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A Guide to HVAC Energy Efficiency

What Is HVAC Energy Efficiency?

HVAC energy efficiency results from operating your **heating, ventilation and air conditioning (HVAC)** and ancillary equipment as optimally as possible without compromising the zone ventilation requirements, temperatures, humidity or differential pressures etc. Simply reducing energy consumption is not of value if the operation of the plant is impacted.

Why Is Energy Efficiency Important for HVAC Systems?

HVAC systems are generally one of the largest energy consumers in a facility, particularly when you include chillers and boilers under the HVAC umbrella. As such, for a facility to make a meaningful impact on their energy, cost and carbon emission reduction targets, HVAC should be front and center as the core focus of any efforts.

What Are The Benefits of an Efficient HVAC System?

When you improve the efficiency of HVAC systems, you will reap a number of benefits which include:

- Reduced costs
- Reduced carbon emissions, which can assist with net-zero targets
- Reduced equipment downtime, and thus increased production uptime
- Increased equipment life cycle – reducing excessive operation
- Improved zone conditions like ventilation, thermal and compliance
- Increased occupant satisfaction, meaning less complaints from staff or occupants

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Top HVAC Energy Efficiency Improvements

Ensure Adequate Maintenance Regimes

Ensuring that HVAC systems are correctly maintained is the first step in improving HVAC energy efficiency and performance. Equipment such as air handling units (AHUs), chillers and boilers require regular maintenance checks to ensure peak performance is maintained.

Some key actions from a maintenance perspective on equipment that will impact energy efficiency are as follows:

Note: these are some typical checks, and this is not an exhaustive list.

Air Handling Units (AHUs)

- Clean water coils
- Ensure no air leaks from panels and water leaks from the coils and pipes
- Ensure damper linkages are secure and dampers are not leaking
- Check calibration of key control sensors (temperature, humidity, differential pressure etc)

Boilers

- Check calibration of control sensors (temperature, differential pressures)
- Ensure no water leaks
- Ensure water levels in system are adequate
- Ensure boiler insulation is correctly installed

Chillers

- Check calibration of control sensors
- Ensure strainers are clean
- Clean chiller tubes and filters
- Confirm correct oil levels

Reduce Excessive Operation

A typical reason for excessive HVAC equipment energy consumption can be attributed to excessive operation. This can occur as a result of poor time schedule management or, more often, equipment that is taken out of automatic operation.

This can happen when the HVAC equipment is manually overridden at the BMS or physically at the equipment itself, but not reverted to automatic. A situation like that can typically occur when there are maintenance activities undertaken on the equipment, or when an operator overrides a piece of equipment to run, or stop, as a temporary measure to meet a field requirement.

Remove Overridden Control Points

Over time, it is common for many of the commissioned set points and parameters to be overridden at the building management system (BMS). This can mean that either:

A. The equipment may be over driving to achieve unrequired set points

B. Control algorithms are not operating correctly to meet zone requirements efficiently

BMS system set points and parameters should be frequently reviewed to ensure that overridden points are minimal and accounted for. Overridden points should never be a permanent solution on the BMS

Ensure physical installation is suitable

If the installation is not adequate for the application, then HVAC efficiency is impacted. The physical installation can be something as simple as a temperature sensor located next to a vending machine, causing the AHU to over cool the zone. It could also be a poorly installed sensor in a duct misreading the return air temperature, meaning you do not make the most of the free cooling potential.

Another frequent issue occurs when zones have been repurposed for different applications and the AHU's are no longer able to run efficiently due to capacity or design issues.

For example, a zone with equipment designed for heating and cooling only is now required to control humidity, however the cooling coil is not sized in a manner that can adequately dehumidify the air.

Ensure control algorithms are operating correctly and suitable for the application

Correctly tuned and functional control algorithms are key to ensuring energy efficient operation of your HVAC plant and equipment. Ensuring the control loops are operating correctly can reduce HVAC consumption by up to 30%.

There are a number of key control loops in your BMS that will define how your system operates, and as such designing, commissioning and monitoring these control algorithms are of paramount importance. Some to look for are:

Air Handling Units (AHUs)

- Supply air temperature control and temperature reset
- Supply air pressure control and pressure reset
- Economy mode (free cooling)
- VAV controls

Chillers

- Chilled water temperature control and temperature reset
- Primary and secondary pump control
- Condenser water temperature reset
- Chiller staging parameters

Boilers

- Boiler temperature control and temperature reset
- Pump controls
- Boiler staging parameters

How Can HVAC Analytics Software Reduce Energy Costs?

Assist With Maintenance

Having building analytics software monitoring your plant and equipment can help pinpoint where the maintenance focus should be. This means moving from preventative maintenance to data driven maintenance, which will help:

- Reduce downtime
- Reduce complaints
- Improve resource efficiency and productivity

Continuously monitoring the equipment will reduce the requirement to physically check many items such as valves, dampers and sensors.

Track Excessive Operation

Building analytics platforms learn, through monitoring and analyzing the data, how the buildings should operate. If equipment suddenly begins to diverge, the system will raise an alert for investigation, pinpointing the areas where there is a sudden change in parameters or operating times. This ensures swift resolution of issues.

Ensure Physical Installation Is Suitable

Building analytics platforms can identify when equipment is not operating efficiently by monitoring and analyzing the various control parameters.

When equipment is not operating efficiently or delivering the conditions that are required, there are a number of potential causes, and sometimes this can be due to poor installation or design.

Based on the control anomalies, the building analytics platform can provide guidance on the issue and potential resolutions, including potential installation issues. This streamlines the rectification.

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