

Potential Energy and Water Efficiency Projects for Schools:

Improvements to Consider:

- Heating, Ventilation and Air Conditioning Systems
 - Consolidate System
 - Update Equipment
 - Automate Controls
 - Geothermal heat pumps

- District heating and cooling systems

- Centralized heating and cooling plant
 - Cogeneration (combined heat and power generation facility)
 - High efficiency chillers
 - High efficiency boilers
 - High efficiency cooling towers

- Lighting
 - Replace T12 with T5 and T8
 - Increase Day lighting
 - Automate Controls

- Building Envelope
 - Upgrade Windows
 - Upgrade Doors
 - Insulation of ceilings and walls
 - Seal/caulk building leaks
 - Duct leak testing and repairing
 - Duct Insulation

- Hot Water
 - Solar Hot Water
 - Tankless Water Heater
 - High efficiency hot water tank

- Cool Roof

- Energy Management System

- Water Efficiency
 - Low Flow Toilets and faucets
 - High Efficiency Irrigation
 - Native, drought resistant vegetation for landscaping

- Recycled or Rainwater systems for non-potable use

Heating, Ventilation and Air Conditioning Systems: The HVAC system is usually one of the largest energy consumers in a school. Because of this, even small improvements to the system can result in relatively large energy savings.

1. Consolidate System – evaluate the size and number of HVAC units currently in use. Consolidating equipment can provide better heating, ventilation and air conditioning coverage while reducing the cost to run and maintain the systems.
2. Update Equipment – Consider replacing old and outdated equipment with something more efficient.
 - a. Variable speed/frequency drives – Offers energy savings in systems which have loads that vary with time.
 - b. Variable Volume Extractors – Offers ability to control fan capacity which allows reduction in the energy consumed by the fans.
 - c. Indirect/Direct Evaporative Cooling (IDEC) – Cools air through evaporation of water. Added benefit of adding moisture to the air
 - d. Replace filters in Air Handlers with Electrostatic dynamic Air Filters – Electrostatic air filters are highly efficient at removing particles from air. They are able to remove fine particulate matter, such as dust and smoke, with minimal impediment to the air stream.
3. Automate Controls – Allow control of the system in response to current conditions or preset temperature set points.
 - a. Adjust Temperature settings.
 - b. Demand Control Ventilation - CO₂ sensors tied to digital control systems.
 - c. Program Thermostats to accommodate usage patterns and comfort levels.
4. Geothermal Heat Pumps – Is a heating/cooling system that pumps heat to or from the ground. Shallow (3-8 ft) horizontal and Deep (100-500 ft) vertical systems allow the transfer of heat to and from the ground and use this temperature exchange to heat or cool the interior of a building using a heat pump.

District Heating and Cooling Systems: These are systems that produce heating and cooling energy, via hot water/steam and chilled water respectively, at a central plant which is then distributed to a network of buildings via pipelines. These systems tend to be more efficient in situations requiring the simultaneous heating/cooling of several separate buildings.

Centralized Heating and Cooling Plant: Retrofitting or upgrading efficiency in central plants.

1. Cogeneration
2. High Efficiency Chillers
3. High Efficiency Boilers
4. High Efficiency Cooling Towers
 - a. Forced-draft, Open-Loop, Counter-flow Towers
 - b. Replace isolation valves with Actuated valves to be controlled by energy management system
 - c. Positive Closure Damper Assemblies

Lighting: In general, lighting accounts for 25% of the energy use of commercial buildings.

1. Replace T12 with T5 and T8 – More efficient lighting offers both direct and indirect energy reduction: not only is less energy used to run the bulb, but the bulb also produces less waste heat which, in turn, reduces the cooling load.
2. Increase Day Lighting – Day lighting is the highest quality light source for visual tasks. It enhances both the color and appearance of objects.
3. Automate Controls
 - a. Occupancy Sensors
 - b. Daylight Harvest Controls
 - c. Emergency Lighting Controls

Building Envelope: An energy efficient building enclosure will reduce the building's overall operating costs by optimizing: moisture control; insulation levels; glazing; shading; air leakage control; and light-colored exterior surfaces.

1. Upgrade Windows
2. Upgrade Doors
 - a. Modify handicap entrances to minimize air infiltration
3. Insulation of Ceilings and Walls
 - a. Roof Board Insulation
 - b. Thermal Barrier Sheet Flashing
4. Seal/Caulk Building Leaks
 - a. Weather stripping
5. Duct Leak Testing and Repairing
6. Duct Insulation
7. Paint exterior surface with light-colored and/or low-e coating.

Hot Water

1. Solar Hot Water
2. Tankless Water Heater
3. High Efficiency Hot Water Tank
 - a. Gas-Fired Condensing Boiler
 - b. Storage Tank

Cool Roof: Have both a high solar reflectance and high thermal emittance which means that they are able to reflect a large amount of the visible, infrared and UV wavelengths of the sun and also emit or radiate heat that has been absorbed. Cool roofs reduce the heat gain of a building and, therefore, the required cooling load of said building.

Energy Management System

1. Provide adequate training for staff
2. Upgrade Communications Infrastructure, if necessary, to accommodate the energy management system
3. Information Management System
 - a. Provides a system to: measure, manage, reduce, verify and forecast usage, cost and emissions
 - b. Real time demand management
 - i. Demand curtailment
4. Modify Sequencing to provide efficient operation of mechanical Systems

Water Efficiency

1. Promote domestic water conservation
2. Low Flow Toilets and Faucets
3. High Efficiency Irrigation
 - a. Automated System
4. Native, Drought Resistant Vegetation for Landscaping
5. Recycled or Rainwater Systems for Non-Potable Uses