PSE&G EnergE Link

Chill Out With Energy Savings

Key Points

- Chillers are a significant source of energy use.
- A chiller efficiency strategy should take into account the dynamics of the entire cooling system.
- Variable fan speed and waterside economizers are commonly used energy-efficiency retrofits.

Source: www.doe.gov

Chillers are widely used for cooling large commercial and industrial facilities. While chillers are a mature, and generally efficient, technology, they are still a substantial energy user—particularly during the peak demand period of summer. Improving chiller efficiency can help reduce operating costs and improve your bottom line.

View the System as a Whole

Any discussion of a chiller upgrade or retrofit should consider the dynamics of the entire chiller system, not individual components. One way to improve chiller efficiency, for example, is to decrease the condensing water temperature. This requires additional cooling tower operation, however, which may increase total operating costs if maximized. In humid climates, increasing the chilled water temperature to save energy may unacceptably reduce the effective removal of humidity if the coil size is not adjusted as well.

Upgrade and Retrofit Strategies

A number of chiller system design changes and operational strategies will help to improve overall system efficiency and reduce energy costs, including varying fan speeds and waterside economizers.

Fan Speed. In cooling towers, the use of two-speed fan motors, in combination with fan cycling, provides improved control and efficiency over fan cycling alone. Variable speed drives (VSDs) provide the most efficient method of control. Fan power is proportional to the cube of the airflow rate; thus, a 20% reduction in fan airflow (and speed) will correspond to a theoretical 49% reduction in fan power. Savings can be maximized if loads are light many hours per year, and if the climate does not have a continually high wet-bulb temperature.

Economizers. Chiller bypass systems can be retrofitted into central plants, enabling waterside economizers to cool spaces with chillers off-line. In these systems, the cooling tower provides chilled water directly with filtering, or indirectly with a heat exchanger. These systems are applicable when many hours of chilled water are required, outdoor temperatures are below 55°F, or cooling loads below 55°F do not exceed 50% of full design loads.

Additional chiller efficiency ideas to consider include:

- Reduce the temperature set point of condenser water (cooling tower) to improve efficiency at partial load. Check with the manufacturer to make sure that the chiller can operate properly at a lower temperature.
- Replace over-sized water impellers, pumps, and motors with right-sized pumps and smaller, energy-efficient motors. Trim the pump impeller rather than using a balancing valve to reduce flow in pump speed applications that are constant; pump power can be reduced significantly.
- Install VSDs on water pump motors.
- Convert single-loop chilled water and the water flow configurations of the condenser to primary-secondary loop configurations. Replace three-way valves with two-way valves on cooling coils and implement variable-flow control on the chilled water loop.
- Chillers that are more than 10 years old are good candidates for replacement because refrigerant replacement issues may

need to be addressed. Moreover, newer models are significantly more efficient. Currently, the most efficient chillers operate at efficiencies of 0.50 kW/ton, a savings of 0.15 to 0.30 kW/ton over most existing equipment.

- Chilled-water storage tanks (typically >500,000 gallons) that are cooled during off-peak hours are economically attractive in larger buildings. Check with your utility provider for rebate programs on thermal storage systems.
- Increase wall insulation. One option for existing buildings is to add an exterior insulation and finish system (EIFS) on the outside of the current building skin. With EIFS, only use systems that include a drainage layer to accommodate for small leaks that may occur over time; avoid barrier-type systems. In some instances, the savings achieved by downsizing the chiller will pay for these types of energy improvements.

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