Strategies for DDC Optimization

OVERVIEW

Building control systems, also called Direct Digital Control (DDC) Systems or Building Automation Systems (BAS), can be optimized to achieve low cost energy savings. The following list of ten strategies outlines commonly identified opportunities in building control systems. These strategies are all non-capital, operational measures that have relatively quick paybacks of less than three years.

STRATEGIES

Reduce Equipment Runtime

The most prevalent opportunity for increasing energy efficiency in buildings is reducing equipment runtime. Equipment is often left on by accident or by the decision of the building operator. Often, DDC schedules are not aligned with occupancy, including statutory holidays. Instead of simply restoring the auto or scheduled running times, the building operator should address the root cause of the potentially avoidable run time, which yields better long-term results. Use hourly energy monitoring information and/or DDC trends to identify opportunities to reduce equipment runtime.

Add or Improve Chilled Water Temperature Reset

Chillers often operate at fixed supply temperature set points, rather than according to the building's actual cooling demands. Increasing the chilled water supply temperature will improve the chiller efficiency. This can be achieved by revising the DDC system to provide chilled water supply temperature reset based on cooling valve positions, high temperature variance, or outdoor temperature, depending on the application.

Volume Control for Pumps and Fans

It is a common practice to install variable speed drives on pumps and fans in variable volume systems. However, inefficiencies result when speed drives are continuously running at high capacity. This can be caused by excessive pressure setpoints, critical zone reset algorithms that do not address rouge zones, debris clogged air intakes, operator overrides, and many other causes. Modulating pumps or fans to deliver the required flow will save energy.

Optimize Ventilation Rates

Optimizing ventilation rates in air handling units provides further opportunities for energy savings. For instance, an air handling unit serving a gymnasium could be outfitted with carbon dioxide sensors which would provide demand controlled ventilation and maintain minimal outdoor air when there is limited or no occupancy.

Eliminate Unnecessary Lighting Hours

Even when building lighting control systems are programmed by a schedule, lights will occasionally remain on when the space is unoccupied. To minimize lighting hours, require the first person using the space to manually turn on the lights (instead of having a scheduled on time) and set up the system to sweep off the lights at fixed intervals at the end of normal occupancy hours.

Optimize Zone Temperature Set Points

When a system is programmed to satisfy the highest cooling demand in a space, a single zone with low set point can set the system to high outdoor ventilation or mechanical cooling, while reheat coils serving other zones are open to provide heat. To rectify the situation, avoid having one zone dictate the supply temperature and limit the range of occupant temperature reset.

Optimize Supply Air Temperature

Another energy saving opportunity is found when the supply air temperature set point is fixed or on an outdoor reset schedule. In some cases, the set points are chosen based on the operator's desire to minimize complaints. In order for the system to run optimally, supply temperature should be adjusted based on the actual requirements of the spaces and occupants.

Eliminate Simultaneous Heating and Cooling

Eliminating simultaneous heating and cooling offers an important means of reducing energy consumption. One prime example is when a Variable Air Volume (VAV) system is delivering a low supply air temperature but all the downstream VAV boxes reheat coils are providing heating. Another occurs when the building has a mix of DDC and pneumatic controls. With the pneumatic thermostat controlling the hydronic baseboard heaters and a DDC space temperature sensor controlling the VAV box, the same space may be simultaneously heated via the baseboard and cooled from overhead.

Optimize Economizer Operation

Economizer dampers are often found failed in minimum position (which results in inadequate free cooling), incapable of full closure, or lacking full range operation. This occurs with aging actuators and damper bearings that are overdue for maintenance. Economizer maintenance should be part of a regularly scheduled maintenance program. Proper economizer operation will reduce mechanical cooling energy by taking advantage of outside air for "free cooling".

IMPORTANCE OF ENERGY INFORMATION

A variety of tools exist to assess and monitor a building's energy performance. These tools include energy profiles, DDC trend logs, DDC graphics (for quick troubleshooting and verification), exception reports that generate alarms, and CUSUM analysis to track changes in energy use. To reduce energy waste and optimize operations, energy information should be used to better understand system operation.

"BEST PRACTICE OBJECTIVE FOR OPERATING HVAC SYSTEMS"

"Best Practice Objective for Operating HVAC Systems" was developed and published by Shared Services BC (SSBC) in February 2010. The purpose was to provide information on high performance operating procedures for HVAC systems that, when implemented, will improve comfort and indoor air quality, and optimize energy performance.

This publication includes both management and operator practices and responsibilities. **In summary, best operating practices will ensure that the operator:**

a. has documentation about the installed systems, including their energy performance, maintenance of comfort conditions, occupant satisfaction (measured by complaints and problems), and maintenance history, and

b. has the knowledge and experience to use the available information to operate HVAC systems to their maximum capabilities, which includes identifying possible ways to enhance operating efficiency and effectiveness.

The HVAC best practices identify many of the building operator's important tasks related to HVAC operations, and the management programs necessary to support those tasks. **The highlights of the HVAC best practices are:**

- HVAC Systems Documentation
- Descriptive Narrative of HVAC Systems
- HVAC Systems Sequence of Operations
- HVAC Systems Operating Plan
- Preventive Maintenance Program
- Management of Occupant Complaints
- Energy and Water Accounting and Monitoring System
- Real Time Comfort and Energy Use Data
- Management of Tenant Improvements
- Ozone Depleting Substances
- HVAC Systems Status Checks
- Periodic HVAC System Evaluation
- Occupant Involvement
- Operator Involvement, Orientation and Training

Prepared by **Prism Engineering Ltd** for **The Climate Action Secretariat**, **BC Ministry of the Environment** with support from **Fortis BC** and **BC Hydro**.