

Conducting an HVAC Audit

The potential for energy conservation varies depending on the design of the system, the method of operation, operating standards, maintenance of control systems, monitoring of the system, and competence of the operators. General opportunities for energy conservation are discussed below. Please keep in mind that some of these efficiencies will need to be conducted by an expert. Some of these efficiencies will be at no cost, while others will require some investment.

Generally, implementing a maintenance plan, installing controls and upgrading equipment when possible, are good ways to save on energy costs.

Assess existing conditions

To conduct a HVAC audit you will first need basic HVAC information such as type and number of units, hours of use, etc. to help you understand the current energy use attributed to HVAC systems in your facility. This information will help you understand how much you are currently spending and the potential savings available from HVAC efficiencies

Assess opportunities for increasing HVAC energy efficiency

Determine if the following opportunities exist for a given location. Each checkbox represents an opportunity for energy savings, followed by suggestions on how to best take advantage of the opportunity.

- Reduce HVAC system operation when building or space is unoccupied.
 - Reduce HVAC operating hours to reduce electrical, heating and cooling requirements.
 - Eliminate HVAC usage in vestibules and unoccupied space.
 - Minimize direct cooling of unoccupied areas by turning off fan coil units and unit heaters and by closing the vent or supply air diffuser.
 - Turn fans off.
 - Close outdoor air dampers.
 - Install system controls to reduce cooling/heating of unoccupied space.

- Reduce HVAC operating hours.
 - Turn HVAC off earlier.
 - Install HVAC night-setback controls.
 - Shut HVAC off when not needed.
 - Adjust thermostat settings for change in seasons.
 - Adjust the housekeeping schedule to minimize HVAC use.

- Schedule off-hour meetings in a location that does not require HVAC in the entire facility.
 - Install separate controls for zones.
 - Install local heating/cooling equipment to serve seldom-used areas located far from the centre of the HVAC system.
 - Install controls to vary hot water temperature based on outside air.
 - Use variable speed drives and direct digital controls on water circulation pumps motors and controls.
- Adjust areas that are too hot or too cold.
- Adjust air duct registers.
 - Use operable windows for ventilation during mild weather.
 - Use window coverings such as blinds or awnings to cut down on heat loss and to avoid heat gain.
 - Use light-coloured roofing material and exterior wall covering with high reflectance to reflect heat.
 - Incorporate outside trees to create shade.
 - Install ceiling fans. Create zones with separate controls.
- Reduce unnecessary heating or cooling.
- Set the thermostat higher in the cooling season and lower in the heating season.
 - Allow a fluctuation in temperature, usually in the range of 68° to 70°F for heating and 78° to 80° for cooling.
 - Adjust heating and cooling controls when weather conditions permit or when facilities are unoccupied.
 - Adjust air supply from the air-handling unit to match the required space conditioning.
 - Eliminate reheating for humidity control (often air is cooled to dew-point to remove moisture, then it is reheated to the desired temperature and humidity).
- Install an economizer cycle
- Instead of operating on a fixed minimum airflow supply, an economizer allows the HVAC system to utilize outdoor air by varying the supply airflow according to outdoor air conditions, usually using an outdoor dry bulb temperature sensor or return air enthalpy (enthalpy switchover). Enthalpy switchover is more efficient because it is based on the true heat content of the air.

Employ heat recovery

A heat exchanger transfers heat from one medium to another. Common types of heat exchangers are: rotary, sealed, plate, coil run-around system, and hot oil recovery system.

- Install heat recovery ventilators that exchange between 50 and 70 percent of the energy between the incoming fresh air and the outgoing return (conditioned) air.

Minimize the amount of air delivered to conditioned space

The amount of air delivered to a space is dependent upon heating/cooling load, delivery temperature, ventilation requirements and/or air circulation or air changes. On average the air should change every five to 10 minutes. Reducing airflow will reduce horsepower. Occupational Safety and Health Administration (OSHA) and local requirements of air exchange must be maintained.

- Extend the time frame for circulation of air by using a fan discharge damper, fan vortex damper (fan inlet), or fan speed change.

Minimize exhaust and make-up air.

Makeup air depends on the needs of ventilation for personnel, exhaust air from workspaces, overcoming infiltration, machine air needs, and federal, state and local requirements.

- Seal ducts that run through unconditioned space (up to 20 percent of conditioned air can be lost in supply duct run).
- Keep doors closed when air conditioning is running.
- Properly insulate walls and ceilings.
- Insulate air ducts, chilled water, hot water and steam pipes.
- Rewire fans to operate only when lights are switched on, as codes permit.
- Check for damper leakage/ensure tight seals.
- Shut off unneeded exhaust fans and reduce use where possible.
- Reduce air volume lost by reducing exhaust rates to the minimum.
- Review process temperatures.
- Install thermal windows to minimize cooling and heating loss.

Implement a regular maintenance plan.

- Inspect to ensure dampers are sealed tightly.
- Clean coil surfaces.
- Ensure doors and windows have tight seals.

- Check fans for lint, dirt or other causes of reduced flow.
- Schedule HVAC tune-ups (the typical energy savings generated by tune-up is 10 percent).
- Check and calibrate thermostat regularly.
- Replace air filters regularly.
- Inspect ductwork.
- Repair leaks.
- Turn off hot water pumps in mild weather.

Maintenance for an expert

- Reduce fan speeds and adjust belt drives.
- Check valves, dampers, linkages and motors.
- Check/maintain steam traps, vacuum systems and vents in one-pipe steam systems.
- Repair, calibrate or replace controls.

Cooling system maintenance.

Clean the surfaces on the coiling coils, heat exchangers, evaporators and condensing units regularly so that they are clear of obstructions.

- Adjust the temperature of the cold air supply from air conditioner or heat pump or the cold water supplied by the chiller (a 2° to 3°F adjustment can bring a three to five percent energy savings).
- Test and repair leaks in equipment and refrigerant lines.
- Upgrade inefficient chillers.

Fuel-fired heating system maintenance (possible five to 10 percent in fuel savings)

- Clean and adjust the boiler or furnace.
- Check the combustion efficiency by measuring carbon dioxide and oxygen concentrations and the temperature of stack gases; make any necessary adjustments.
- Remove accumulated soot from boiler tubes and heat transfer surfaces.
- Install a fuel-efficient burner.

Control setting maintenance

- Determine if the hot air or hot water supply can be lowered.
- Check to see if the forced air fan or water circulation pump remains on for a suitable time period after the heating unit, air conditioner or chiller is turned off to distribute air remaining in the distribution ducts.

- Implement an energy management system (EMS).

An EMS is a system designed to optimize and adjust HVAC operations based on environmental conditions, changing uses and timing.

 - Create an energy management system to automatically monitor and control HVAC, lighting and other equipment.

- Upgrade fuel-burning equipment.
 - Install a more efficient burner.
 - Install an automatic flue damper to close the flue when not firing.
 - Install turbulators to improve heat transfer efficiency in older fire tube boilers.
 - Install an automatic combustion control system to monitor the combustion of exit gases and adjust the intake air for large boilers.
 - Insulate hot boiler surfaces.
 - Install electric ignitions instead of pilot lights.

- Evaluate thermostat controls and location.
 - Install programmable thermostats.
 - Lock thermostat to prevent tampering.
 - Ensure proper location of thermostat to provide balanced space conditioning.
 - Note the proximity of the heated or cooled air producing equipment to thermostat.

- Evaluate boiler operations.
 - Investigate preheating boiler feed water
 - Adjust boilers and air conditioner controls so that boilers do not fire and compressors do not start at the same time but satisfy demand.
 - Use hot water from boiler condensate to preheat air.

- Use existing cooling towers to provide chilled water instead of using mechanical refrigeration for part of the year.

- Install water meters on cooling towers to record makeup water usage.

- Installed controls on heat pump (if has electric resistance heating elements) to minimize use.



- ☑ Install a variable air volume system (VAV) with variable speed drives on fan motors. A VAV system is designed to deliver only the volume of air needed for conditioning the actual load.
- ☑ Employ cool storage to save on electric bills. The concept behind cool storage systems is to operate the system during off-peak electricity hours, and use the stored coolness to satisfy a building's air conditioning needs. Avoiding peak electricity hours will reduce electric bills.
- ☑ Upgrade to premium efficiency models when available.

