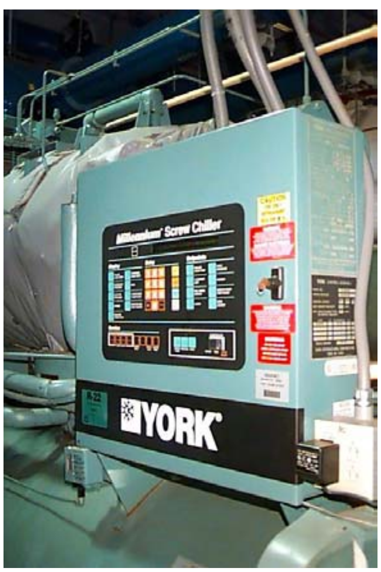
CHILLED WATER/THERMAL ICE STORAGE

Project Description

Two office/manufacturing complexes, Buildings 11 and 12 at the Texas Instruments' (TI) Attleboro, Massachusetts facility require chilled water 24 hours per day, 365 days per year. The chilled water serves the heating, ventilation and air conditioning (HVAC) and process loads of these operations. Historically, chilled water production accounted for a significant portion (~15%) of the total electrical demand of TI's Attleboro facility during peak electricity demand periods – when electricity is more expensive. This had significant negative financial implications for TI.

Figure 1: Building 11 Ice Storage System

Figure 2: Chiller Panel



As part of its energy management program, TI installed two chilled water/thermal ice storage systems between 1994 and 1996 to make ice at night, during off peak electricity demand periods, and melt it to serve HVAC and process loads in the buildings during the peak demand periods of the day. The chilled water/thermal ice storage systems consist of ice storage (see Figures 1 and 3), electric drive chillers (see Figure 2), cooling towers with variable frequency drives (VFDs), and water/coolant re-circulating pumps with VFDs (see Figure 4). An additional plate and frame heat exchanger is used to provide "free" cooling using the cooling towers during cold weather without the requirement to run a chiller (see Free Cooling case study).

Prior to the construction of the central chilled water/thermal ice storage systems, cooling loads for Building 11 were served by an aging air-cooled refrigeration (DX and chilled water) system while a centrifugal chiller served Building 12. Both systems benefited from the technical and financial assistance from Massachusetts Electric Company (MECo) as provided under its Design 2000 energy efficiency rebate program.

Figure 3: Building 12 Ice Storage System

Energy and Cost Savings

The new central chilled water/thermal ice storage systems include high efficiency equipment and shifts electricity load by producing ice during lower cost off-peak hours. As a result, these projects shifted 1.1 MW of peak demand to of-peak periods helping to level the facility load factor. TI estimates that the annual savings from these projects is approximately $460,000.

Environmental Benefits

It is estimated that indirect emission reductions occur (at electric generating facilities feeding into the regional New England Power Pool - NEPOOL) when load (MW) shifts from less efficient peaking electric generating units and is shifted to more efficient base load electric generating units as a direct result of these peak demand reduction projects. Estimated annual emission reductions are provided below.[1]

Chilled Water/Thermal Ice Storage

Total Capital Costs		**$ 3.3 million**
MECo Rebates		**$ 1.2 million**
Net Cost to TI		**$ 2.1 million**
Demand Savings		**1.1 MW**
Cost Savings		**$460,000/year**
Emissions Avoided		
	NOx	**~0.5 tons/year**
	SO_2	**~1.4 tons/year**
	CO_2	**~96.4 tons/year**
	Mercury	**~0.0005 lbs/year**

Figure 4: Variable Frequency Drives

[1] It is estimated that this peak demand reduction project shifts 1.1 MW of demand and the corresponding emissions associated with the production of that electricity by more efficient base load units. Estimated emission reductions are based on published fossil emission rates feeding into the New England Power Pool (NEPOOL).