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ICE STORAGE

PLANNING FOR A NEW COOLING SYSTEM IN A HIGH-PERFORMANCE FINANCIAL INSTITUTION.

BY **PAUL VALENTA,** LEED AP

Air-conditioning systems are responsible for up to 9 percent of a building's energy consumption in all U.S. office and professional buildings (U.S. Department of Energy, Annual Energy Use of Commercial Office Buildings).

In New York, peak demand has grown 5.2 times as fast as the state's population and 2.1 times as fast as employment according to "The Power to Grow" (www.ppinys.org). In California, the summer peak demand goes up to 50,000 megawatts from a peak demand of 30,000 megawatts during October to March (California Electrical Energy: Peak Demand and Sources). This increased demand is largely due to air-conditioning use and can account for 25 to 30 percent of the country's peak demand.

In order to effectively lower energy usage as demand increases, an air-conditioning system must be optimized for efficiency. Seen from a holistic point of view, all the building equipment selected must be analyzed as a system. At the same time, the HVAC system must be analyzed against other building equipment and features such as daylighting and shading strategies and renewable resources.

THERE'S MORE TO COOLING THAN A CHILLER

When it comes to cooling the building of a financial institution, air-conditioning must be viewed as an integral part of the company's core mission, which is mostly about money. Today, however, upper management at these institutions stresses three additional objectives: cost containment, employee satisfaction/retention and social responsibility. These ideas may appear to conflict with the core mission, but, in fact, these objectives are smart business. Keeping costs down increases profitability; fulfilling one's social responsibility attracts clients and pleases stockholders; and minimizing employee turnover boosts productivity.

Energy-efficient replacement chillers from Trane and an ice storage system from CALMAC enable this 2.2 million-square-foot office building, which houses the national headquarters of Credit Suisse, to save 2,153,200 kWh per year and lower peak energy usage by more than 900kW, according to NYSERDA.

ICE STORAGE AS A COOLING OPTION

Consider that Credit Suisse, the Durst Organization and Morgan Stanley have all opted for ice storage as part of their air-conditioning solution. The facility management teams thought about not only when to begin the chiller replacement process but how to include upper management's objectives. William Beck, the head of critical engineering systems for Credit Suisse, a multinational financial services corporation, was quoted last summer on CBS and Fox network news broadcasts as saying, "If you take the time to look, you can find innovative ways to be energy efficient, be environmental, and sustainable."

The working principle of ice storage is based on using plentiful and efficient nighttime electricity to cool buildings. Ice storage uses that electricity to create and store ice inside storage tanks, and then uses that stored ice to augment the next day's cooling demand during peak periods.

A closer look at the nighttime charging cycle shows how ice storage affects the overall efficiency of the cooling system. A water-glycol solution is cooled to twenty-five degrees Fahrenheit by a chiller. The solution circulates through a spiral tube heat exchanger inside the ice storage tanks freezing the surrounding water. This process is complete in about 6-8 hours. During a peak cooling day, a reduced size chiller, augmented by the stored ice, cools the building. Many times during non-peak cooling times, the stored ice cools the facility entirely. The size of the ice storage system is determined by the building requirements such as size, type of construction, use, location and utility rates.

Shown is the interior of a CALMAC Ice Storage Tank (piping configuration through which chilled, glycol solution flows).

ICE STORAGE AS AN ENVIRONMENTAL AND FINANCIAL OPTION

In addition to system efficiency, using nighttime electricity to store cooling has both financial and environmental impacts. Most utilities, such as Con Edison (New York's utility company), charge less for nighttime electricity, although that's not universally the case across the nation. Lower electricity costs may be in the form of time-of-day tariffs (lower charge per kWh based on time of consumption) or from lower demand charges ($/kW/monthly) for shifting electricity demand to non-peak times. Utilities offer time of use rates to discourage businesses from overburdening the power infrastructure during the day, which may cause brownouts and blackouts.

On hot summer days, demand for cooling forces many utilities to turn on their "peaker" power plants in order to provide the electricity being demanded. Peaker plants are generally less efficient and tend to spew a higher level of greenhouse gas emissions into the atmosphere. Because ice storage uses nighttime electricity, which is normally produced by the utility's most efficient generators, it lowers the impact of cooling on the environment by reducing the carbon footprint (CO_2) and other greenhouse gas emmisons — SO_x and NO_x .

Furthermore, ice storage helps alleviate the need for new power plants because it makes more energy available during peak times of day. For every four buildings that use ice storage, sufficient electricity is shifted to nighttime use to allow a fifth building to be added to the grid without providing new generation.

The replacement ice storage cooling system at Credit Suisse, for example, lowers the facility's peak energy use by 900 kilowatts, and reduces overall electric usage by 2.15 million kilowatt-hours annually — enough to power about 200 homes. At the Morgan Stanley facility in Westchester County (New York) the replacement ice storage system reduces peak energy use by 740 kilowatts and overall electricity usage by 900,000 kilowatt-hours annually.

PERFORMANCE EARNS HONORS

Ice storage cooling systems may earn credits in the Energy and Atmosphere section of the Leadership in Energy and Environmental Design (LEED) rating system. Ice storage has helped the Hewlett Foundation in Menlo Park, Calif., earn LEED Gold, and Owens Illinois World Headquarters attain LEED Silver Certification.

The New York State Energy Research and Development Authority (NYSERDA) has recognized 1155 Avenue of the Americas, Credit Suisse and Morgan Stanley for the installation of their efficient ice storage systems. And, ice storage is being installed at the new Bank of America tower in New York City to help optimize the performance of the building's cogeneration system.

RENEWABLE RESOURCES

Dependency on renewable energy (i.e. wind and solar) sources is also clearly increasing. State laws, and possibly soon Federal laws, are starting to mandate 15 to 20 percent on the grid by 2020 to 2030. These resources operate when nature allows them to perform. Ice storage can contribute to the viability of renewable energy resources. For example, wind power, combined with an ice storage system, can be captured and stored to cool buildings during peak periods

Photovoltaic (PV) panels, which collect energy from the sun, may not be as reliable as the energy from power plants. For instance, PV electricity generation is generally strongest in the afternoon but ends long before the cooling peak does since high temperatures persist even when the sun is very low in the sky or below the horizon. An ice storage system may help overcome some of these obstacles by providing a lower connected load with a "rightsized" cooling system and the ability to tap into a reservoir of stored cooling, produced at night by cleaner generating plants or wind power.

CHOOSING THE IDEAL COOLING SYSTEM

Early planning is always best for cooling system replacement initiatives. For many, early planning for system replacement has a 10-year lead time, while for others it may be less. Waiting until equipment expires or becomes overly problematic is not only shortsighted, it could prove costly and inefficient. HVAC designers and energy managers always think about

Many financial organizations in New York are turning to ice storage systems that use stored ice to augment the next day's cooling demand during peak periods.

how to optimize energy purchases and comfort systems to meet a company's overall business strategy for profit, employee satisfaction and social responsibility.

Today, energy conservation measures that require a temperature comfort sacrifice are becoming unnecessary. Business leaders recognize that planning early and being good neighbors and caring employers is every bit as sound a strategy as growing market share and expanding to new areas.

Here are a few fundamental steps to take in order to make sure your chiller replacement goes smoothly and meets your company's core objectives.

1. The first step is to determine both short-term and long-term organizational plans. If those plans include additions to the workforce, building expansions or other factors that will affect an air-conditioning system, this is an ideal time to build that into the decision process. Be sure to consider management's expanded goals.

2. Next, research and create a list of all the options that appear to meet those plans.

3. Reach out to fellow designers, developers and managers. Touring their buildings is one of the best means of learning first-hand about each option's strengths and weaknesses.

4. Consider other environmental initiatives that may affect cooling loads such as adding solar panels, daylighting and shading strategies, lighting upgrades, etc.

5. Contact vendors and designers and seek their assistance in ascertaining the facility's cooling needs and how their system will meet those needs and develop cost parameters for installation and operation.

6. Determine space requirements, installation procedures and consider any disruptions that may occur.

7. Perform a cost analysis that will determine each system's energy cost saving payback period, taking into account installation, operating and maintenance costs.

CONCLUSION

In new construction, keep in mind that the cooling system will need to operate with less dependency on the utility grid and that energy costs continue to rise. More and more energy management risks and purchasing decisions will be moved to the consumer. Energy cost savings will come from consumption and purchasing flexibility.

In a retrofit situation, replacing old equipment can give a significant boost to overall efficiency and dramatically lower cooling costs. Cooling equipment is much more efficient and less polluting than it was 20 years ago. Chillers, a major component of a central cooling system, tend to last about 20 to 30 years. Even if the chiller is just showing signs of wear and tear, the energy savings from a new system may warrant retiring the chiller early.

There's an adage in the financial community that says, "Even if it's not about the money, it's about the money." Instead of simply replacing aging equipment with another or simply selecting a seemingly efficient piece of equipment, our times require a more thorough approach to retrofitting our buildings, with sustainability and the energy markets in mind. Research, analysis and careful selection help ensure the best air-conditioning system is chosen to meet the company's objectives.

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CALMAC Corp. manufacturers IceBank ice storage equipment with more than 3,000 ice storage installations worldwide. IceBank can store renewable energy like wind and solar thereby increasing project values. An ENERGY STAR Partner and USGBC member, CALMAC Corporation is widely recognized for promoting peak energy conservation and energy cost savings. Visit www.Calmac.com.