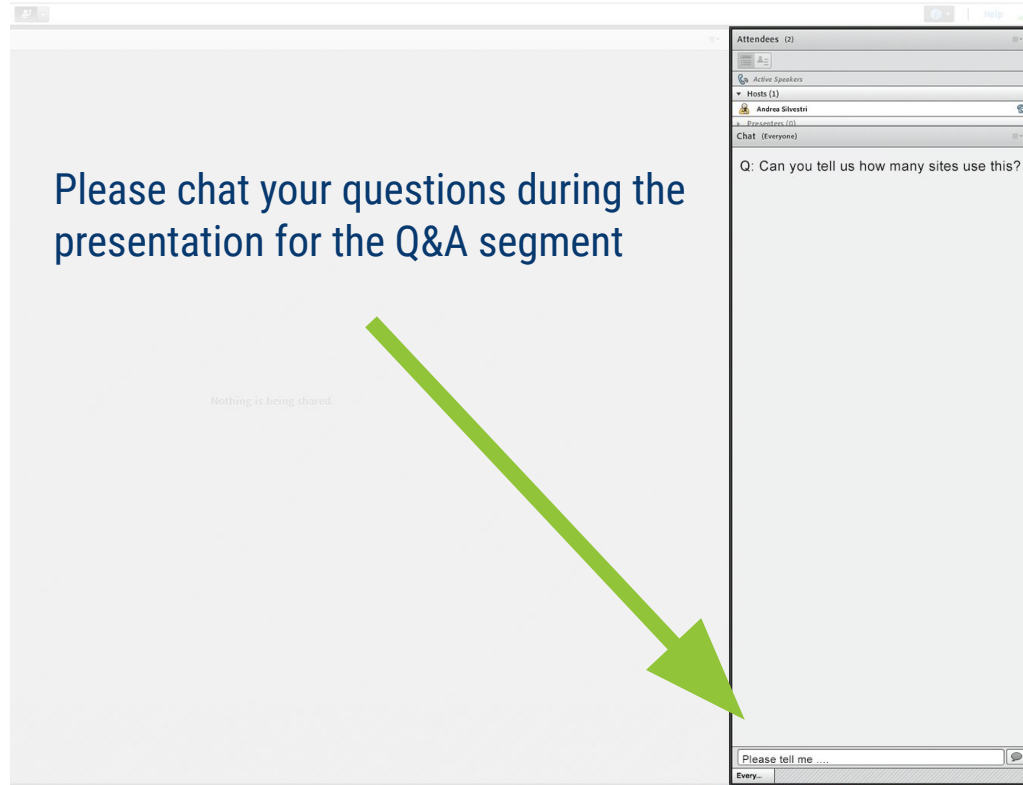
Webinar Agenda

- ❑ **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

Please chat your questions during the presentation for the Q&A segment

Nothing is being shared.




The screenshot shows a presentation window with a chat sidebar on the right. The chat sidebar has a title bar 'Attendees (2)' and sections for 'Active Speakers', 'Hosts (1)', 'Presenters (0)', and 'Chat (Everyone)'. A question is visible in the chat: 'Q: Can you tell us how many sites use this?'. At the bottom of the chat window is an input field with the text 'Please tell me ...' and a send button. A large green arrow points from the text 'Please chat your questions...' in the main presentation area to the chat input field.

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](https://www.gsa.gov)

[GSA.gov/GPG](https://www.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



GPG-020 | MARCH 2015

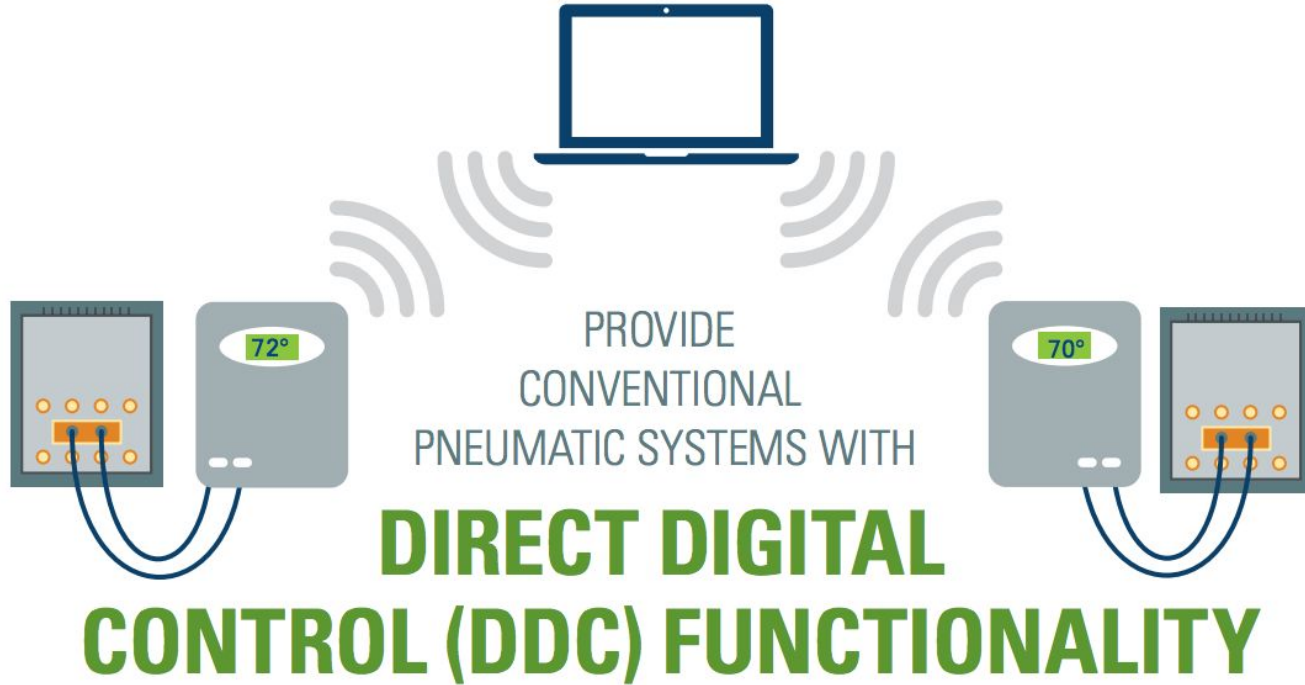
WIRELESS PNEUMATIC THERMOSTATS



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

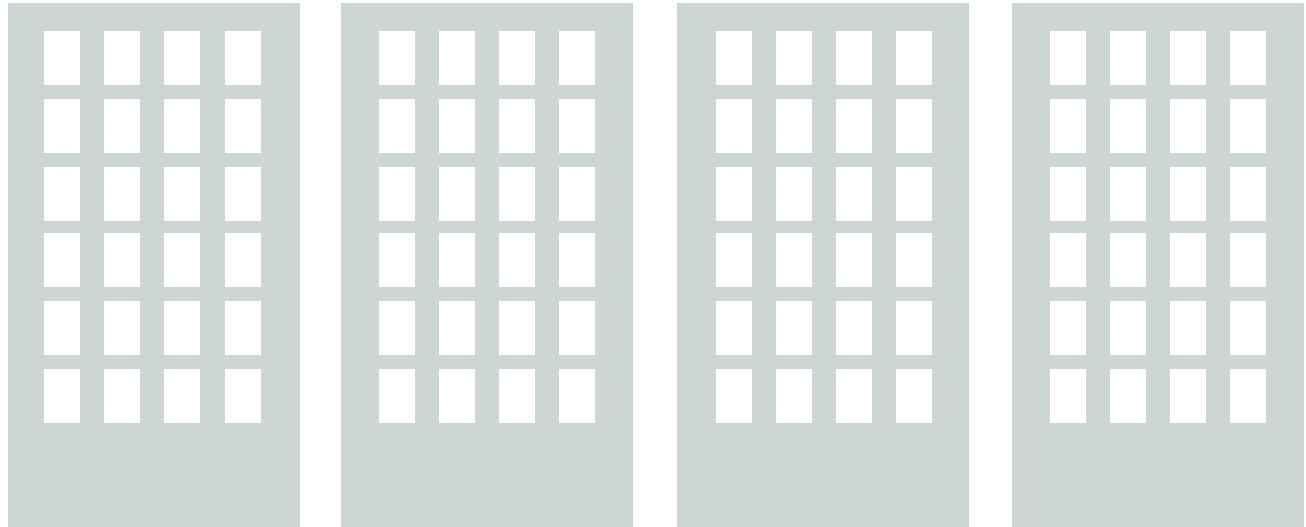


Opportunity



of GSA buildings could benefit from WPT:

PNEUMATIC SYSTEMS COMMON IN MULTI-STORY BUILDINGS > 20,000 ft² 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.



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

Max. density
1 per 250 ft²

Average 1 per 900 ft²

Min. density 1 per 1,000 ft²

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 ft ² Payback (years)		Medium Office 53,630 ft ² Payback (years)		Small Office 5,500 ft ² Payback (years)	
CLIMATEZONE	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/ft²

Medium \$0.60 - \$1.10/ft²

Small \$0.70 - \$1.20/ft²

*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

The screenshot shows a web browser window with the URL <https://www.gsa.gov/portal/content/215315>. The page is part of the GSA's 'GPG PROGRAM' and is titled 'Wireless Pneumatic Thermostats'. The navigation bar includes links for TRAVEL, REAL ESTATE, ACQUISITION, TECHNOLOGY, POLICY & REGULATIONS, and ABOUT US. The main content area features a sidebar with a table of contents for the GPG PROGRAM, including sections like Overview, What is GPG?, Published Findings, Building Envelope, Energy Management, HVAC, and various numbered items such as '020. Wireless Pneumatic Thermostats'. The main article is dated 'GPG-020, March 2015' and describes the wireless pneumatic thermostat (WPT) as a new technology that can be retrofitted to an existing pneumatic control system. It highlights that 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. The article includes several key sections: 'OPPORTUNITY' (Commercial Buildings Built Before 1999), 'TECHNOLOGY' (Direct Digital Control (DDC) Functionality), 'M&V' (Measurement and Verification), and 'RESULTS' (Effective Application, Energy Savings, and 2-6 Yrs Payback). The 'RESULTS' section is particularly prominent, showing a large '2-6' and stating 'YRS PAYBACK WITH UNOCCUPIED/OCCUPIED CONTROL STRATEGY AND LOW INSTALLATION COSTS²'. The page also features a 'READ 4-PAGE FINDINGS' section with a thumbnail of the report cover, a 'DOWNLOAD FULL REPORT' section with a mobile device icon, and an 'ADDITIONAL RESOURCES' section listing case studies and guidance documents.

Wireless Pneumatic Thermostats

GPG-020, March 2015

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. [Click on the infographic below to enlarge.](#)

READ 4-PAGE FINDINGS

Findings: [Wireless Pneumatic Thermostats >](#)

DOWNLOAD FULL REPORT

[Wireless Pneumatic Thermostat Evaluation Ronald Reagan Building and International Trade Center Washington, DC >](#)

ADDITIONAL RESOURCES

- Case Study: NASA Ames, The Wireless Pneumatic Thermostat Enables Energy Efficiency Strategies, Ongoing Commissioning and Improved Operational Control (FUPWG/Cypress Envirosystems, 10-2011)
- Guidance: Small- and Medium-Sized Commercial Building Monitoring and Controls Needs: A Scoping Study, p. 37 (PNNL, 10-2012)

OPPORTUNITY

Where are pneumatic thermostats typically found?

COMMERCIAL BUILDINGS BUILT BEFORE 1999 that are > 20,000 ft² and multi-story¹

TECHNOLOGY

How do Wireless Pneumatic Thermostats work?

PROVIDE CONVENTIONAL PNEUMATIC SYSTEMS WITH **DIRECT DIGITAL CONTROL (DDC) FUNCTIONALITY**

M&V

Where did Measurement and Verification occur?

OAK RIDGE NATIONAL LABORATORY assessed wireless pneumatic thermostats provided by Cypress Envirosystems at the Woodrow Wilson International Center for Scholars in Washington, DC

RESULTS

How did Wireless Pneumatic Thermostats perform in M&V?

EFFECTIVE APPLICATION OF ENERGY-SAVING CONTROL STRATEGIES²

ENERGY SAVINGS ACROSS CLIMATE ZONES AND OFFICE SIZES³

2-6 YRS PAYBACK WITH UNOCCUPIED/OCCUPIED CONTROL STRATEGY AND LOW INSTALLATION COSTS²

Q & A



For more information: gsa.gov/GPG

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