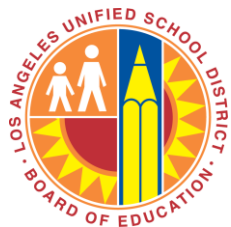


**Wireless Pneumatic Thermostat
Technology Demonstration Test**

**Los Angeles Unified School District
333 S. Beaudry Ave.**

***Final Report
April 23, 2015***



Objective of Demonstration

Demonstrate ability of Wireless Pneumatic Thermostats to improve the control of heating and cooling and to save energy in Los Angeles Unified School District (LAUSD) buildings. LAUSD is the second largest school district in the US (after New York City), with 1,124 schools and 655,000 students.

Overview

333 South Beaudry Street is a 29 story building in downtown Los Angeles which serves as the headquarters for LAUSD, accommodating over 3,000 individuals in approximately 1.6 million sq-ft of office space. Pneumatic thermostats are currently used to control 1079 zones in the building, which uses hot water and chilled water and fan-coil units to regulate space temperature.

Two floors were selected for this test:

- 22nd Floor served as the test floor, where 23 legacy pneumatic thermostats were replaced with Wireless Pneumatic Thermostats (WPT's) from Cypress Envirosystems.
- 23rd Floor served as the control floor, where existing thermostats were left in place to compare performance with the test floor.
- Both floors have virtually identical layout and occupancy, and were independently instrumented for Measurement and Verification using Spirax energy meters which measured the hot water and chilled water flow to each floor.

The following Energy Conservation Measures were implemented on the test floor using WPT's:

- Setpoint Control
 - Enforce "reasonable" setpoints
 - Implement auto-calibration to avoid drift
 - Reduce simultaneous heating/cooling
- Retro-commissioning and On-going commissioning
 - All WPT's were calibrated and set on auto-calibration upon installation. Diagnostic services run at commissioning.
- 4 degree Deadband
 - Cool above and heat below, but ventilation only in deadband

The test was approved by Adrian Tylim, LAUSD Sustainability Specialist, and Brad Rodgers, Chief Engineer of 333 South Beaudry Ave. The test was initiated in April 2013 and data was gathered for chilled water and hot water consumption, zone temperatures, outside temperatures, and occupant comfort (log of hot/cold calls) up till November 2014.

Test Findings

Figure I shows the comparison of chilled water energy consumption between the test floor and the control floor over the 574 day test period, and Figure II shows the comparison for hot water energy consumption:

- Cooling:
 - Control floor used 966,246 MBTU, and Test Floor used 754,109 MBTU, a difference of 212,137 MBTU during this period, or 22% less.
- Heating:
 - Control floor used 93,979 MBTU, and Test Floor used 35,472 MBTU, a difference of 58,507 MBTU or 62% less.

Figure I – Cooling Energy Consumption

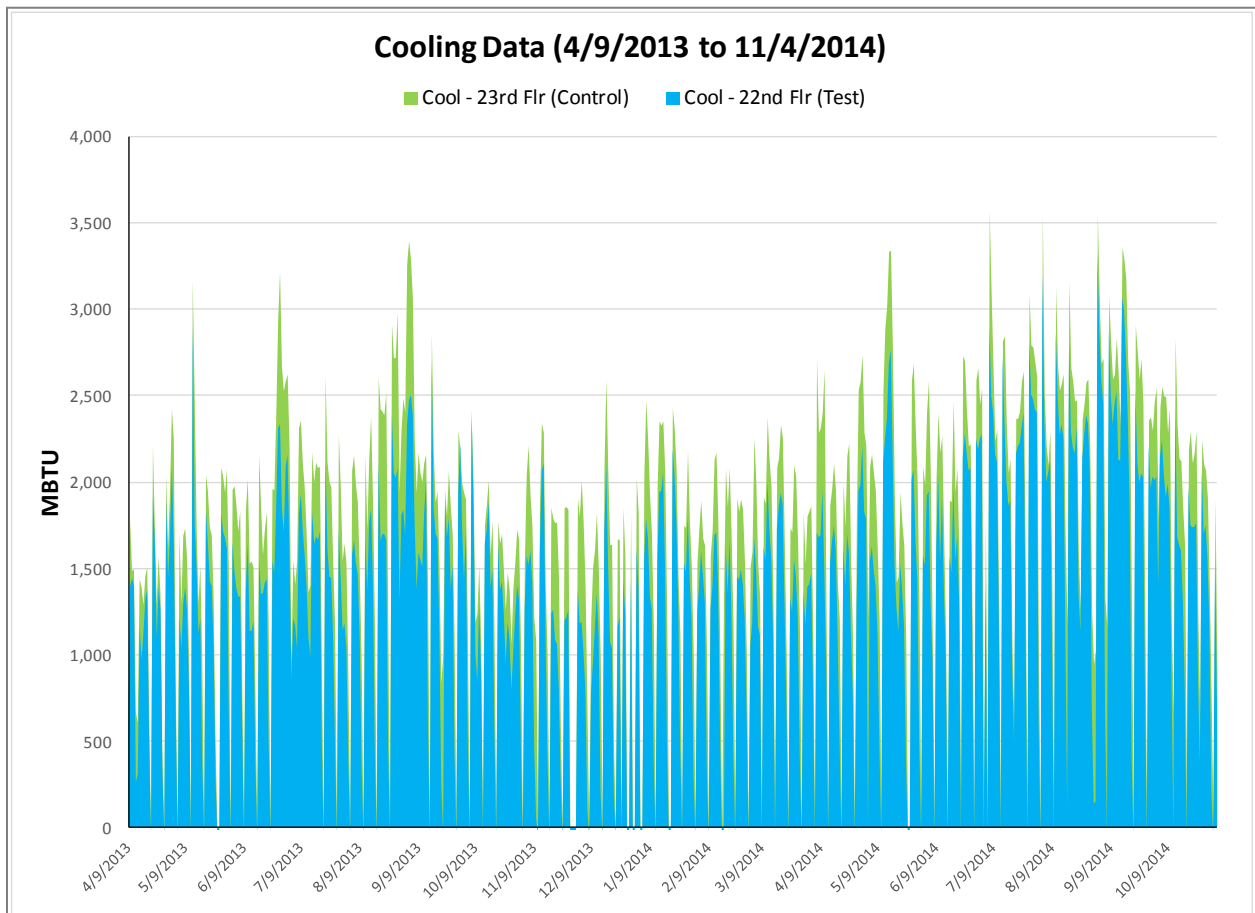
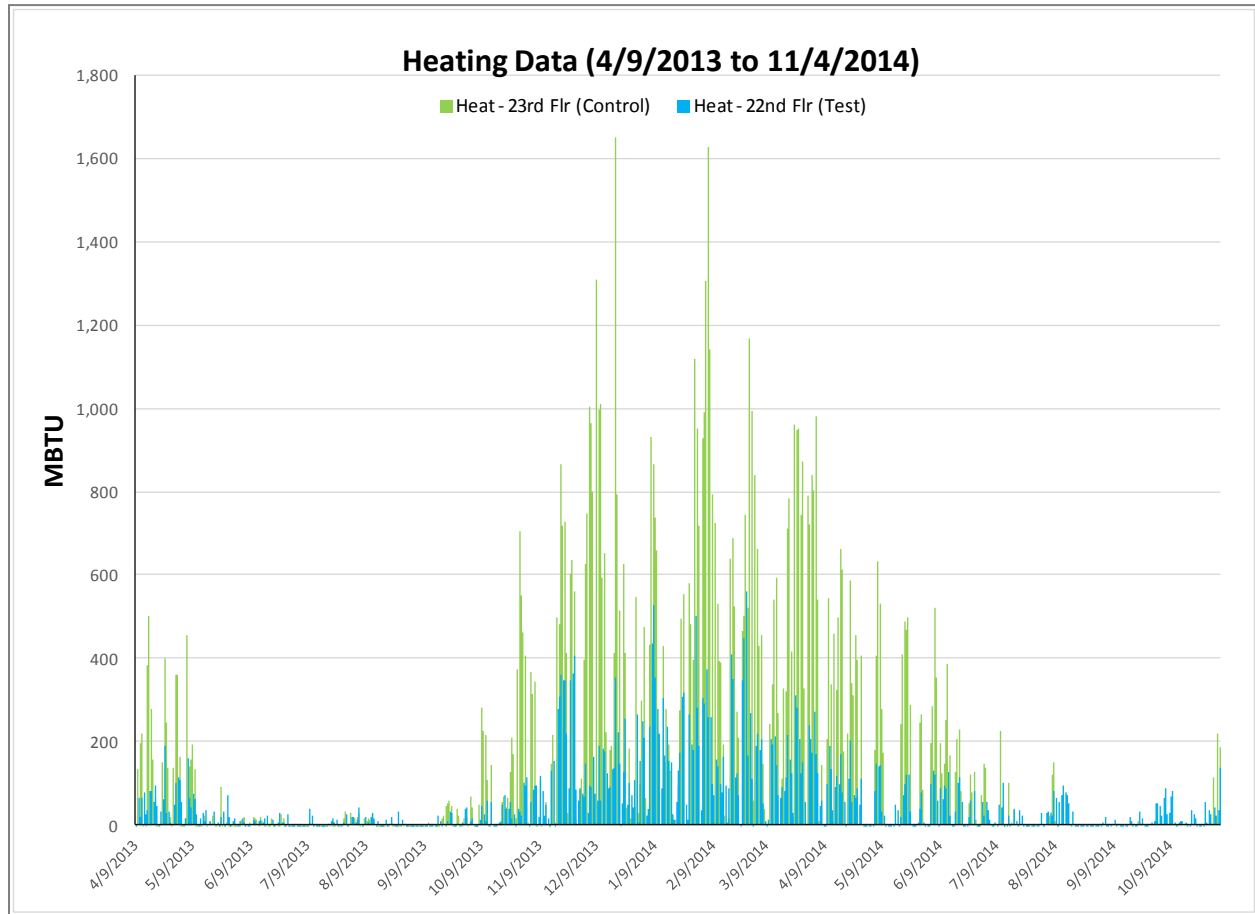


Figure II – Heating Energy Consumption



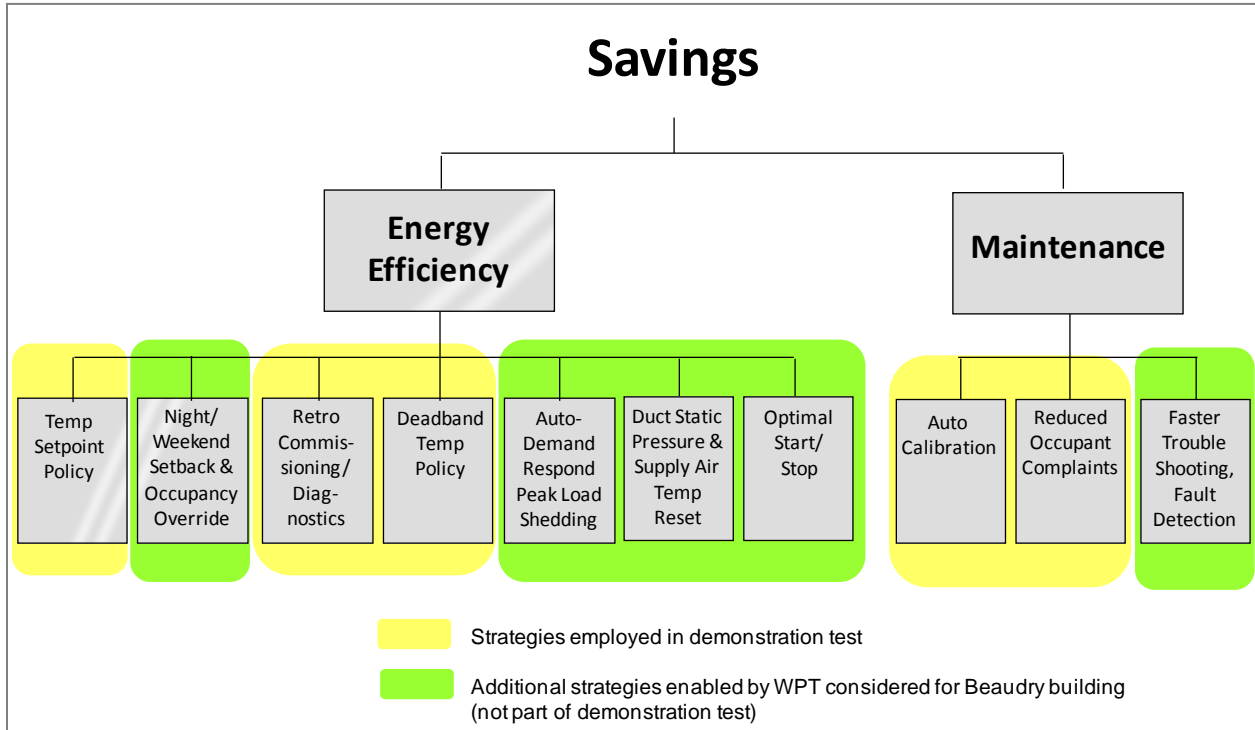
During the period of the test, hot and cold call complaints from occupants decreased (based on anecdotal reports from building staff, but quantitative comparison data was not collected). An informal survey was also conducted among the occupants of the test floor, who responded that they were comfortable and satisfied with the temperature control.

Post Test Activity

LAUSD shared the test results with the Los Angeles Department of Water and Power (LADWP), which approved a custom rebate of \$48 per thermostat based on 700 thermostats. This rebate amount was for implementation of setpoint control and deadband setpoints only.

However, the WPT system is capable of executing many more energy savings strategies including schedule setbacks, supply water temperature resets, fan speed control, optimal start/stop, auto-demand response etc. Figure III shows the strategies which were tested in this demonstration project, and those which are possible using the WPT system. LADWP indicated that a higher rebate amount will be approved if LAUSD implemented additional strategies.

Figure III – Energy Savings Strategies Enabled by WPT



Conclusions

The WPT system shows a clear ability to save significant energy (22% for cooling and 62% for heating) for the LAUSD Beaudry building. Based on current LAUSD utility rates, the payback period for implementing the WPT system is approximately 2.5 years.

It is noteworthy that realized savings from the test only reflected the use of setpoint control strategy. With additional energy savings strategies made possible by the WPT, the reduction in energy use would even be greater and would enable more attractive payback periods.