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08/14 | Printed in USA | 153-BPS-883

SIEMENS

Fred Hutchinson Cancer Research Center

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"Every system in every building is overdesigned because engineers must design for the worst case scenario and then add the safety factor. The same is true when they set the static pressure in the air handler; they chose a number that met the worst case scenario—typically the warmest day of the year—and then added the safety factor."

— Robert Cowan
Director of Facilities
Fred Hutchinson Cancer Research Center

Seattle, Washington – The Fred Hutchinson Cancer Research Center has a 40-year history of combining world-renowned scientists, including three Nobel laureates, and staff who work together to prevent, diagnose, and treat cancer, HIV/AIDS, and other life-threatening diseases. Researchers at Fred Hutchinson are discovering new ways to detect cancers earlier, when cure rates are highest; developing effective treatments with fewer side effects; and learning how to prevent cancers from growing in the first place.

For nearly 24 years, the facilities team at Fred Hutchinson has worked closely with Siemens Industry, Inc., to improve building performance and energy efficiency of the center's campus. A cornerstone of this relationship is the implementation and continuous collaboration on optimum operation of Siemens Demand Flow® VAV within Fred Hutchinson's HVAC system since 2001.

Fred Hutchinson Facilities Team Seeks Advanced Technologies

Beginning in 1990, Fred Hutch began the construction of its 1.5 million sf campus and was completed in 6 different phases over a 22 year period. Today it is one of the most technically complex sites in the state of Washington. With sensitive patient care, research, and pharmaceutical manufacturing equipment onsite, the center represents one of the most intense energy users in the U.S. In fact, one-year energy usage totals have exceeded 217,000,000,000 btu, including 33 million kWh—even with the center's proactive participation in energy conservation programs with the local utilities.

Fred Hutchinson's Director of Facilities Robert Cowan notes that conserving energy requires one or more of the following strategies:

- Deliver the right amount of energy, including reducing lighting levels to meet facility needs, and reducing the static pressure to meet facility needs
- Deliver the energy just in time, including providing lighting and HVAC when buildings are occupied, and reducing or eliminating them when buildings are unoccupied
- Deliver the energy in an efficient manner using the latest technologies and strategies

During the 1990s, Siemens presented the Fred Hutchinson facilities team with a new technology that would help the research center better manage its energy consumption. At the time, this solution was known as "Variable Volume Variable Pressure" (VVVP), and represented an emerging technology that presented an impressive economic case to the Fred Hutchinson team. Today, this solution is called Demand Flow VAV, and has been up and running at the cancer research center since 2001.

About Demand Flow VAV

Demand Flow VAV is a proprietary control solution that "learns" how a facility's VAV system functions, then identifies an appropriate duct static pressure model and dynamically specifies the fan outlet static pressure set point in response to varying airflow rates. Optimizing a VAV system in this way creates both energy and operational cost savings, reduces noise, and maintains desired control performance.

VAV System at Fred Hutchinson

Fred Hutchinson's VAV system was characterized by numerous variable volume supply boxes serving individual zones as well as a variable volume supply fan with inlet cone control or VSD motor. These combined to create a constant 2-inch SP supply. To implement the Demand Flow VAV solution, Siemens and Fred Hutchinson worked together to:

- Gather field data (i.e. duct layout, supply boxes, fan performance)
- Conduct field tests for equipment performance
- Generate system model
- Implement system model

This work was completed in two phases. The first phase of implementation covered seven air handlers, which replaced inlet vane fan control with VSDs and the variable static pressure control strategy. For phase two, Siemens added the variable static pressure control strategy to six additional air handlers.

[1]In an independent study at Texas A&M University, the Demand Flow VAV approach was selected from 13 different static pressure reset strategies as an optimal solution in a VAV fan system. In this study, an emulator was created based on the performance of a real AHU. By applying the DF VAV principle in that emulator, 74% energy savings was recorded when compared to constant static pressure set point. (Source: Kimla, John William. Optimized Fan Control In Variable Air Volume HVAC Systems Using Static Pressure Resets: Strategy Selection And Savings Analysis. Thesis, Texas A&M University: 2009.)

Demand Flow VAV Creates $1.5 Million in Energy Savings

As shown in the chart below, following implementation of the Demand Flow VAV solution, Fred Hutchinson saw its baseline 2-inch constant discharge SP reduce to an average of 1.1. In addition, the first seven air handlers achieved single-fan operation capability. According to Cowan, implementing Demand Flow VAV "allowed us to take out the overdesign but still meet the needs of the building on the worst day of the year without paying the energy penalty the other 364 days."

In the 13 years since implementing the Demand Flow VAV solution, Fred Hutchinson has saved approximately $1.5 million in energy cost reduction. Cowan says, "Although we could have done a static pressure reset, we would have realized just 50-70% of the potential energy savings. Demand Flow VAV allowed us to get maximum energy savings every hour of every day. This approach pays dividends in every type of building, but particularly in laboratory and hospital settings where huge air handlers operate 24/7/365 with highly variable air demands throughout the day."

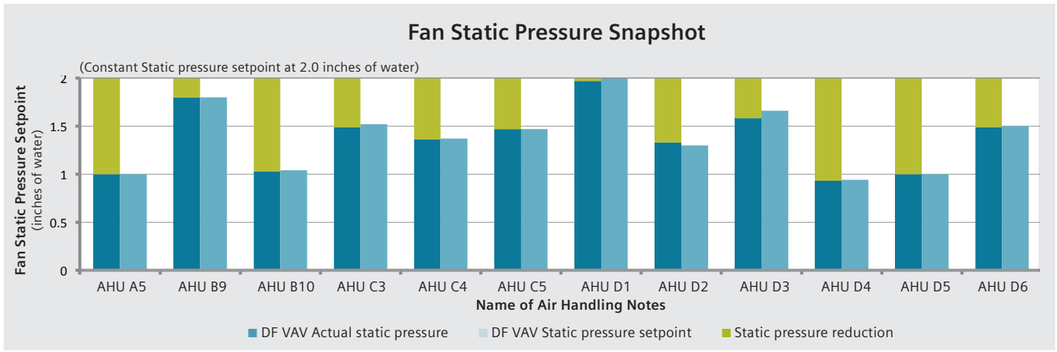
Diagnostic Solution Keeps VAV System Operating at Peak Performance

In addition to creating a more energy-efficient VAV system, the Fred Hutchinson team has come to rely on the Demand Flow VAV solution as a diagnostic tool. According to Controls Lead Rick Larson, "We can use this solution almost as a continuous commissioning tool. When something is not operating exactly as we need it, Demand Flow VAV gives us an avenue to investigate and correct that situation."

Today, Fred Hutchinson is seeing static pressures well below the 2.0 average they experienced prior to the Demand Flow VAV implementation:

"Demand Flow VAV allowed us to get maximum energy savings every hour of every day. This approach pays dividends in every type of building, but particularly in laboratory and hospital settings where huge air handlers operate 24/7/365 with greatly changing air demands throughout the day."

— Robert Cowan
Director of Facilities
Fred Hutchinson Cancer Research Center



DF VAV provides a significant pressure in fan pressure. In the case of AHU A5, the reduction was 50%.
When fan pressure is required operationally, as in the case of AHU D1, DF VAV delivers design static pressure of 2.0 inches of water.
This level of accuracy and efficiency demonstrates the power of controlling fan static pressure set-points using Demand Flow VAV.

Long-Term Partnership with Siemens

Although the Demand Flow VAV has generated significant benefits in terms of both energy savings and operational improvements, Fred Hutchinson credits the service relationship it has had with Siemens over the past two decades. "In addition to Demand Flow VAV, we have implemented Siemens building automation system, controls, and a wide variety of other solutions within our facility. They're simply great solutions, but they can be a bit difficult to understand. Siemens has provided us with the necessary training, support, and service agreements we need to stay up and running. They've created a generation of Siemens fanatics here at Fred Hutchinson," says Jim Walker, Staff Engineer.

As one example, the facility expansion and renovation projects over the years had created an IT network that wasn't as effective as it could have been. When the team lost network communication entirely, Siemens deployed a team to help Fred Hutchinson identify and correct the root cause of the issue. "You can have the best chillers, boilers, and air handlers in the world," says Cowan. "But the building automation system is the cornerstone of all of our operations today. Even with the best BAS, you need the right people managing it or it won't work right. Siemens has done a great job of getting us everything we need, including onsite training, to keep us working effectively," he concludes.

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